

EPA WORK ASSIGNMENT NO.: 004-2L1E
EPA CONTRACT NO.: 68-W8-0110
EBASCO SERVICES INCORPORATED

ARCS II PROGRAM

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FINAL

FEASIBILITY STUDY REPORT
CIRCUITRON CORPORATION SITE
SUFFOLK COUNTY, NEW YORK

JANUARY, 1991

NOTICE

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EBASCO SERVICES INCORPORATED

EBASCO

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January 16, 1991
ARCSII-91-34

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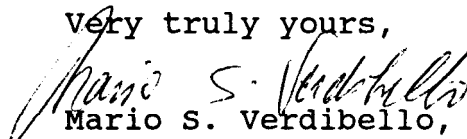
SUBJECT: CIRCUITRON CORPORATION SITE
EAST FARMINGDALE, LONG ISLAND, NEW YORK
WORK ASSIGNMENT NUMBER 004-2L1E
EPA CONTRACT NUMBER 68-W8-0110
FINAL FEASIBILITY STUDY REPORT

Dear Ms. Hacker and Dr. Fayon:

Ebasco Services, Incorporated is pleased to submit the final version of the Feasibility Study Report for the Circuitron Corporation Site to USEPA. Please find enclosed 7 copies of the document for your offices. In addition, a copy has been forwarded directly to Mr. James Bologna of NYSDEC.

Please return the acknowledgement of receipt form attached to this letter. If you have any questions or comments, please do not hesitate to contact me at (201) 460-6195, or the Site Manager, Mr. Richard Zarandona at (201) 460-6232.

Very truly yours,


Mario S. Verdibello, P.E.
Deputy Program Manager,
ARCS II

cc: S Alvi (EPA)
J Bologna (NYSDEC - 1 copy) ✓
M Kuo
R Zarandona
R Rienzo
ARCSII Files

-2-

January 16, 1991
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Ms. J Hacker
Dr. A M Fayon

SUBJECT: CIRCUITRON CORPORATION SITE
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FINAL FEASIBILITY STUDY REPORT

ACKNOWLEDGEMENT OF RECEIPT

Please acknowledge receipt of this final Feasibility Study Report by signing and returning the duplicate copy of this letter to the sender at the above address. Thank you.

Ms. Jill Hacker
Regional Project Officer

Date

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EBASCO SERVICES INCORPORATED

ARCS II PROGRAM

FINAL

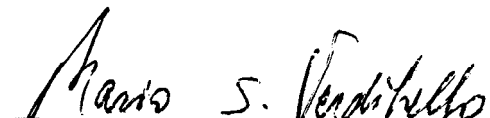
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CIRCUITRON CORPORATION SITE
SUFFOLK COUNTY, NEW YORK

JANUARY 1991

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FINAL
FEASIBILITY STUDY REPORT
CIRCUITRON CORPORATION SITE

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EXECUTIVE SUMMARY

In September 1988, the United States Environmental Protection Agency (USEPA) authorized Ebasco Services Incorporated (Ebasco) to conduct a Remedial Investigation and Feasibility Study (RI/FS) at the Circuitron Corporation Site located in Suffolk County, New York. This work was performed in response to Work Assignment no. 004-2L1E under ARCS II Contract no. 68-W8-0110.

The objective of the Circuitron Corporation Feasibility Study is to develop and screen potential alternatives to remediate environmental contamination present at the site. The most promising remedial alternatives are evaluated utilizing a range of factors and compared against each other. This evaluation will provide a basis for the USEPA to select the optimum solution for remediation of the site.

The Circuitron Corporation Site is located at 82 Milbar Boulevard in the community of East Farmingdale which is an unincorporated hamlet in the Town of Babylon in Suffolk County, New York. East Farmingdale is predominantly an industrial area of Babylon. It is also one of the most heavily industrialized sections of Suffolk County, and has been characterized frequently by problems associated with industrial pollution.

The Circuitron Corporation Site, a former circuitboard manufacturing facility, is situated within an industrial and commercial area near the Suffolk County and Nassau County border on Long Island and is approximately 0.9 acre in size. Neighboring properties consist of various active businesses, including small industrial and manufacturing facilities. The Circuitron Corporation Site consists of an abandoned, one story building, of about 23,500 square feet in area, a parking area in front, and small areas of property surrounding the other three sides. The majority of the site is impermeable, with approximately 95 percent of the area covered either with asphalt or by the building. The building was used to house the offices and the manufacturing operations of the corporation.

The topography of the site is relatively flat with a slight slope of less than one percent up to the southeast. Before the site was developed, this region of Long Island was mainly used for agricultural purposes. There are no streams, lakes or other surface water bodies on or in the vicinity of the site. In addition, no wetlands, critical environmental habitats or significant cultural resources were found to exist at the site.

The main geologic units encountered beneath the site area, in ascending order, include bedrock, the Raritan Formation, the Magothy Formation and the Upper Glacial Formation. The Magothy

Formation is an important water supply aquifer in central Long Island, and is generally encountered 70-75 feet below the ground surface. The water table of the Upper Glacial Formation occurs at between 25-27 feet below grade. The Magothy Aquifer consists of poorly graded fine to medium sands with some mixture of clay. The Upper Glacial Aquifer is comprised of well graded sands with some gravels and poorly graded sands. Regional groundwater flow within the site area is generally to the southeast.

The Circuitron Corporation facility was in operation from 1961 until mid 1986, at which time the site was vacated by its current owners. The facility had a history of illegal discharges to groundwater from its State Pollutant Discharge Elimination System (SPDES) permitted leaching pool, as well as from other unauthorized underground structures located at the site. These structures included sanitary cesspools, storm drains and other leaching pools. The illegal discharges were documented by both the New York State Department of Environmental Conservation (NYSDEC) and the Suffolk County Department of Health Services (SCDHS). As a result of these illegal waste discharges, the Circuitron Corporation was issued a Consent Order and a Stipulated Agreement from the SCDHS for clean-up of the site. The facility was vacated without satisfactory compliance with the Consent Order and Stipulated Agreement.

An emergency response action was performed by the USEPA at the site in mid 1989. This action included removal of waste drums from inside the building, the emptying of underground tanks containing various substances, cleaning and removal of the aboveground tanks from the rear of the building and general clean-up of the suspected contaminated debris from inside the building.

The results of the Ebasco remedial investigation show that the sediments and surrounding soils of the underground structures at the site, including the cesspools, storm drains and leaching pools, are mainly contaminated with elevated levels of 1,1,1-trichloroethane (1,1,1-TCA), bis (2-ethylhexyl)phthalate (BEHP) and copper. The groundwater of the Upper Glacial Aquifer beneath the site was also found to contain elevated levels of 1,1,1-TCA along with lower concentrations of other volatile organic compounds.

The contamination detected in the contents (sediments and/or aqueous material) of the leaching pools, sanitary cesspools and storm drains existing beneath the Circuitron Corporation Site consisted of volatile, semivolatile and inorganic compounds at concentrations higher than the background soil concentrations expected to be found in U.S. sandy soils for this region. Therefore, these underground structures currently serve as potential contaminant sources to the soil and/or groundwater

below the site. The presence of all the contaminants found in the sediments can be attributed to the illegal discharges of untreated wastes during the operation of the Circuitron Corporation facility.

The upgradient monitoring wells, both shallow and deep, which were installed to provide groundwater samples uncontaminated by the hazardous waste at the site, showed signs of contamination with volatile organic compounds. Samples from these wells contained elevated levels of 1,1,1-TCA, which was the main contaminant found in on-site monitoring wells. Other volatile organic compounds and metals were also detected in the upgradient groundwater samples. The degree of concentration of these upgradient groundwater contaminants was equivalent to, or even higher, than levels of these contaminants detected in the on-site wells.

The area of highest soil/sediment and groundwater contaminant concentration was found to be the southwest corner of the site. The soil sample from the monitoring well installed in this area contained 100,000 ug/kg of 1,1,1-TCA at a depth of 20-22 feet, and 20,000 ug/kg of BEHP at a depth of 15-17 feet. The groundwater in the shallow well at this location showed a concentration of 4,600 ug/l of 1,1,1-TCA.

A risk assessment was performed in which exposures were evaluated by comparing concentrations of chemicals in the contaminated exposure medium (e.g., groundwater) at a point of potential exposure, to State or Federal environmental standards, criteria, or guidelines that were identified as "Applicable or Relevant and Appropriate Requirements" (ARARs) or other relevant guidelines.

The results of this risk assessment showed that ingestion or inhalation of groundwater from on-site wells would result in unacceptable carcinogenic and non-carcinogenic risks. However, similar results were obtained when considering the ingestion or inhalation of upgradient groundwater. Use of groundwater from the Upper Glacial Aquifer both above the site and on-site would result in similar unacceptable risk factors. The on-site samples show a slightly elevated risk value, as could be expected due to the contribution to groundwater contamination from leaching of contaminants from site soils and sediments.

Based on the risk assessment, the only potential exposure of concern is if the Upper Glacial Aquifer is developed in the future for use as a potable water supply. These risks are due to the concentration of inorganic and volatile organic contaminants found in the groundwater of the Upper Glacial Aquifer.

Although this scenario may have a chance of occurring in the future, the likelihood is extremely small due to the unlikely combination of many conservative assumptions used in the risk assessment and the fact that Long Island authorities do not consider the Upper Glacial Aquifer a potable source of drinking water in the central region of the island. It is not presently used for potable water supply anywhere within a 3 mile radius of the site at similar depths as the contamination was found.

During the USEPA response action at the site, wipe samples from the interior surfaces of the building were taken. Analytical results of these samples show an elevated level of several metals, especially copper, present in the dust. By assuming that all the dust could potentially be resuspended and inhaled, it can be shown that the levels of metals in the dust will be in violation of OSHA Standards for air quality for an industrial use building.

Based on the evaluation of available data, the remedial action objectives are:

- o Long term monitoring of groundwater utilizing wells installed during performance of remedial investigation. This will enable the effects of the natural flushing action of the groundwater to be evaluated.
- o Elimination of the source of contamination by:
 - removing sediments from the authorized leaching pool and the interconnected pools outside of the building (LP-1, LP-2 and LP-7);
 - removing sediments from the two sanitary cesspools (CP-1, CP-2);
 - removing sediments from the three storm drains located in the western portion of the site (SD-1, SD-2, and SD-3);
 - removing the soil from the southwest corner of the site (MW-4) down to the water table during the storm drain clean up;
 - removing the leach pools from beneath the plating room floor slab (LP-3, LP-4, and LP-5); and
 - removing and replacing the concrete floor slab in the plating room.
- o Restoration of the process building for future reuse.

Based upon these objectives, areas and quantities of wastes to be remediated were developed. It is estimated that approximately 48 cubic yards of sediment contaminated with 1,1,1-TCA and copper would require remediation. These sediments are contained in the underground leaching structures at the site. Along with this material, approximately 5 cubic yards of building dust has been considered contaminated and would also require remedial action.

Remedial measures for the collection and treatment of contaminated groundwater were not evaluated as a part of this feasibility study. Because of upgradient groundwater combination at equivalent concentrations, or higher in some instances, an additional investigation on a more regional basis was recommended as part of each source control alternative. Risk factors were also found to be equivalent for both upgradient and on-site groundwater. The area and scope of this study would include the surrounding industrial properties and the identification of the source of the upgradient contamination. A groundwater monitoring program was also included with each alternative as a way of evaluating the effectiveness of the potential remedial source control alternatives.

Technologies were identified and screened for the treatment of the contaminated sediment, and for remediating the structure. Those that passed the initial screening were combined to develop source control alternatives for the Circuitron Corporation Site.

The procedures and methods used in developing and evaluating remedial alternatives for the contaminated soil, groundwater and building are those suggested in the USEPA "Guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA" (Interim Final; October 1988). The following are the steps taken in this FS:

- o General response actions were identified for each of the contaminated media based on the remedial action objectives;
- o The potentially applicable technology types and process options associated with each of the general response actions were then identified and investigated;
- o These technology types and process options were screened with respect to technical implementability, based on specific site conditions, contaminant pathways and risk, remedial response objectives, and nature and extent of contamination;
- o The technically feasible remedial technologies identified in the previous step were grouped into potential remedial action alternatives for each contaminated medium. Normally, these alternatives are screened

based on effectiveness, implementability and cost considerations; however, for this report, because of the limited number of alternatives that could be developed, this screening process was omitted. All of the developed alternatives were subjected to a detailed evaluation.

- o In this detailed evaluation, each remedial alternative is to be evaluated against nine criteria, i.e., short-term effectiveness long-term effectiveness; reduction of toxicity, mobility and volume; implementability; cost; compliance with ARARs; overall protection; state acceptance, and community acceptance. It is anticipated that comments from the State and the public will be provided during the 30-day public comment period and will be addressed in the ROD and responsiveness summary. Therefore, only the first seven criteria were used to evaluate remedial alternatives.

The five source control alternatives developed for the remediation of the Circuitron Corporation Site are:

- o Alternative 1: No Action;
- o Alternative 2: Limited Action;
- o Alternative 3: Containment/Building Decontamination;
- o Alternative 4: In-Situ Vacuum Extraction/Excavation of Sediment/On-Site Stabilization and Disposal/Site Containment/Building Decontamination; and
- o Alternative 5: In-situ Vacuum Extraction/Excavation of Sediment/Off-Site Incineration/Off-Site Disposal/Site Containment/Building Decontamination.

Cost estimates were calculated for each of the 5 alternatives. Present worth estimated costs for each of the 5 alternatives, based on an interest rate of 5%, and 30 year time interval, are as follows:

- o Alternative 1 - \$508,408
- o Alternative 2 - \$540,403
- o Alternative 3 - \$656,695
- o Alternative 4 - \$573,945
- o Alternative 5 - \$636,525

1.0 INTRODUCTION

A Remedial Investigation and a Feasibility Study (RI/FS) of the Circuitron Corporation Site in East Farmingdale, New York was authorized by the United States Environmental Protection Agency (USEPA) on September 26, 1988. The RI/FS was performed by Ebasco Services Incorporated under ARCS II Contract Number 68-W8-0110, as Work Assignment Number 004-2L1E. This Feasibility Study report has been prepared in compliance with the Final RI/FS Work Plan (Ebasco, 1989) for this site approved by USEPA in February, 1989.

This FS has been conducted subsequent to the performance of a Remedial Investigation at this site. The RI has identified several areas of contamination which were addressed in the FS.

1.1 PURPOSE AND ORGANIZATION OF REPORT

The Circuitron Corporation Site FS was performed in order to assess the levels of contamination discovered at the site and to investigate the possible remediation measures that are necessary to bring the site back to acceptable standards or levels of contamination to prevent unhealthful human exposure as defined in the site Risk Assessment. The purpose of this report is to present these findings comprehensively in terms of the various alternatives evaluated and the results of a screening process of those alternatives to aid in identifying the optimum remediation solution for the site in terms of its effectiveness, practicality and economics.

This report consists of five sections, the contents of which are briefly described below, and four appendices which contain additional data. Documents utilized in the development of the information contained in this FS report include the EPA "Guidance on Feasibility Studies under CERCLA" (USEPA, 1985a) and the EPA "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (USEPA 1988b).

This first section, in addition to the above introduction, contains an abridged description of the site including its geology and hydrogeology, history of the area, regulatory actions taken and the nature and extent of the site contamination. Also provided is a summary of the baseline (no action) risk assessment.

Section 2.0 presents the development of remedial action objectives for the soil and the groundwater with regard to the allowable exposure limits for the contaminants found at the site. A description of the general response actions which have been developed for the site is provided. The quantities of materials to which remedial alternatives will be applied are also included in this section. Appropriate technology types and process options for the response actions will be identified and screened with regard to technical compatibility with the site conditions.

In Section 3.0 the rationale for combining various technologies and processes into a range of treatment and containment remedial alternatives, as required, is explained. Because of the limited number of alternatives developed, the usual step of screening these alternatives has been omitted.

Section 4.0 presents the results of a detailed analysis of the most viable alternatives as described in Section 3.0. This detailed evaluation consists of an assessment of each alternative with regard to its technical feasibility, environmental and public health impacts, capital and operating costs, and community relations aspects. The selected remedial alternatives are then compared with each other to provide a basis for determining the most efficient and effective solution.

Section 5.0 contains the references employed during the development of the feasibility study parameters and for preparation of this report. Appendix A contains a detailed breakdown of the major construction components of each of the identified remedial alternatives, Appendix B presents the detailed cost estimates for each alternative and Appendix C contains a discussion of the soil clean-up levels for the site.

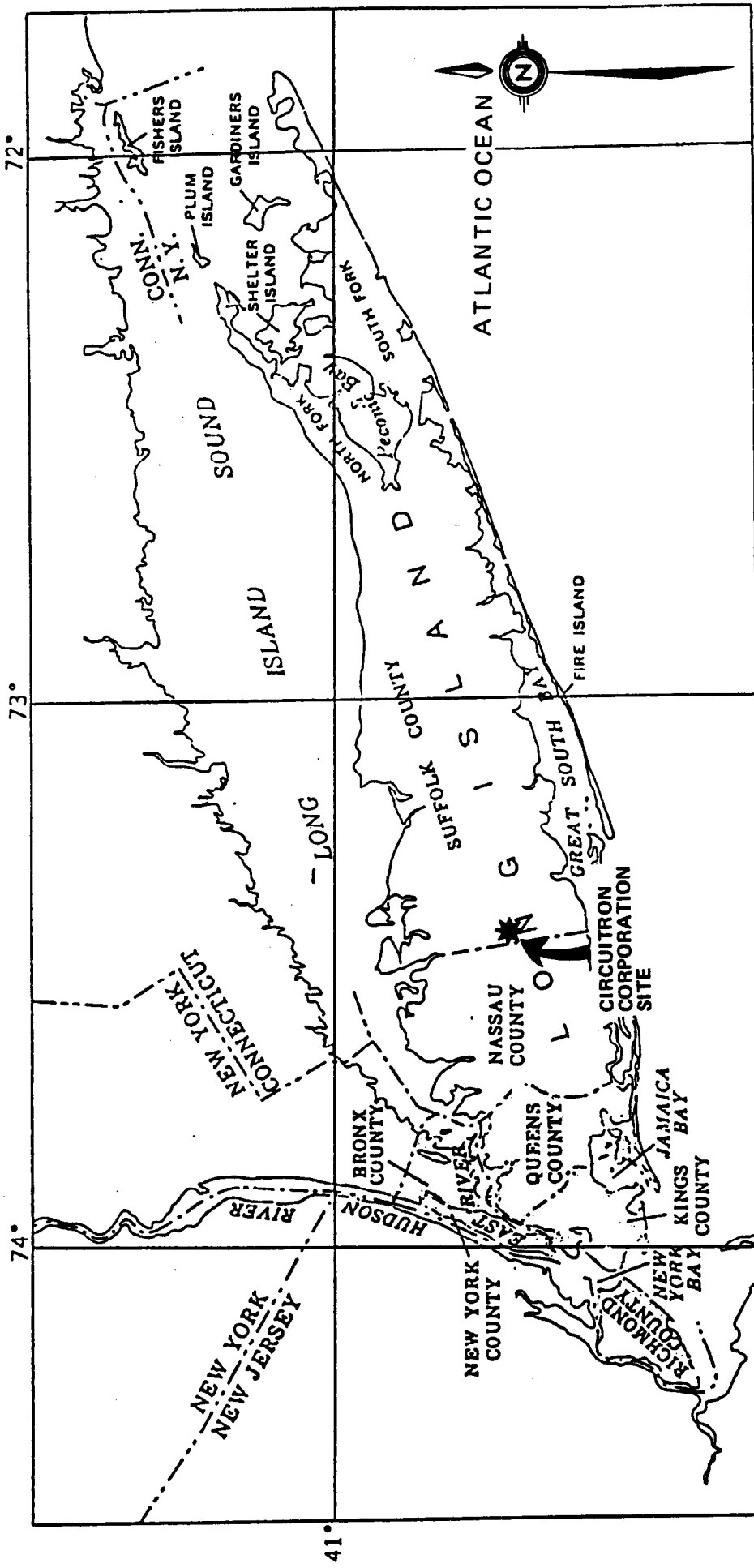
Appendix D presents the estimated air emissions from the site during the implementation of the remedial action.

1.2 BACKGROUND INFORMATION

1.2.1 Site Description

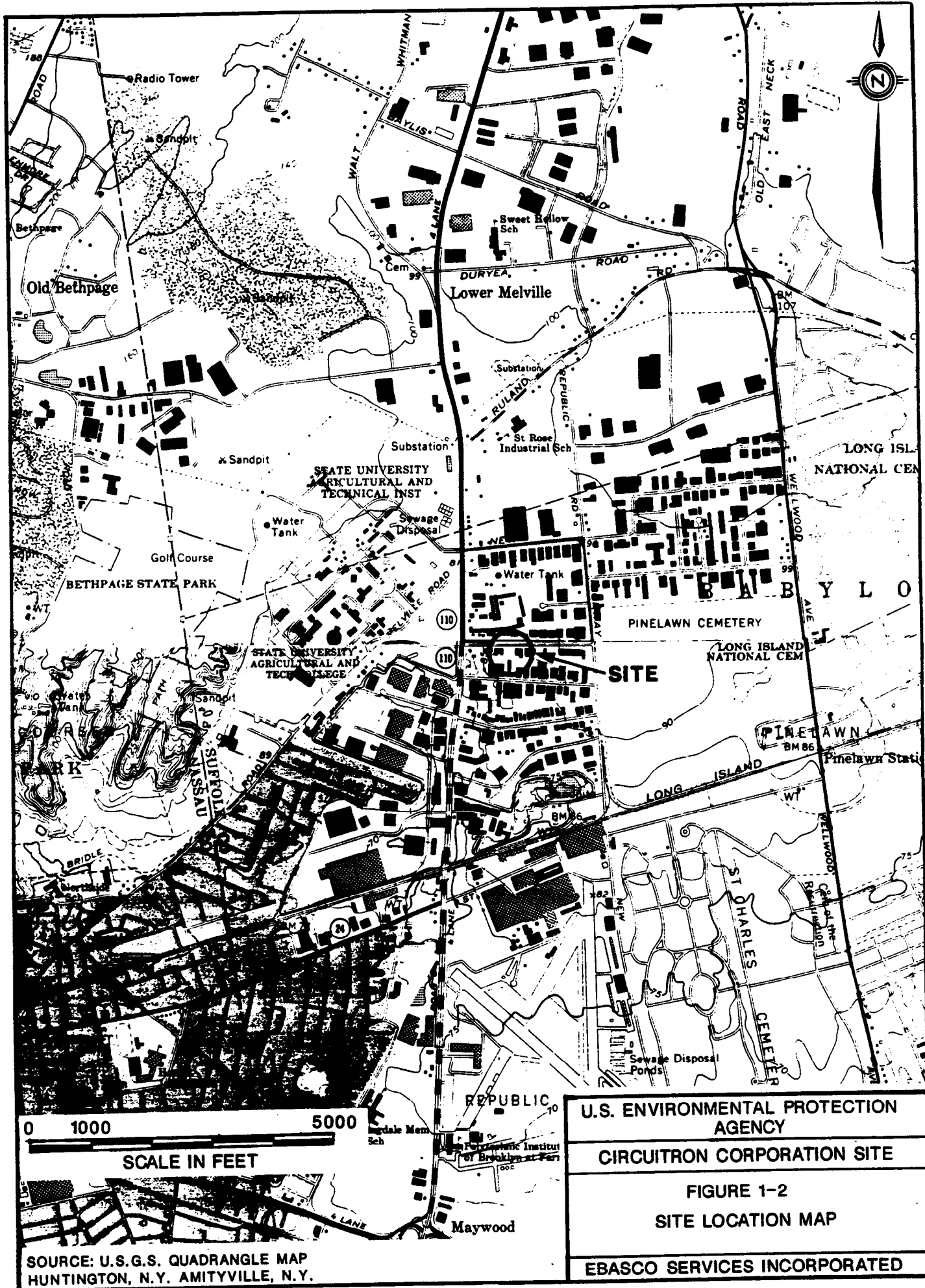
The Circuitron Corporation Site is located at 82 Milbar Boulevard, East Farmingdale, Suffolk County, New York. The site is situated on the Nassau County - Suffolk County border in central Long Island. The site encompasses approximately 1 acre in an industrial/commercial area just east of Route 110 and the State University of New York, Agricultural and Technical College campus in Farmingdale. The site is generally flat and has a slight slope up to the southeast of less than 1 percent. The site elevation is approximately 85 to 90 feet above mean sea level (MSL). Figure 1-1 and 1-2 present regional and detailed location maps for the Circuitron Corporation Site. Figure 1-3 shows the site plan and the location of the above and below ground structures.

The Circuitron Corporation Site consists of an abandoned building that was used for the manufacture of electronic circuit boards. Aside from the building, the site is primarily asphalt paved, with the exception of a small area in the rear of the building. The paved area in front of the building was used in the past as a parking lot for the employees of Circuitron Corporation and is presently used for parking by employees of nearby companies. Approximately 95% of the site is paved or covered by the building.



U.S. ENVIRONMENTAL PROTECTION AGENCY
CIRCUITRON CORPORATION SITE
FIGURE 1-1
REGIONAL LOCATION MAP
EBASCO SERVICES INCORPORATED

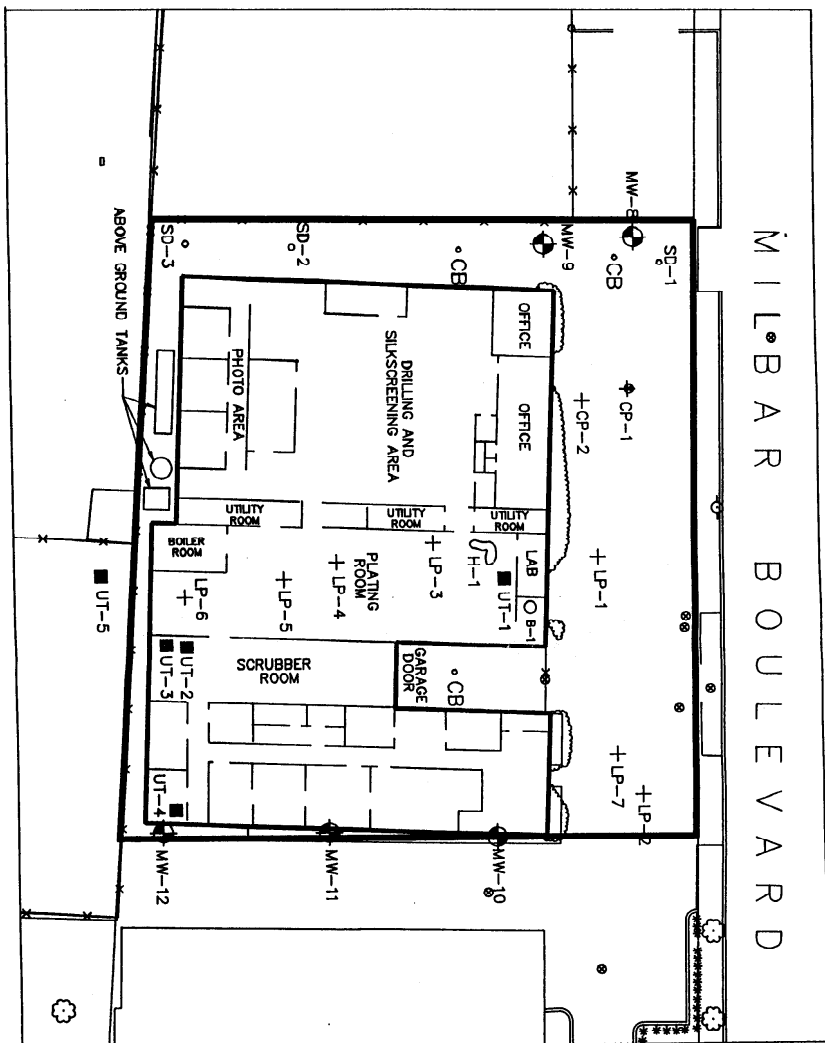
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MILBAR BOULEVARD

E 1145200

E 1145400

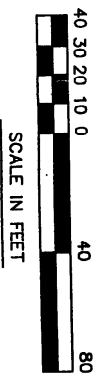


MAP NOTES

1.) AERIAL PHOTOGRAPHY AND MAPPING BY LOCKWOOD SUPPORT SERVICES, DATE OF AERIAL PHOTOGRAPHY - NOV. 18, 1988.

LEGEND

- MW MONITOR WELL (S.A.T.O. & 11 DISTING.)
- SD STONE DRAIN
- CB CATCH BASIN
- + LP LEACHWATER
- + CP SANITARY CONTROL
- WASTEWATER TREATMENT BASIN
- HOLE
- UT UNDERGROUND TANK



SCALE IN FEET

N 212800

N 213000

E 1145200

E 1145400

MILBAR BOULEVARD	
DATE	NOV. 18, 1988
BY	LOCKWOOD SUPPORT SERVICES
PROJECT	GROUNDWATER MONITORING
CLIENT	LOCKWOOD SUPPORT SERVICES
LOCATION	MILBAR BOULEVARD, WASHINGTON, D.C.
SCALE	1" = 40'
DATE	NOV. 18, 1988
BY	LOCKWOOD SUPPORT SERVICES
PROJECT	GROUNDWATER MONITORING
CLIENT	LOCKWOOD SUPPORT SERVICES
LOCATION	MILBAR BOULEVARD, WASHINGTON, D.C.
SCALE	1" = 40'

Two known unauthorized leaching pools exist below the concrete floor in the plating room inside the building. A circular depression in the concrete floor towards the front of this room indicates the presence of other unauthorized leaching pools. These are identified on Figure 1-3 as LP-3, LP-4, LP-5 and LP-6.

A series of leaching pools lies beneath the parking lot in the front of the building. These leaching pools include an authorized wastewater discharge pool (authorized via a New York State Pollution Discharge Elimination System (SPDES) permit No. NY-007-5655) below a manhole located on the north side of the property in front of the laboratory (see Figure 1-3), and two old abandoned leaching pools located in the northeast corner of the site. These structures are identified as LP-1 which is the SPDES pool, LP-2 and LP-7 on Figure 1-3.

At least two sanitary cesspools have been documented to exist below the parking lot in front of the northwest corner of the building (identified as CP-1 and CP-2 on Figure 1-3). The sanitary cesspools were authorized to accept sanitary wastes only. However, Suffolk County Department of Health Services (SCDHS) analyses indicated that the cesspools were used for disposal of hazardous materials (Ebasco, 1990).

A line of interconnected storm drains exists on the western portion of the site (see Figure 1-3). The storm drains range from 10 feet to approximately 13 feet in depth. These storm drains are identified as SD-1, SD-2 and SD-3 on Figure 1-3.

1.2.2 Site History

Circuitron Corporation was an electronic board manufacturing facility. The facility began operations in 1961 under the ownership of the 82 Milbar Corporation, of which Mario Lombardo and Julius D'Amato were principal owners. In 1983, Mario Lombardo sold Circuitron Corporation to F.E.E. Industries, which in turn sold it to ADI Electronics. The 82 Milbar Corporation still retains ownership of the property, and ADI Electronics, located at 51 Trade Zone, Ronkonkoma, New York, is the current owner of the Circuitron Corporation. The current owners ceased operations and vacated the site some time between May and the end of June 1986.

The facility had an approved SPDES permit, No. NY-007 5655, to discharge industrial wastewater to a series of leaching pools located below the parking lot in front of the building. This permit was expired by the New York State Department of Environmental Conservation (NYSDEC) on September 12, 1986 based on a July 1, 1986 inspection indicating that discharge had ceased.

Circuitron Corporation had received numerous warnings concerning SPDES permit violations and unauthorized discharges from both the SCDHS and NYSDEC. An Order of Consent (SCDHS, 1984) and the Stipulated Agreement (SCDHS, 1985) issued by the SCDHS in 1984 and 1985, respectively, required that all leaching pools and storm drains be remediated; all toxic and hazardous materials be

removed from the site including drums, tanks, and piping; and a groundwater quality study be performed. Circuitron Corporation installed 5 monitoring wells at the site, however, there are no engineering or well installation reports available concerning the construction of these wells. In addition, the analytical results from the Circuitron Corporation and the SCDHS groundwater sampling of these wells are in conflict with each other. To date, only the unauthorized leaching pool in the southern part of the plating room has been cleaned out and backfilled. This work was performed by Circuitron Corporation. There are no records available regarding the amount of waste removed from the unauthorized leaching pool or the existence and the extent of contaminated soil in and around the leaching pool. Circuitron Corporation has received a large fine from New York State for environmental pollution, and the original owner, Mario Lombardo, has been fined and convicted of a felony in connection with unauthorized discharges.

Circuitron Corporation vacated the site without satisfactory compliance with terms in the Order of Consent and the Stipulated Agreement. Circuitron Corporation has since filed for bankruptcy. The property owner is attempting to block bankruptcy proceedings until the site is remediated. Litigation in this case is ongoing.

1.2.3 Legal Actions

Circuitron Corporation has received numerous warnings and notices concerning SPDES permit violations and in regard to unauthorized discharges at the facility.

To satisfy the violations, Circuitron Corporation agreed to a SCDHS Order on Consent, No. IW 84-46, on June 27, 1984 (SCDHS, 1984).

In response to additional violations of the Suffolk County Sanitary Code, Circuitron Corporation entered into a Stipulated Agreement, No. IW 0885, with SCDHS on March 7, 1985 (SCDHS, 1985).

In 1984, the former owner of Circuitron Corporation, Mario Lombardo, was charged for discharging organic solvents to unauthorized "hidden" leaching pools between March 1, 1982 and March 22, 1984. He was indicted on 6 felony counts of unlawful dumping of hazardous wastes, under N.Y.S. Environmental Conservation Law (ECL) Section 27, Subsection 09-14; 19 felony counts of offering a false instrument for filing, under Suffolk County Penal Law Section 175, Subsection 135; and 20 misdemeanor counts of violating N.Y.S. ECL Section 17, Subsection 03-01 and 05-01. On May 9, 1985, Mario Lombardo pleaded guilty to unlawful dumping of hazardous wastes, NYS Section 27, Subsection 09-14. He was fined \$50,000 and sentenced to 700 hours of community service.

When Circuitron Corporation informed SCDHS that they would be vacating the facility, SCDHS informed the owners that a cleanup of toxic and hazardous materials and a groundwater study would be required. SCDHS also required further off-site groundwater monitoring. Circuitron Corporation refused to comply with the off-site groundwater monitoring requirement. In addition, the property owner, 82 Milbar Corporation has brought suit against the current facility owners, ADI Electronics, for cleanup of the site.

1.2.4 Previous Investigation Results

Previous investigations on the Circuitron Corporation Site were performed over the past few years by the SCDHS and the USEPA prior to the performance of the RI. Results of these investigations have documented the contamination of the facility's septic system, SPDES leaching pool system and area storm water drainage system with volatile organics and heavy metals. The results of these investigations, including the work performed, samples taken and parameters detected, are presented in Sections 1.0 and 2.0 of the RI report for this site (Ebasco, 1990). Additional information regarding the USEPA Technical Assistance Team (TAT) field investigation and removal operation at the Circuitron Corporation Site is also described in the TAT Sampling Plan (USEPA, 1989a) and the Sampling Plan for Removal Operations at Circuitron Corporation (USEPA, 1989b). The analytical results of the USEPA sampling effort are contained in the "On-Scene Coordinator's Report" (USEPA, 1990).

1.2.4.1 On-Site Contamination

SCDHS sampling at the Circuitron Corporation facility included dye testing of piping systems to determine discharge points. The dye testing revealed that untreated wastewater discharges were going directly to the SPDES leaching pool (LP-1); to a storm drain in the southwest corner of the site (SD-3); and to at least two unauthorized leaching pools below the floor of the plating room in the building (LP-3, 4, 5 or 6). These wastewaters contained mainly heavy metals, solvents, and semivolatile organics.

Analysis of samples collected from the SPDES industrial discharge leaching pool LP-1 indicated the presence of particularly high levels of copper and 1,1,1-trichloroethane (1,1,1-TCA).

Analysis of samples collected from the sanitary cesspool CP-1 indicate that it received organic solvents such as methylene chloride and 1,1,1-TCA and metals such as copper, lead and silver.

In 1981, samples from the distribution pool (LP-2) in the northeast portion of the site also indicated that organic

solvents, such as 1,1,1-TCA, had been discharged. The distribution pool directed wastewater to the other leaching pools (LP-1, LP-7) in the northeast portion of the site.

The storm drain in the southwest corner (SD-3) has been cleaned at least once. The unauthorized leaching pool in the southern end of the plating room (LP-6) has also been cleaned, the sides scraped and the pool backfilled.

1.2.4.2 Groundwater Contamination

Five groundwater monitoring wells (MW-8 through MW-12) were installed by Circuitron Corporation. Their locations are shown on Figure 1-3. These wells were never approved because there are no engineering reports providing information on the wells' installation and development. SCDHS sampled the wells on September 10, 1985, and found that the groundwaters from the three downgradient wells (MW-10, MW-11 and MW-12) were contaminated with 1,1,1-TCA ranging in concentration from 60 to 520 ppb.

In addition to the on-site wells, municipal well S-22003, located at the Gazza Boulevard well field, approximately 1,500 feet south-southeast from the site, has been restricted due to contamination by volatile organic compounds. However, this well is screened at a depth of 268 feet below grade.

1.2.4.3 Surface Water Contamination

Surface water drainage is directed to the line of storm drains on the west side of the site (see Figure 1-3). These storm drains are interconnected with each other, but do not connect with the public storm drains on Milbar Boulevard and allow leaching or seepage directly into the soil below the bottomless storm drain structure. The SPDES leaching pool (LP-1) was observed to be overflowing as a result of facility operations on at least two occasions. The overflow of industrial wastewater was observed entering the storm drain (SD-1) on the west side of the site and also entering storm drains on Milbar Boulevard. The storm drains on Milbar Boulevard discharge to recharge basins which allow the storm water to slowly seep into the ground. The storm drain recharge basins for the stormdrains located along Milbar Boulevard have not been included in this scope of study.

1.2.4.4 Air Contamination

There are no documented incidents of an air release outside the building. The storm drain in the southwest corner, which received untreated wastes, has a slotted manhole cover as do the other storm drains along the storm drain line. The storm drains were monitored using an HNu photoionization detector, OVA flame ionization detector, and an explosimeter during the May 14, 1987 site inspection by the NUS Field Investigation Team 2. There were no readings above the background level detected in any of the storm drains.

There is a documented air release from one of the hidden leaching pools in the building. One of the SCDHS inspectors sampling the pool collapsed while wearing a respirator. SCDHS described waste in the pool as having a strong solvent odor.

1.2.4.5 Building Contamination

During the work performed at the site by the USEPA TAT during May 1989, wipe samples were obtained from the building's interior surfaces. This sampling was conducted subsequent to the removal of debris from the building by the USEPA. A total of 13 wipe samples were taken from the walls and floors of all four rooms of the building. Analysis of these samples reveals that there are traces of metals in the dust inside the building. The metals found in the dust were those commonly used in the circuitboard manufacturing process, such as copper and lead.

1.3 REMEDIAL INVESTIGATION RESULTS

This section will present a summary of the results of the Circuitron Corporation RI performed by Ebasco Services, Inc. during the months of August to November 1989. The information contained in this section is applicable for the performance of this feasibility study. If more detailed information is required for further investigation of the remedial alternatives discussed in this report or for the implementation of the remedial action for this site, the RI report (Ebasco, 1990) should be consulted.

1.3.1 Geological and Hydrological Characteristics

The Circuitron Corporation Site is located on outwash plain deposits south of the Ronkonkoma recessional moraine. These deposits, which are a mixture of coarse sand and gravel, constitute the soils of the Upper Glacial Aquifer. These soils overlay a southward sloping wedge of unconsolidated deposits consisting of the Magothy Aquifer, an aquiclude of Raritan clay, the Lloyd sand aquifer and finally bedrock.

Based upon evaluation of water levels taken from both shallow and deep monitoring wells, the groundwater flow is to the southeast in both the Upper Glacial Aquifer and the Magothy Aquifer. The depth to the beginning of the water table in the Upper Glacial Aquifer is 25-27 feet below the ground surface. The Magothy Aquifer is estimated to begin 70-75 feet below the ground elevation.

There are several municipal water supply wells within a 3-mile radius of the site. All of these wells are screened in the Magothy Aquifer, except for one which is reported to be screened in the deeper portions of the Upper Glacial Aquifer. Recharge to the Upper Glacial Aquifer occurs by percolation of precipitation; the underlying aquifers, consisting of the Magothy and the Lloyd, are hydraulically connected to the Upper Glacial Aquifer.

The site soil column is deep. Grain size analysis and total organic carbon analyses were performed on soils sampled from 5 to 32 feet in four different monitoring well borings. The grain size averaged 22.6% gravel, 75.8% sand and 1.6% silt-clay. Soil texture is an important factor and can control a contaminants' mobility. The organic carbon content of soils averaged 0.058% (range: 0.010% to 0.270%); the cation exchange capacity of the soil was not determined but is likely to be minor because of the small amount of the silt/clay fraction.

The water transmitting properties of Long Island have been widely studied and are important for a clear understanding of the aquifers in the area of the site (Upper Glacial Aquifer and Magothy Aquifer). Values for these properties, such as those given below, can be calculated using specific capacity data from wells. For the Upper Glacial Aquifer, in the vicinity of the site, the following estimates have been made: the average hydraulic conductivity is equal to 2,000 gpd/ft², the average saturated thickness of the aquifer is equal to 50 feet, and the average transmissivity of the aquifer is equal to 100,000 gpd/ft. For the Magothy Aquifer, in the vicinity of the site, the following estimates have been made: the average hydraulic conductivity is equal to 400 gpd/ft², the average saturated thickness of the aquifer is equal to 700 feet, and the average transmissivity of the aquifer is equal to 280,000 gpd/ft.

Vertical conductivity in the Magothy Formation is less than in the horizontal direction because beds and lenses of silt and clay impede the vertical movement of water; on the contrary, groundwater moves readily through the coarse outwash deposits of the Upper Glacial Aquifer where stratification is less apparent. Some estimates for the hydraulic conductivity of the Upper Glacial Aquifer are 390 ft/d in the horizontal to 160 ft/d in the vertical direction for the Magothy Aquifer 66 ft/d in the horizontal to 6 ft/d in the vertical direction. Although these

data vary widely, they illustrate that the relative vertical permeabilities are an order of magnitude lower in the Magothy Aquifer.

For the Upper Glacial Aquifer, the hydraulic gradient equals 0.0015 ft/ft and the hydraulic conductivity equals 2000 gpd/ft² or 267 ft/day. Assuming an effective porosity of 0.25, the groundwater velocity is estimated to approximately 1.6 ft/day.

For the top of the Magothy Aquifer the gradient equals 0.0026 ft/ft and the hydraulic conductivity equals 400 gpd/ft² or 53 ft/day. Assuming the same effective porosity of 0.25, the groundwater velocity is estimated to approximately 0.5 ft/day.

In the Upper Glacial Aquifer, the estimated groundwater flow beneath the site is approximately 37,500 gallons per day. The estimated flow in the top 25 feet of the Magothy Aquifer underneath the site is 6,500 gallons per day. From this analysis, it appears that more groundwater moves through the Upper Glacial Aquifer underneath the site than moves through the top 25 feet of the Magothy Aquifer beneath the site.

1.3.2 Nature and Extent of Contamination

Previous investigations and the RI (Ebasco, 1990) have shown that there were discharges of untreated process wastewater to the identified underground liquid handling structures at the site. These include the known leaching pools both inside and outside the building, the sanitary cesspools in the front of the building and the storm drains along the western edge of the property. The construction of these structures is such that the liquid entering is allowed to percolate into the surrounding soil. These structures are bottomless and some have perforated sides to accomodate lateral percolation as well as vertical. The untreated process wastewater appears to have consisted of chlorinated solvents, residues of plastics operations (phthalates), and spent metal plating solutions. This can be determined from evaluation of the contaminants found on-site and also from historical data for similar operations. Due to the settling of the particulates in the water, a layer of sediment has accumulated at the bottom of these structures. The RI focused around these underground structures. Soil borings were drilled in areas of suspected dumping of wastewater, and both shallow and deep groundwater monitoring wells were installed so as to capture groundwater flowing past the structures. Samples of the sediments at the bottom of the structures were also taken.

1.3.2.1 Groundwater

Monitoring wells were installed and screened in both deep and shallow portions of the Upper Glacial Aquifer, at upgradient, on-site and downgradient locations. The monitoring wells were installed in a cluster arrangement, one deep well screened at 90-100 feet deep and one shallow well screened between 2 feet above the water table surface to 8 feet below the water table surface. The depths of the shallow well range from 34 to 38 feet. These wells were located downgradient of the suspected sources of contamination, the underground structures, so as to provide an accurate measure of the groundwater contamination. The upgradient wells, MW-1D and MW-1S, were intended to monitor groundwater before it became contaminated by any on-site contaminants by flowing through the site area. These "background" conditions would then be compared to the characteristics of the groundwater taken from the on-site monitoring wells to determine the extent of groundwater contamination due to site activity. Samples from these wells, along with the 5 existing wells installed previously by Circuitron Corporation, were taken and analyzed for volatile organic compounds, extractables, metals and hexavalent chromium. The contaminants of concern as determined during the Risk Assessment (discussed later in Section 1.3.4) that were detected in the groundwater monitoring wells are shown in Figures 1-4 and 1-5.

These figures show, for each well sampled and all rounds of sampling, the contaminants of concern that were detected and the concentrations. The compounds identified as contaminants of concern are presented in Table 1-1. The figures enable a quick comparison of which areas of the site groundwater contained which contaminants. The figures may also be used to compare the highest concentrations for the contaminants during each round of sampling to determine the effect of the upgradient concentrations upon the groundwater below the site, or other areas of groundwater contamination.

Seven volatile organic compounds were the most abundant from both a concentration and frequency of occurrence basis. These include: 1,1-dichloroethene, 1,1-dichloroethane, trans-1,2-dichloroethene, chloroform, 1,1,1-trichloroethane, trichloroethene, and tetrachloroethene. 1,1,1-Trichloroethane (1,1,1-TCA) was present at the greatest concentrations, both upgradient and on-site, relative to the other volatile organics analyzed. The concentration ranges for each of these compounds for each well are shown on Figure 1-4 for the shallow groundwater.

The greatest total volatile organic concentrations in all the wells, with the exception of one, was MW-1S (760 ug/l and 1,216 ug/l) which was located north and upgradient of the site across Milbar Boulevard.

This was an unexpected result since this well was located to represent the upgradient, off-site (and presumed uncontaminated) well. Other volatile organic compounds detected in MW-1S include 1,1-dichloroethane and 1,1-dichloroethene.

The most contaminated groundwater sample was taken during Round 1 from MW-4S and it contained a total of 4,753 ug/l of volatile organic compounds, of which 4,600 ug/l was attributed to 1,1,1-TCA. However, during Round 2 of the groundwater sampling, the concentration of 1,1,1-TCA in the same well was found to be below detection limits. This discrepancy may have been due to either a sampling error or a laboratory error. This well is located slightly downgradient of SD-3, which was known to have received discharges of untreated process wastewater consisting of spent solvents and metal salt solutions.

The levels of inorganics detected in the groundwater samples were all below Federal or State drinking water or groundwater standards except for lead. Several other metals were detected in elevated concentrations (but below ARARs), including copper (ND-538 ug/l) chromium (ND-870 ug/l), lead (ND-61.4 ug/l) and nickel (ND-73.4 ug/l). The majority of the wells which showed elevated levels of metals were located in the vicinity of the underground structures.

Based upon the interpretation of the data collected during the RI with regard to the groundwater, the following conclusions can be made of the shallow aquifer contamination at the Circuitron Corporation Site:

- (1) Because of the presence of volatile organic compounds, especially 1,1,1-TCA, in MW-1S, there is existing contamination of the shallow aquifer upgradient of the site. The 1,1,1-TCA concentration level increases slightly beneath the site, specifically in MW-4S which is in the area of SD-3, indicating the presence of a contamination source in this area, and then decreases significantly downgradient of the site. The other volatile organic compounds detected in MW-1S were also present in equivalent concentrations in on-site wells.
- (2) Stormwater runoff draining through SD-2 and SD-3 has caused the leaching of spent solvents from the storm drain sediments at the southwest corner of the site and resulted in excessive soil contamination by 1,1,1-TCA in that area. This clearly has resulted in shallow aquifer contamination by this compound at that location as seen in the Round 1 groundwater sample taken from MW-1S.

The deeper portions of the Upper Glacial Aquifer appear to be minimally affected by the site activities. Contamination was discovered in the deep upgradient groundwater monitoring well which consisted of many of the same or similar compounds, in equivalent concentrations, as were found in the on-site deep monitoring wells. This upgradient groundwater contamination is likely responsible for much of the contamination found in on-site and downgradient deep wells.

1.3.2.2 Soil/Sediment

These two media will be considered together due to similar contamination characteristics.

Surface soil samples were collected at two locations behind the building from the only unpaved portion of the site. These samples were taken at depths of 0' to 0.5'. Subsurface soil samples were taken at depths of every two feet from six soil borings (SB-1 through SB-6) and during the drilling of four deep monitoring wells (MW-1 through MW-4). Approximately 86 soil samples were taken and analyzed for volatile organics, extractables and metals. The total organic carbon content of some of the samples were also determined. The borings were located in the vicinity of the underground structures so as to provide information on the possible spatial contamination of the soil as a result of the untreated wastewater discharges to the structures. The monitoring wells were installed at locations to capture groundwater flow past the underground structures, except for the upgradient Well MW-1D, which was intended to measure "background" conditions against which the on-site soil and groundwater contamination would be compared.

Sediment samples were taken from all of the underground structures with the exception of the unauthorized leach pools beneath the building floor. This sampling included SD-1, SD-2, and SD-3, and CP-2, and LP-1 outside the building. The other suspected leach pools outside the building, LP-2 and LP-7, were not sampled because of inaccessibility. The sediments were analyzed for the same parameters as the soil samples with the exception of the omission of total organic content analysis.

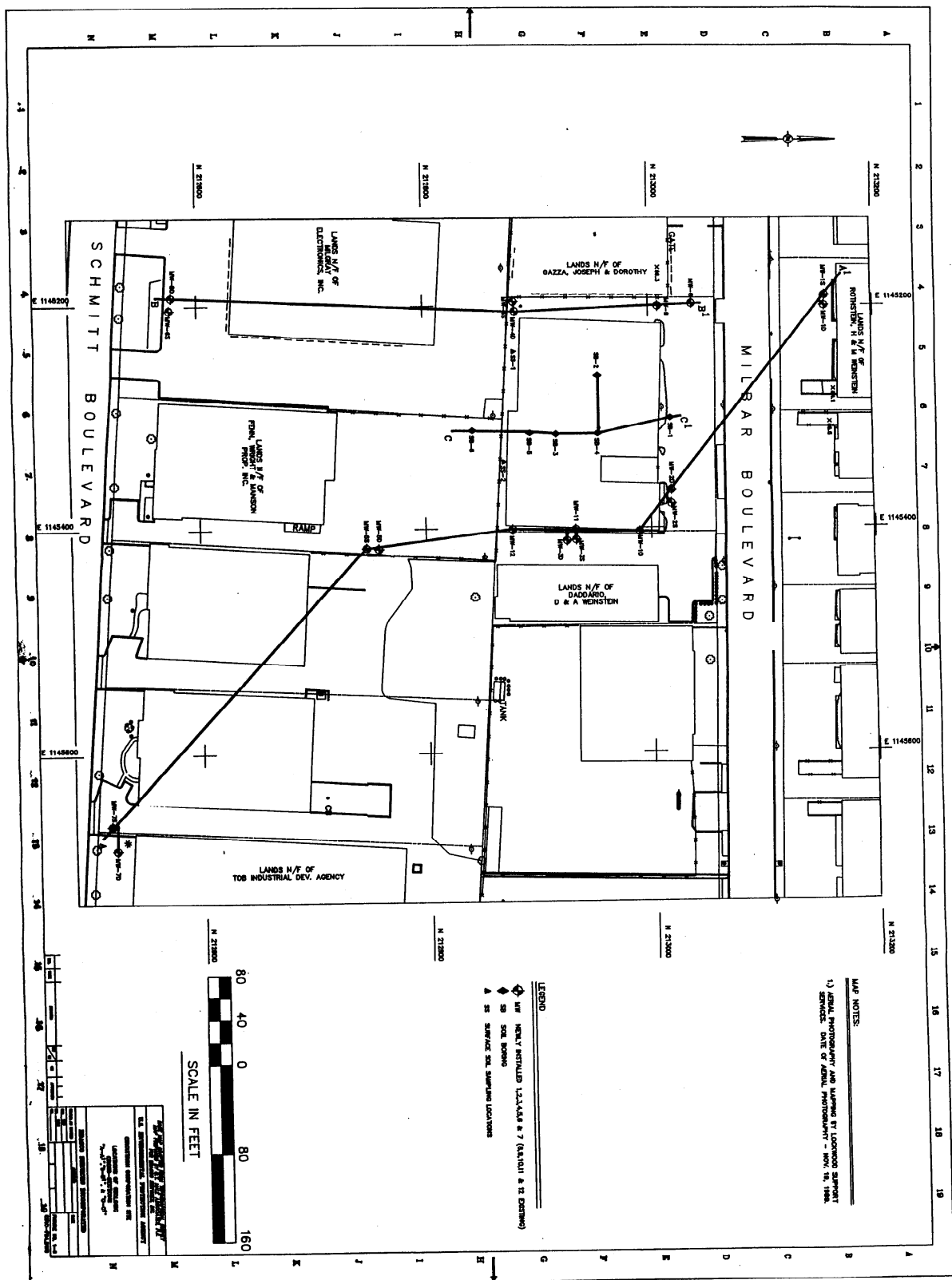
These analyses showed that the soil samples are contaminated with volatile organic compounds, several phthalate compounds and high levels of copper in some areas. The sediments are contaminated with volatile organics, phthalates, pesticides, and metals. All of these contaminants, except for the pesticides, can be traced to the discharge of untreated process wastewater to the various underground structures by Circuitron Corporation during facility operations, which ceased approximately 5 years ago. The pesticides were detected in the storm drain sediments and are probably the result of landscaping activities at the site combined with stormwater runoff. There is no evidence that pesticides were used for industrial purposes at the site.

In order to compare the analytical results of the subsurface soil sampling program on a vertical extent, geological cross sections were developed. Figure 1-6 shows the locations of the cross sections. Figures 1-7 through 1-9 illustrate the vertical distribution of the contaminants of concern determined during the performance of the risk assessment of this site in the subsurface soils of three geologic cross sections A-A', B-B' and C-C'. The risk assessment which identified the contaminants of concern is discussed below in Section 1.3.4. The spatial distribution of the contaminants of concern in the surface and subsurface soils at upgradient, on-site and downgradient locations is presented in Figure 1-10. Figure 1-11 shows the distribution of the contaminants of concern in the sediments of the underground structures. Discussion of these figures is presented in the following paragraphs.

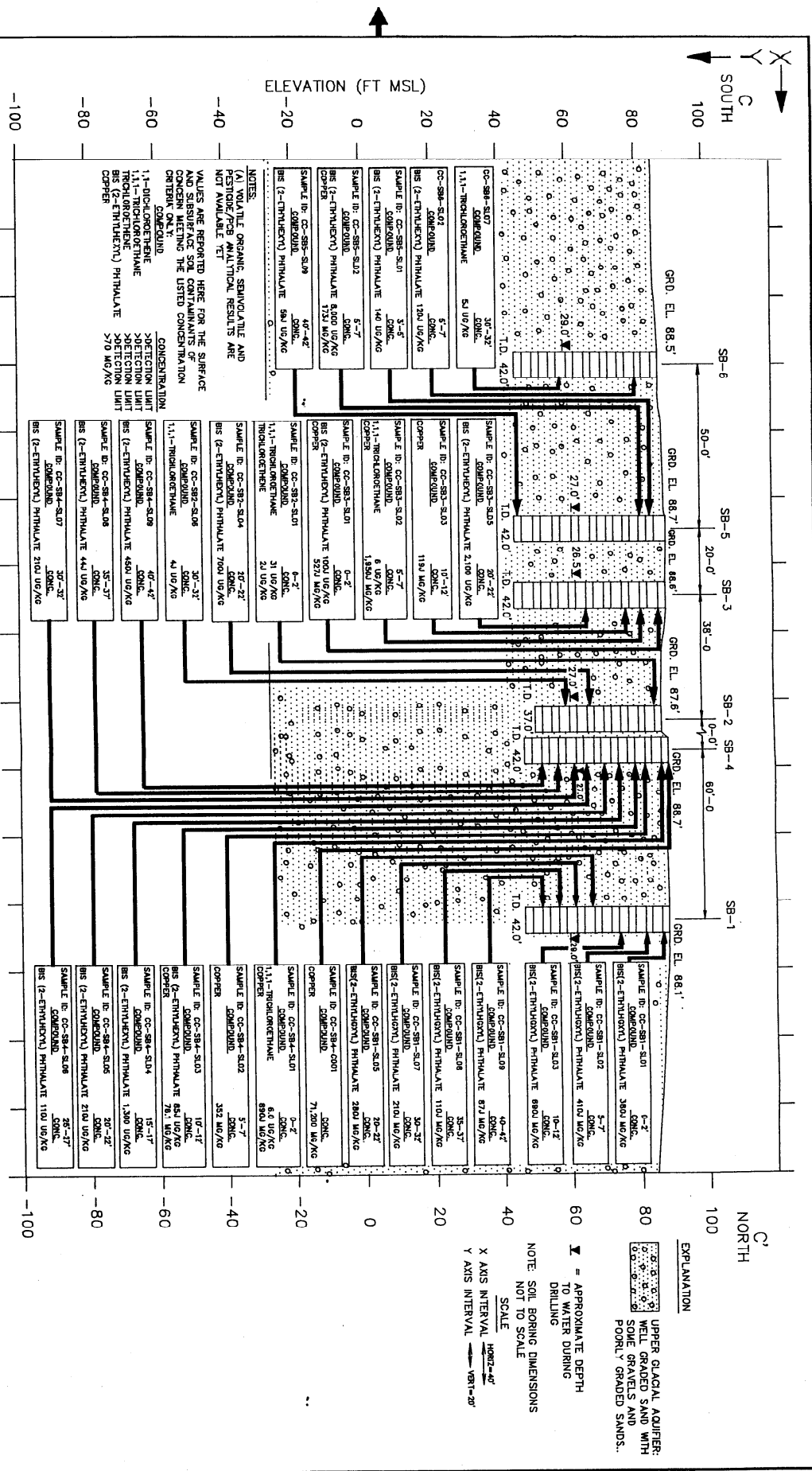
The surface soil samples were found to be contaminated with elevated levels of copper; 5,060 mg/kg were detected in one sample; and phthalates. The surface soil in the southwest portion of the building was found to contain 1,300 ug/kg of bis(2-ethylhexyl)phthalate (BEHP) and smaller amounts of other phthalate compounds.

The analytical results of the soil samples collected from beneath the building show that there is evidence of soil contamination due to the use of the unauthorized leaching pools during facility operations. The main constituents of the soil contamination are copper and BEHP. Copper was found in the top 12 feet of soil at concentrations above naturally occurring levels, with a maximum concentration of 1,950 mg/kg in the 5-7 foot deep sample of SB-3. Phthalates were detected at all depths through the water table at concentrations up to 1,300 ug/kg. As can be seen on Figure 1-10, the majority of the contamination appears to be focused in the soils beneath the plating room where the unauthorized leaching pools are located. This soil contamination can be directly attributed to the use of these leaching pools for the discharge of process wastewater.

The soils in the southwest corner of the site at MW-4D were found to be the most highly contaminated of all the samples collected during the RI. Various volatile and semi-volatile organic compounds were found at all depths through the water table to the bottom of the well screen at 34 feet below grade. The predominant volatile organic compound found is 1,1,1-TCA which was detected at a concentration of 100,000 ug/kg at a depth of 20-22 feet below grade and just 3 feet above the water table of the Upper Glacial Aquifer. The predominant semi-volatile contaminant is BEHP. The highest concentration (20,000 ug/kg) was found in the sample taken at the depth of 15-17 feet below grade. The elevated levels of contamination

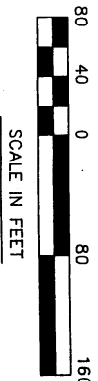
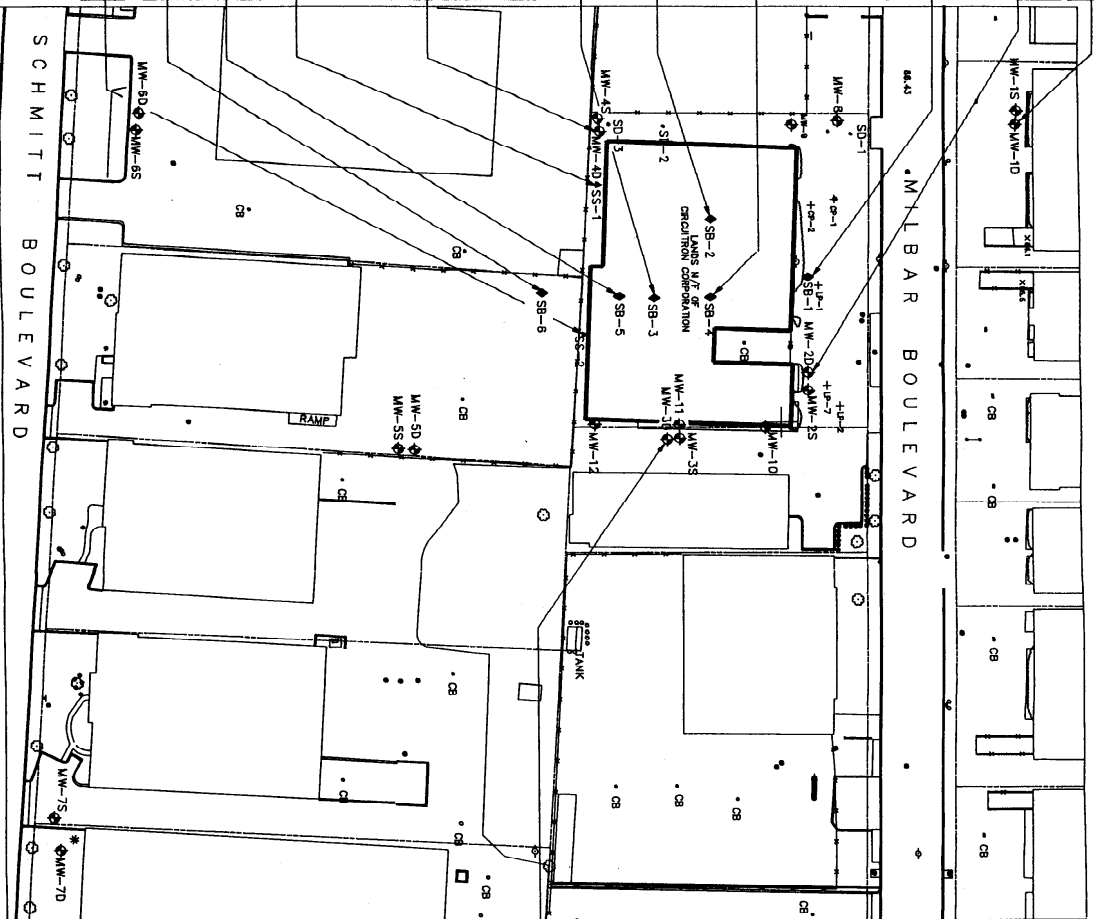






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CIRCUITON CORPORATION SITE			
GEOLOGIC CROSS SECTION C - C'			
SUBSURFACE SOIL RESULTS FOR CONTAMINANTS OF CONCERN			
FIG. NO. 1-9			
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ORIG. 8/27/80			
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APPROVED			
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8310.071			
CIRCUITON CORPORATION SITE			
GEOLOGIC CROSS SECTION C - C'			
SUBSURFACE SOIL RESULTS FOR CONTAMINANTS OF CONCERN			
FIG. NO. 1-9			
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ORIG. 8/27/80			
11X17			

NAME	TYPE	LOCATION	DATE	STATUS
NAME 1	TYPE 1	LOCATION 1	DATE 1	STATUS 1
NAME 2	TYPE 2	LOCATION 2	DATE 2	STATUS 2
NAME 3	TYPE 3	LOCATION 3	DATE 3	STATUS 3
NAME 4	TYPE 4	LOCATION 4	DATE 4	STATUS 4
NAME 5	TYPE 5	LOCATION 5	DATE 5	STATUS 5
NAME 6	TYPE 6	LOCATION 6	DATE 6	STATUS 6
NAME 7	TYPE 7	LOCATION 7	DATE 7	STATUS 7
NAME 8	TYPE 8	LOCATION 8	DATE 8	STATUS 8
NAME 9	TYPE 9	LOCATION 9	DATE 9	STATUS 9
NAME 10	TYPE 10	LOCATION 10	DATE 10	STATUS 10
NAME 11	TYPE 11	LOCATION 11	DATE 11	STATUS 11
NAME 12	TYPE 12	LOCATION 12	DATE 12	STATUS 12
NAME 13	TYPE 13	LOCATION 13	DATE 13	STATUS 13
NAME 14	TYPE 14	LOCATION 14	DATE 14	STATUS 14
NAME 15	TYPE 15	LOCATION 15	DATE 15	STATUS 15
NAME 16	TYPE 16	LOCATION 16	DATE 16	STATUS 16
NAME 17	TYPE 17	LOCATION 17	DATE 17	STATUS 17
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NOTES:

1. AERIAL PHOTOGRAPHY AND MAPPING BY LOGWOOD SURVEY SERVICE, DATE OF AERIAL PHOTOGRAPHY - NOV. 18, 1988.

LEGEND:

- MW NEWLY INSTALLED 1,2,3,4,5,6 & 7 (S&L,1) 12 (EXISTING)
- SB SOL. DRAIN
- SD STORM DRAIN
- CB CATCH BASIN
- + UP LEAKHOLE
- + CP CESSPOOL
- A SS SURFACE SOL. SAMPLING LOCATIONS

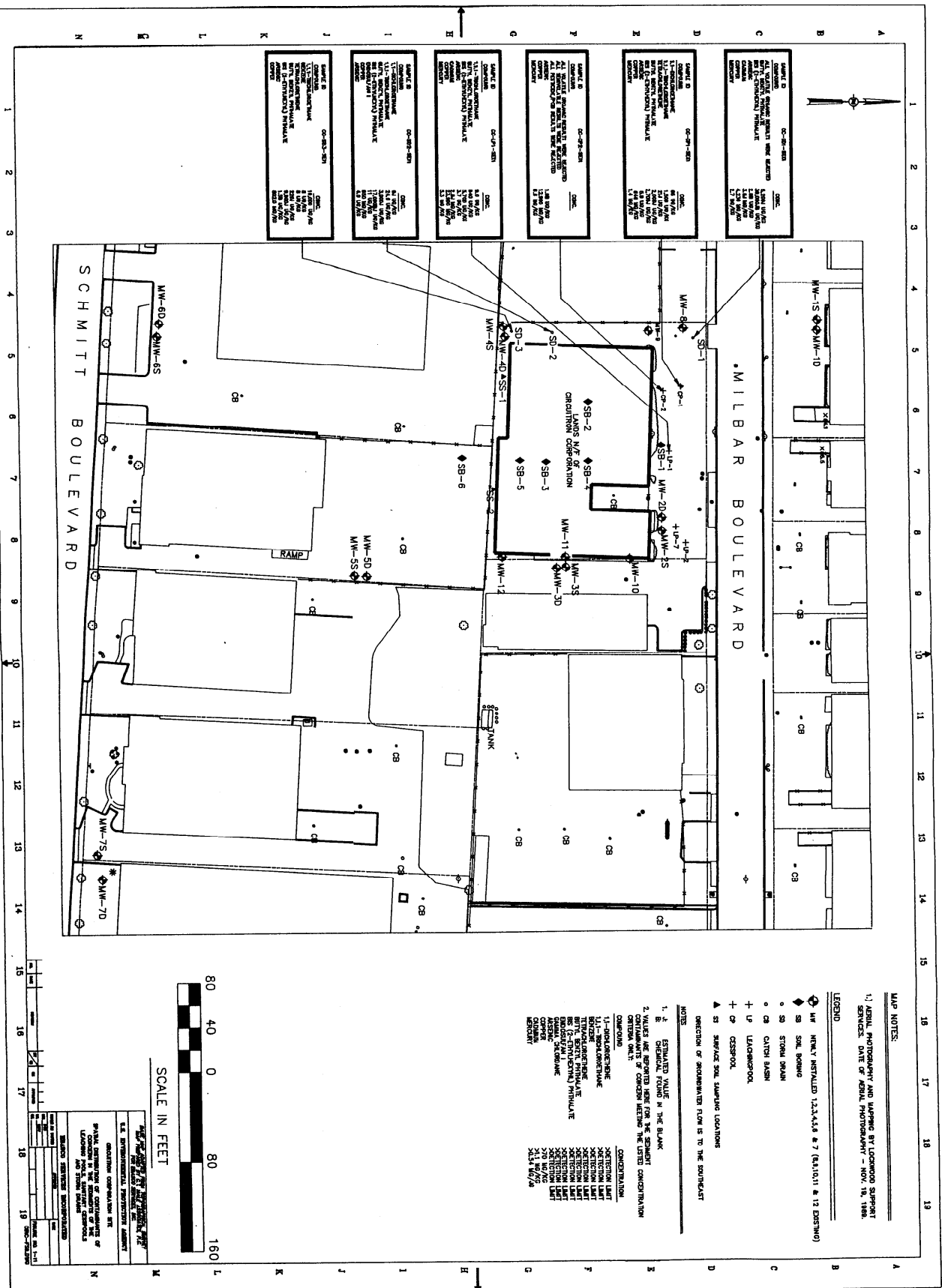
DIRECTION OF GROUNDWATER FLOW IS TO THE SOUTHEAST

VALUES ARE REPORTED HERE FOR THE SURFACE AND SUBSURFACE SOL. CONCENTRATIONS OF CHLORINE NITRATES THE LISTED CONCENTRATION IS THE AVERAGE OF THE SURFACE AND SUBSURFACE CONCENTRATIONS.

CONCENTRATION:

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- 1.6 - 2.0 MG/L
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- 2.6 - 3.0 MG/L
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- 54.1 - 54.5 MG/L
- 54.6 - 55.0 MG/L
- 55.1 - 55.5 MG/L
- 55.6 - 56.0 MG/L
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- 66.6 - 67.0 MG/L
- 67.1 - 67.5 MG/L
- 67.6 - 68.0 MG/L
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- 68.6 - 69.0 MG/L
- 69.1 - 69.5 MG/L
- 69.6 - 70.0 MG/L
- 70.1 - 70.5 MG/L
- 70.6 - 71.0 MG/L
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- 79.6 - 80.0 MG/L
- 80.1 - 80.5 MG/L
- 80.6 - 81.0 MG/L
- 81.1 - 81.5 MG/L
- 81.6 - 82.0 MG/L
- 82.1 - 82.5 MG/L
- 82.6 - 83.0 MG/L
- 83.1 - 83.5 MG/L
- 83.6 - 84.0 MG/L
- 84.1 - 84.5 MG/L
- 84.6 - 85.0 MG/L
- 85.1 - 85.5 MG/L
- 85.6 - 86.0 MG/L
- 86.1 - 86.5 MG/L
- 86.6 - 87.0 MG/L
- 87.1 - 87.5 MG/L
- 87.6 - 88.0 MG/L
- 88.1 - 88.5 MG/L
- 88.6 - 89.0 MG/L
- 89.1 - 89.5 MG/L
- 89.6 - 90.0 MG/L
- 90.1 - 90.5 MG/L
- 90.6 - 91.0 MG/L
- 91.1 - 91.5 MG/L
- 91.6 - 92.0 MG/L
- 92.1 - 92.5 MG/L
- 92.6 - 93.0 MG/L
- 93.1 - 93.5 MG/L
- 93.6 - 94.0 MG/L
- 94.1 - 94.5 MG/L
- 94.6 - 95.0 MG/L
- 95.1 - 95.5 MG/L
- 95.6 - 96.0 MG/L
- 96.1 - 96.5 MG/L
- 96.6 - 97.0 MG/L
- 97.1 - 97.5 MG/L
- 97.6 - 98.0 MG/L
- 98.1 - 98.5 MG/L
- 98.6 - 99.0 MG/L
- 99.1 - 99.5 MG/L
- 99.6 - 100.0 MG/L

NAME	TYPE	LOCATION	DATE	STATUS
NAME 1	TYPE 1	LOCATION 1	DATE 1	STATUS 1
NAME 2	TYPE 2	LOCATION 2	DATE 2	STATUS 2
NAME 3	TYPE 3	LOCATION 3	DATE 3	STATUS 3
NAME 4	TYPE 4	LOCATION 4	DATE 4	STATUS 4
NAME 5	TYPE 5	LOCATION 5	DATE 5	STATUS 5
NAME 6	TYPE 6	LOCATION 6	DATE 6	STATUS 6
NAME 7	TYPE 7	LOCATION 7	DATE 7	STATUS 7
NAME 8	TYPE 8	LOCATION 8	DATE 8	STATUS 8
NAME 9	TYPE 9	LOCATION 9	DATE 9	STATUS 9
NAME 10	TYPE 10	LOCATION 10	DATE 10	STATUS 10
NAME 11	TYPE 11	LOCATION 11	DATE 11	STATUS 11
NAME 12	TYPE 12	LOCATION 12	DATE 12	STATUS 12
NAME 13	TYPE 13	LOCATION 13	DATE 13	STATUS 13
NAME 14	TYPE 14	LOCATION 14	DATE 14	STATUS 14
NAME 15	TYPE 15	LOCATION 15	DATE 15	STATUS 15
NAME 16	TYPE 16	LOCATION 16	DATE 16	STATUS 16
NAME 17	TYPE 17	LOCATION 17	DATE 17	STATUS 17
NAME 18	TYPE 18	LOCATION 18	DATE 18	STATUS 18
NAME 19	TYPE 19	LOCATION 19	DATE 19	STATUS 19
NAME 20	TYPE 20	LOCATION 20	DATE 20	STATUS 20



detected at this location appear to be the result of the illegal discharges of process wastes and spent solvents from an old operations tank inside the building to the storm drain (SD-3) which is located immediately upgradient of MW-4D. The interconnection of the facility piping system with the storm drain was confirmed by SCDHS in an earlier investigation utilizing dye testing.

The storm drains along the western edge of the site, (SD-1, SD-2, and SD-3) were found to be the most contaminated of all the sediment samples collected. Elevated levels of 1,1,1-TCA and phthalates were detected, such as 19,000 ug/kg of 1,1,1-TCA, 39,000 ug/kg of bis(2-ethylhexyl)phthalate, and 5,200 ug/kg of butyl benzyl phthalate. Copper was also detected in these sediments at concentrations of 802 mg/kg to 4,230 mg/kg. The sediments of the cesspools and the authorized leaching pool LP-1 were also sampled and found to contain levels of copper, phthalates and 1,1,1-TCA above expected background levels. The copper concentrations in the sediments of cesspool CP-2 and leachpool LP-1 were 12,900 mg/kg and 23,900 mg/kg respectively. As stated previously, all of these contaminants were constituents of chemicals suspected of being used at the facility while it was operational. Because several of these underground structures, most notably storm drains SD-1, SD-2 and SD-3, are capable of receiving stormwater runoff and allowing it to percolate into the ground, the contaminated sediments currently serve as potential contaminant sources to the soil and groundwater beneath the site (Ebasco, 1990).

In summary, it is apparent that there are several highly contaminated areas at the site attributed to the long term discharge of chemicals and process wastewater during operation of the Circuitron Corporation manufacturing facility. The groundwater, soil and sediment sample analytical results show that the majority of the contamination appears to be in the vicinity of the underground structures, and that the chemical laden sediments existing within these leaching pools are capable of, and most probably are contributing to the site contamination problem.

1.3.2.3 Structure

The site includes the building that was used to house the offices and the plant operations of the circuitboard manufacturing facility. Portions of the building were also subjected to examination with regard to determining the extent of contamination of the structure itself.

The area of the building designated as the plating room was the location of the heaviest use of chemicals in the manufacturing process. This room contained several plating baths and it is evident from visual inspection of the concrete floor in this

room that there is severe contamination of a portion of the floor due to spillage, leakage or similar misuse of the chemicals required for the circuitboard plating process. Analytical results of concrete core taken from this area of the floor showed high levels of pesticide compounds, such as 97 ug/kg of endosulfan sulfate, 29 ug/kg of delta-BHC and 25 ug/kg 4-4-DDE. Also detected in this core was 71,200 mg/kg of copper.

The USEPA TAT activities included a wipe sampling program inside the building. A total of 13 wipe samples were collected from the walls and floors of all four rooms of the building. The samples were taken after completion of the removal of all debris generated as a result of the clean-up activities. Evaluation of the analytical results of the samples shows that there is some small amount of metals contamination in the dust inside the building clearly due to the manufacturing nature of the activities formerly performed at this location (USEPA, 1990). This is based on the conservative assumption that all the settled dust on the floors and walls may become resuspended in the air. The amounts of metals contained in the air as a result of the complete resuspension of the dust will be in violation of OSHA Standards.

1.3.3 Contaminant Fate and Transport

This section will briefly summarize the information contained in Section 7.0 of the RI report (Ebasco, 1990) for this site relating to the environmental fate and transport mechanisms for the contaminants detected at the Circuitron Corporation Site.

The volatile organic compounds, as discussed in Section 1.3.2.1, contained in the groundwater and subsurface soils and sediments at the site are highly soluble in water, mobile, they are readily transported into the atmosphere when in contact with air. They also exhibit low soil adsorption characteristics. For these reasons, these compounds are not very persistent in the environment and are easily removed from soil. Surface water percolation through contaminated soils or sediments and subsequent groundwater transport of the contamination are the principle environmental fate processes for this class of compounds.

The semi-volatile organic compounds found at the site include several phthalate esters and polycyclic aromatic hydrocarbons (PAHs). These compounds were contained primarily in the soil/sediment matrix. As opposed to the volatile organic compounds described above, these compounds generally exhibit very low

volatilization and relatively low water solubility characteristics, and readily adsorb onto soil particles and organic matter. The phthalate esters and PAHs associated with the site are relatively persistent in the soil/sediment matrix. The significant fate/transport mechanisms for this class of contaminants are biodegradation and sorption, and groundwater transport of the soil particles they are adsorbed to.

Numerous metals were detected in the groundwater and soil/sediment matrices at the site. Many of these metals are normal constituents of the sandy soils of this region or in the groundwater due to leaching from the soil over long periods of time. In general the metals detected at greater than background concentrations are typically persistent within environmental matrices. This persistence is primarily related to recycling mechanisms within environmental matrices for some metals (e.g., arsenic, lead and copper), and removal mechanisms (precipitation, cationic exchange, adsorption, etc.) which decrease mobility. Chemical speciation of metals in the environment can result in metal concentrations in both solid and aqueous media or preferential presence entirely in one medium. However, the fate reactions and the behavior of these metals under site geochemical conditions may lead to an increase and/or decrease in their concentrations in specific matrices.

The metals, which are associated with the particulate phase, will migrate more slowly in the groundwater than the volatile organics due to their high affinity for adsorption to soil and organic matter.

In conclusion, based on the physical properties and locations of the various compounds detected as contaminants at the Circuitron Corporation Site, the primary mechanism of contaminant migration into the aquifer below the site and off the site is via surface water runoff leaching and groundwater transport. Leaching of contaminants via infiltration of precipitation is somewhat minimized by the asphalt paving and building which cover most of the site.

1.3.4 Baseline Risk Assessment

The purpose of the baseline risk assessment is to evaluate exposures and potential risks that surrounding residents are currently subject to with regard to existing site conditions. The public health evaluation also anticipated potential future uses for the site and the groundwater beneath the site. The detailed description of the procedures and methodologies employed in the risk assessment for the Circuitron Corporation Site is presented in Section 8.0 of the RI report (Ebasco, 1990).

The exposure routes utilized in the performance of the risk assessment were limited to those involving future land use scenarios. The existing site conditions are such that no exposure pathway is presently complete because of the limited exposure of the site to residential areas and non-use of the Upper Glacial Aquifer which lies beneath the site for potable water supplies. The potential future exposure routes of contaminants at the site include ingestion of and other domestic uses of the groundwater from the Upper Glacial Aquifer, and potential dermal exposure to sediments by workers during remediation activities. Ingestion and exposure/contact with contaminated soil by residents was not evaluated because of the limited possibility of this scenario occurring due to the fact that approximately 95% of the site is paved area.

Based on the evaluations performed as a part of the risk assessment, contaminants of concern were identified for groundwater, soil and sediment. These compounds are presented in Table 1-1. In the groundwater, the worst case cancer risk was associated with 1,1-dichloroethane. Benzene, trichloroethene and tetrachloroethene were retained because of their inherent carcinogenicity. The remaining organic compounds were included because of their non-carcinogenic risk factor of greater than 1%. The metals identified in Table 1-1 as contaminants of concern in the groundwater were selected because of their risk factors. The compounds identified as contaminants of concern in the soils and sediments include metals that were detected above background levels and having carcinogenic and/or non-carcinogenic risk factors greater than 10%.

Tables 1-2 through 1-5 present the carcinogenic and non-carcinogenic effects of the groundwater exposure pathways, both via ingestion and inhalation while showering.

Based on the risk assessment, the only major potential exposure for concern is if the Upper Glacial Aquifer is developed as a public water supply in the future. This aquifer is not presently used for drinking water supply in this region of Long Island due to the regional contamination of volatile organic compounds and other contaminants as a result of various discharges to groundwater by the many industries located there (Ebasco, 1990). The risks are due to the possibility of the use of this aquifer as a potable water source and the concentrations of inorganic elements and volatile organic compounds detected in the groundwater of this aquifer.

As can also be seen from examination of the data in Tables 1-2 through 1-5, there presently exists evidence of both carcinogenic and non-carcinogenic risks that would result from the use of upgradient groundwater. Both shallow and deep well results,

TABLE 1-1

SUMMARY OF ORGANIC AND INORGANIC
CONTAMINANTS OF CONCERN

<u>Surface/Subsurface Soils</u>	<u>Sediments</u>	<u>Groundwater</u>
1,1-dichloroethene	1,1-dichloroethane	1,1-dichloroethene
1,1,1-trichloroethane	1,1,1-trichloro- ethane	1,1-dichloroethane benzene
trichloroethene	benzene	chloroform
	tetrachloroethene	1,1,1-trichloro- ethane
		trichloroethene
		tetrachloroethene
bis(2 ethylhexyl)phthalate		
copper	butylbenzyl phthalate	
	bis(2 ethylhexyl) phthalate	
	endosulfan I	copper
	gamma-chlordane	chromium
		nickel
		lead
	arsenic	
	cadmium	
	copper	
	mercury	

TABLE 1-2

CIRCUITRON CORPORATION SITE

GROUNDWATER INGESTION PATHWAY

CARCINOGENIC EFFECTS

RESIDENTIAL AND SITE WORKER

MW SAMPLES	CASE	UPGRADIENT ADULT-RES	ON-SITE ADULT-RES	ON-SITE ADULT- WORKER	DOWN- GRADIENT ADULT-RES
Round I:					
Shallow wells	Ave	---1/	7.87 E-5*	2.70 E-5*	5.43 E-6*
	Max	---1/	2.62 E-4*	8.98 E-5*	1.81 E-5*
Deep wells	Ave	1.36 E-5*2/	2.06 E-5*	1.41 E-5*	2.45 E-5*
	Max	4.55 E-5*	6.86 E-5*	4.70 E-5*	8.17 E-5*
Round II:					
Shallow wells	Ave	2.01 E-5*	7.06 E-5*	4.84 E-5*	5.98 E-6*
	Max	6.69 E-5*	2.35 E-4*	1.61 E-4*	1.99 E-5*
Deep wells	Ave	1.26 E-5*	3.13 E-5*	2.14 E-5*	2.15 E-5*
	Max	4.21 E-5*	1.04 E-4*	7.13 E-5*	7.18 E-5*

Notes:

1/ No carcinogens detected in upgradient shallow wells.

2/ The "*" indicates a carcinogenic risk greater than
1 x 10⁻⁶.

TABLE 1-3

CIRCUITRON CORPORATION SITE

GROUNDWATER INGESTION PATHWAY
NON-CARCINOGENIC EFFECTS

MW SAMPLES	UPGRADIENT		ON-SITE		DOWNGRADIENT	
	CHILD-RES	ADULT-RES	CHILD-RES	ADULT-RES	CHILD-RES	ADULT-RES
Round I:						
Shallow wells	0.963 1/	0.482	28.0 *2/	14.0 *	1.23 *	0.614
Deep Wells	0.198	0.099	2.80 *	1.40 *	11.5 *	5.74 *
Round II:						
Shallow wells	0.750	0.375	25.2 *	9.50 *	0.269	0.135
Deep wells	4.50 *	3.08 *	5.88 *	2.94 *	6.38 *	3.19 *

NOTES:

1/ Values shown are the total hazard index. A value less than 1 indicates a non-hazardous situation.

2/ The "*" indicates that a potential hazard exists for this scenario.

TABLE 1-4

CIRCUITRON CORPORATION SITE

INHALATION OF CONTAMINANTS WHILE SHOWERING
CARCINOGENIC EFFECTS

<u>MW</u> <u>SAMPLES</u>	<u>CASE</u>	<u>UPGRADIENT</u> <u>ADULT</u>	<u>ON-SITE</u> <u>ADULT</u>	<u>DOWNGRADIENT</u> <u>ADULT</u>
Round 1:				
Shallow wells	Ave	— 1/	1.33 E-4 *2/	7.39 E-6 *
	Max	—	4.45 E-4 *	2.47 E-5 *
Deep wells	Ave	4.61 E-5 *	7.21 E-5 *	9.08 E-5 *
	Max	1.54 E-4 *	2.41 E-4 *	3.03 E-4 *
Round 2:				
Shallow Wells	Ave	7.13 E-5 *	2.05 E-4 *	1.08 E-5 *
	Max	2.38 E-4 *	6.83 E-4 *	3.61 E-5 *
Deep Wells	Ave	3.38 E-5 *	9.96 E-5 *	5.41 E-5 *
	Max	1.13 E-4 *	3.32 E-4 *	1.80 E-4 *

Notes:

1/ No carcinogens detected in upgradient shallow wells.

2/ Value exceeds risk of 1E-6.

TABLE 1-5

CIRCUITRON CORPORATION SITE

INHALATION OF CONTAMINANTS WHILE SHOWERING
NON-CARCINOGENIC EFFECTS

NM SAMPLES	<u>UPGRADIENT</u>		<u>ON-SITE</u>		<u>DOWNGRADIENT</u>	
	<u>CHILD</u>	<u>ADULT</u>	<u>CHILD</u>	<u>ADULT</u>	<u>CHILD</u>	<u>ADULT</u>
Round 1:						
Shallow wells	7.65 E-4	3.82 E-4	6.66 E-1	3.33 E-1	6.99 E-2	3.49 E-2
Deep wells	5.33 E-2	2.67 E-2	2.5 E-1	1.25 E-1	3.42 E-1	1.71 E-1
Round 2:						
Shallow Wells	4.03 E-1	2.01 E-1	1.38 E-1	6.91 E-2	4.69 E-2	2.34 E-2
Deep Wells	8.80 E-3	4.40 E-3	2.26 E-2	1.13 E-2	8.11 E-3	4.06 E-3

NOTES:

1/ A value less than 1 indicates a non-hazardous orientation.

in various combinations, show the possibility that use of groundwater in the area of the upgradient monitoring well group could result in unacceptable risk factors. Although the on-site risk levels are slightly higher, there is definitely evidence that upgradient sources, in addition to the contaminated soils and sediments at the Circuitron Corporation facility, are also responsible for contaminating the on-site groundwater.

2.0 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

In this section, the development of the objectives of the remedial action and the general response actions to accomplish those objectives will be discussed. From the appropriate response actions selected, various technologies and process options that are applicable were identified and evaluated. The technology types and processes were selected on a medium specific basis. The preliminary screening evaluation serves to eliminate those technologies that cannot be implemented at the site due to either physical or technical considerations.

Those technologies and processes that are shown to be feasible as treatment or containment options for the site will be carried through this initial screening stage and evaluated either singly or in combination with other viable options as remedial alternatives for the site. This evaluation process is described in Section 4.0 of this FS report.

2.1 REMEDIAL ACTION OBJECTIVES

In Section 9.0 of the RI Report for the Circuitron Corporation site (Ebasco, 1990) the recommended remedial action objectives for the site are:

- o Long term monitoring of groundwater utilizing wells installed during performance of remedial investigation. This will enable the effects of the natural flushing action of the groundwater to be evaluated.
- o Elimination of the source of contamination by
 - removing sediments from the authorized leaching pool and the interconnected pools outside of the building (LP-1, LP-2 and LP-7);
 - removing sediments from the two sanitary cesspools (CP-1, CP-2);
 - removing sediments from the three storm drains located in the western portion of the site (SD-1, SD-2, and SD-3);
 - removing the soil from the southwest corner of the site (MW-4) down to the water table during the storm drain clean up;
 - removing the leach pools from beneath the plating room floor slab (LP-3, LP-4, and LP-5); and
 - removing and replacing the concrete floor slab in the plating room.

- reduction of groundwater contaminant concentrations in the Upper Glacial Aquifer underlying the site to equal the upgradient contaminant concentrations.

2.1.1 Contaminants and Media of Interest

The media that were found to be contaminated at the site include surface and subsurface soils, sediments, groundwater and the interior surfaces of the building. Contaminated sediments were located in the on-site storm drains, leaching pools and the sanitary cesspools. The contaminants of concern identified as part of the risk assessment include volatile organics, semivolatile organics, and metals, and were shown previously in Section 1.3.4, Table 1-1.

2.1.2 Allowable Exposure Based on Risk Assessment

As described in further detail in the Risk Assessment (Ebasco, 1990), potential exposure pathways of the contaminated media at the site were investigated. This included ingestion of the groundwater from the Upper Glacial Aquifer as the primary pathway, with inhalation while showering or bathing as a secondary exposure route. However, at the present time there are no residential water wells installed in the Upper Glacial Aquifer on or in the vicinity of the site, nor are there any near term plans for new potable water wells in the area. The Magothy Aquifer is the primary water supply source in the area.

Dermal contact with contaminated sediments during cleanup activities was also evaluated as a potential exposure pathway. A study of ingestion of sediments was not undertaken because of the unlikely possibility of this occurring due to the physical conditions at the site, such as the depth of the sediments and their concealment under manhole covers. Due to the minimal amount of exposed surface soils at the site and industrial zoning of the area, the ingestion of contaminated soils was not considered an issue and this pathway of exposure was not evaluated as part of the Risk Assessment.

Additional discussion is presented in Paragraph 1.3.4 of this report.

2.1.3 Allowable Exposure Based on ARARs

The ARARs presented below were selected to provide some measure of guidance in the development of the acceptable levels of remediation to which the identified technologies would be applied. These ARARs include:

- o Federal Water Quality Criteria (Quality Criteria for Water 1986. EPA 440/5-86-001, May 1, 1986) and Groundwater
- o Ambient Surface Water Quality Standards (6 NYCRR 701 and 703)

- o Resource Conservation and Recovery Act Maximum Contaminants Levels 40 CFR 264. Subpart F
- o Safe Drinking Water Act Maximum Contaminant Level Goals 40 CFR 141.50
- o New York State Pollution Discharge Elimination System 6 NYCRR 750 et seq.
- o New York State Air Pollution Control Regulations 6 NYCRR 212-257
- o New York State Ambient Water Quality Standards and Guidance Series Technical and Operations Guidance Series (TOGS) 1.1.1, April 1, 1987
- o New York State Underground Injection/Recirculation (UIR) at Groundwater Remediation Sites, TOGS, 2.1.2, April 1, 1987
- o New York State Sanitary Code, Part 5

The contaminant levels detected in the upgradient, on-site and downgradient monitoring wells may be compared to these various Federal and State health-based ARARs to provide a basis, in combination with the results of the risk assessment, for the formulation of remediation activities and the development of clean-up levels. These values are presented in Table 2-1. Further discussion of the groundwater remediation issue is presented in the next section.

2.1.4 Development of the Remedial Action Objectives

The recommended remedial action objectives that were theorized during performance of the RI were presented in the introductory paragraph of Section 2.1. These objectives prescribe a "pump and treat" scheme that would remediate the groundwater so that contaminant concentration in on-site samples match those found in the upgradient monitoring wells. Ordinarily, the effluent from a groundwater treatment process for reinjection into an aquifer would have to meet ARARs or MCLs before it would be considered acceptable. However, at this site, it was preliminarily considered appropriate during the preparation of the Remedial Investigation Report to state that the effluent from any groundwater treatment process be reinjected with contaminant concentrations equivalent to the upgradient levels. This was due to the fact that levels of contamination in the upgradient groundwater samples were above ARARs and MCLs. Additional discussion of this subject is presented below.

At this stage of the feasibility study, upon further evaluation of the data obtained during the RI and previous investigations, it has been determined to concentrate this FS on technologies and alternatives involving direct source control and treatment such as remediation of contamination soils and sediments. The basis for employing this approach is discussed below.

TABLE 2-1

CIRCUITRON CORPORATION SITE

POTENTIAL FEDERAL AND STATE HEALTH-BASED ARARs
IN COMPARISON TO LEVELS DETECTED IN GROUNDWATER (ug/l)

COMPOUND	FEDERAL			STATE		RANGE OF GROUNDWATER CONTAMINATION	
	ARAR: SAFE DRINKING WATER ACT MAXIMUM CONTAMINANT LEVEL	OTHER GUIDANCE MCLG	AMBIENT WATER QUALITY CRITERIA FOR PROTECTION OF HUMAN HEALTH	AMBIENT WATER QUALITY CRITERIA FOR CLASS GA WATERS		ROUND 1	ROUND 2
INORGANICS:							
Cadmium	10	5(1)	10	10		ND - 870	ND - 2.5
Chromium	50 (as VI)	50 (as VI)	179,000, 50(2)	50 (as VI)		ND - 21.3	ND - 21.3
Copper	—(4)	1,300(1)	1,000 (c)	1,000		ND - 538	ND - 287
Lead	50	20(1)	50	25		ND - 61.4	ND - 14.6
Mercury	2	3(1)	10	2		ND - 0.3	—
Nickel	—	—	15.4	—		ND - 70.2	ND - 36.7
Silver	50	—	50	50		ND - 13.4	—
Zinc	—	—	5,000(3)	5,000(3)		ND - 110	5.5 - 99.6
Cyanide	—	—	200	200		ND - 25	—
Arsenic	50	—	—	25		ND - 6.6	ND - 5.1
ORGANICS:							
Trichloroethylene	5.0	0	0.28(6)	5		ND - 18	ND - 27
Tetrachloroethylene	5.0	0	0.88(6)	5		ND - 110	ND - 87
Benzene	5.0	0	0.67(6)	5		ND - 3	—
1,2-dichloroethane	5.0	0	0.94(6)	5		ND - 2	ND - 25
1,1-dichloroethane	—	—	—	5		ND - 17	ND - 6.6
1,1,1-trichloroethane	200	200	19 mg/l (6)	5		ND - 4600	ND - 1181
1,1-dichloroethene	7.0	7.0	—	5		ND - 12	ND - 11
Chloroform	—	—	—	5		ND - 31	ND - 207
Total trihalomethanes	100	—	—	5			

- NOTES:**
- (1) Proposed
 - (2) Applies for Chromium (III) and Chromium (VI), respectively
 - (3) Organoleptic-based on taste and odor effects
 - (4) — None Available
 - (5) ND - None Detected at CRDL
 - (6) Concentrations resulting in 10⁻⁶ risk

1. There is a similar risk factor from ingestion of groundwater from both upgradient and on-site deep monitoring wells. This is shown in Tables 1-2 through 1-5 of Section 1.3.4. Deep wells at all locations showed evidence of similar contaminants at equivalent concentrations.
2. The upgradient shallow monitoring well (MW-1S) contains several of the compounds identified as contaminants of concern for the on-site groundwater in the Risk Assessment. In most cases, the upgradient shallow well groundwater sample contained equivalent or higher levels of volatile organic compounds than did the on-site wells, specifically the compound 1,1,1-TCA. The concentration of 1,1,1-TCA was found to be higher in MW-1S during the second round of groundwater sampling than the first round; and the levels of 1,1,1-TCA found in the on-site shallow well samples also rose during the second round of sampling. Without the benefit of additional sampling for comparison, it appears evident that the upgradient source is a substantial contributor to the on-site groundwater contamination, with the possible exception of the southwest corner of the site.
3. There was only one groundwater sample out of 35 samples taken during the RI which contained higher levels of 1,1,1-TCA than the upgradient wells. This was in the area of MW-4S, where it was known that untreated process wastewater was discharged directly to the aquifer via SD-3. This area would be considered a hot-spot and subject to soil/sediment removal and/or treatment.
4. Several of the inorganics identified as contaminants of concern in the groundwater were also identified in the upgradient well. Lead was the only inorganic found above ARARs for groundwater. However, these inorganics were detected in higher levels on site due to the fact that they were commonly used in the manufacture of circuit boards. The inorganic contamination appears to be centered around the underground structures, where these metals were also detected in the soils and sediments. The only element found in the groundwater and not above typical background values in the soil/sediment samples taken was nickel. This contamination may not be justified as coming from the site because there is no indication of soil contamination with nickel at any of the on-site areas that were sampled.
5. The upgradient groundwater monitoring well, MW-4S, contained concentrations of 780 ug/l and 1,181 ug/l of 1,1,1-TCA; 6.1 ug/l of 1,1-DCE and 6.6 ug/l of 1,1-DCA. Of all the on-site shallow wells, MW-4S showed the highest levels of contamination by volatile organic compounds. The levels for one round of sampling were: 4,600 ug/l of 1,1,1-TCA; 12 ug/l of

1,1-DCE and 17 ug/l of 1,1-DCA. Other compounds detected in these wells are shown in Figure 1-4. Of all the other on-site wells sampled during the RI, the highest concentration of 1,1,1-TCA detected was 380 ug/l found in MW-12. The highest levels of 1,1-DCE and 1,1-DCA in other wells were 23 ug/l and 10 ug/l, respectively, and these were also found in MW-12. As can be seen from this comparison, disregarding the one sample taken during the first round of groundwater sampling from MW-4S, the highest levels of 1,1,1-TCA were found in the upgradient monitoring well MW-1S. The levels of the other contaminants detected in all wells are similar in degree of concentration both upgradient and on-site.

6. The plume of contamination existing in the Upper Glacial Aquifer beneath the site does not begin at the site boundary. Elevated levels of contamination were detected in the upgradient monitoring wells. The plume continues down through the site from upgradient sources. Because the conditions of the plume originating upgradient are at levels already much higher than allowed by ARARs and also higher or comparable to levels present in most on-site samples, it would not be feasible to pump and treat the on-site groundwater for an indeterminate amount of time to assure that the effluent is in compliance with ARARs. The pump and treat system developed for this site would have to be designed to remediate the groundwater to NY State Class GA Standards before it could be reinjected, and thus would be remediating contamination not related to this site under this response action.
7. Because of the infiltration of upgradient sources of contamination into the groundwater beneath the site, and in order to fulfill the requirements of the Circuitron Corporation Site response actions and not be responsible for remediating offsite sources of contamination, it may be possible to develop alternatives for cleaning up the on-site groundwater to meet upgradient levels of contamination. However, as previously discussed, in all shallow groundwater samples collected from the site except for one sample from MW-4S, the levels of total volatile organics in on-site samples were below those detected in the upgradient shallow groundwater samples. Based on this fact, it would seem very ineffective or impossible to remediate the on-site aquifer to meet groundwater based ARARs and MCLs or to equal the upgradient conditions because the upgradient concentration of total volatile organic compounds was higher in most samples taken during the RI. Additional sampling would be required to determine if this situation is true and to better define the levels of upgradient contamination in order to further investigate the remediation of groundwater.

8. The Upper Glacial Aquifer is not presently used as a potable water supply in this region of Long Island. The potential health risk as a result of the ingestion and domestic use of the groundwater is minimal in comparison to the almost limitless expense which would be required to pump and treat the on-site groundwater for an indefinite length of time to assure the reduction of up-gradient contamination concentrations to drinking water quality. This may not even be possible due to the constant influx of an unknown amount of contamination flowing through the site from upgradient sources. It would also be very difficult and uneconomical to design and engineer a practical treatment system with no known limit on the influent, upgradient concentrations.

As can be seen from the above discussion, it may not be practical to implement a "pump and treat" groundwater alternative at this time. It is apparent that there are unknown, upgradient sources of contamination in this region of Long Island. It should also be noted that there are several similar investigations and studies being performed at other industrial sites in the area, including upgradient sites, such as Claremont Polychemical Site in Old Bethpage, NY, which show similar signs of groundwater contamination. A more regional approach to the remediation of the groundwater contamination problem would seem to be a viable solution rather than on a site by site basis.

Because of these reasons, remediating the groundwater will not be evaluated as a part of this feasibility study. It is recommended that the development of groundwater remediation measures be postponed until a more definitive groundwater investigation of upgradient contamination sources be performed. This may be conducted as a second operable unit for this site, and may include the installation of other upgradient monitoring wells for further study. All of the alternatives developed for this feasibility study will include the long term monitoring of groundwater, and the additional investigation of the upgradient source of contamination section. Treatment of this aquifer at the present time is not an urgent matter. During the performance of the upgradient groundwater investigation, prohibition of groundwater use could be instituted.

The discussion presented previously in Section 1.3.2.2 on the nature and extent of the soil/sediment contamination, in Section 1.3.4 on the risk assessment, and stated in the above paragraphs of this section, support the theory of source remediation as a feasible, practical method of remediating the on-site contamination. The site activity has ceased and the facility has not been operational for approximately 5 years. There have been no reported discharges to the underground structures in that time. The continuous and direct on-site groundwater contamination sources have been removed via the closing down of the facility. The only existing sources of on-site contamination are the sediments contained within the underground structures. There is

limited percolation of rainwater through most of the leaching pools except for the stormdrains, and the bottoms of these structures are well above the water table. By removing these materials, the remaining potential contaminant sources will be removed from the site.

During meetings held with USEPA and Ebasco in attendance on March 27 and March 29, 1990, these issues were discussed and it was agreed that this would be the approach taken for this feasibility study.

2.2 GENERAL RESPONSE ACTIONS

The general response actions that were determined to be most applicable to the conditions present at the Circuitron Corporation Site are summarized in Table 2-2. This table shows for each applicable response action the contaminated media that response action will be applied to. Also shown are the corresponding technology types which will subsequently be utilized to identify and screen technologies and process options. The viable technologies and process options will be combined or used alone to develop the remedial alternatives that will achieve the remedial action objectives for the site. The general response actions that are typically considered for the remediation of hazardous waste sites include: no action; limited action; containment; collection; treatment; and disposal.

The no-action alternative has been identified to be used as a baseline against which the other actions may be measured and compared. Limited actions include minor institutional controls such as access restrictions to the site and use restrictions which would limit the current and future use of the land in the affected area. The remaining actions represent methods of protecting human health and the environment by minimizing the risks of exposure, and reducing the volume, mobility and toxicity of contaminated materials.

2.2.1 Remediation Target Areas and Volumes

The areas that will be subject to source control remediation activities include the plating room and all of the underground structures. The building interior will also be decontaminated. This discussion is based on the information presented in Section 1.3.2, Nature and Extent of Contamination. The approximate volume of contaminated soil and sediment to be excavated from each of these areas and the reasoning for the selected volumes of removal is presented below. Figure 2-1 shows the locations of each of these areas. Table 2-3 presents a compilation of the areas and volumes to be remediated for each source control location.

TABLE 2-2

SUMMARY OF GENERAL RESPONSE ACTIONS
AND ASSOCIATED TECHNOLOGY TYPES

<u>Response Action</u>	<u>Medium</u>	<u>Technology Type</u>
No Action	Groundwater	- Groundwater Monitoring and Investigation Program, and Public Awareness Program
	Soil/Sediment	- Groundwater Monitoring Program and Public Awareness Program
	Structure	- Groundwater Monitoring Program and Public Awareness Program
Limited Action	Soil/Sediment	- Access and Use Restrictions
	Structure	- Access and Use Restrictions
Containment	Soil/Sediment	- Capping - Subsurface Barriers
Removal	Soil/Sediment	- Excavation
Treatment	Soil/Sediment	- Chemical - Physical - Thermal - In-Situ
	Structure	- Physical
Disposal	Soil/Sediment	- On-site - Off-site
	Structure	- On-site - Off-site
Transportation	Soil/Sediment	- Truck - Train
	Structure	- Truck - Train

TABLE 2-3

SUMMARY OF SOURCE CONTROL AREAS AND VOLUMES

<u>CONTAMINATED MEDIA</u>	<u>AREA LOCATION</u>	<u>MATERIAL VOLUME</u>
Sediment	Plating Room	7.0 cubic yards
	SD-1, SD-2, SD-3	3.0 cubic yards
	CP-1, CP-2	10.0 cubic yards
	LP-1, LP-2, LP-7	<u>18.0 cubic yards</u>
		48.0 cubic yards
Structure	Interior	5.0 cubic yards
	Surfaces	<u>(dust)</u>
	(46,500 ft ²)	5.0 cubic yards

1) Plating Room: The entire floor within the plating room will be demolished, removed and disposed of. The leaching structures beneath the floor will be located, and the sediments from within them will be excavated. All sediment will be removed to a depth of 2 feet below the surface of the material, or to a depth at which no visible signs of contamination are evident. This may be confirmed by an on-site evaluation by a geologist who can identify a layer undisturbed, clean sandy soil native to the site area. The leaching structures, drums, piping, and any other material found beneath the floor will be left in place. It is estimated that 5 areas of sediment will be excavated, for a total removal of 7.0 cubic yards of contaminated sediment. Demolition of the concrete floor will generate approximately 80 cubic yards of material for non-hazardous disposal.

2) SD-1, SD-2, and SD-3: The sediments from within each of these structures is to be removed to a depth of 2 feet, or as described above, until clean soil is reached. It is estimated that a total of 3.0 cubic yards of contaminated sediment will be removed from these storm drains.

3) CP-1 and CP-2: The entire contents of these structures will be removed for subsequent management. The contaminated sediments will be excavated to the previously mentioned depth of 2 feet below the sediment layer surface for each of these structures. Approximately 10.0 cubic yards of contaminated material is expected to be removed from both of the cesspools.

4) LP-1, LP-2, and LP-3: The exact locations of these leaching structures must first be determined and their contents exposed. The sediments within the structures will then be excavated to the depth of 2 feet, or until clean soil is encountered. This excavation is expected to generate a total of approximately 18.0 cubic yards of contaminated sediments from all 3 structures.

The soil cleanup levels that are utilized to determine these excavation locations are presented in Appendix C along with an explanation concerning their development. Briefly stated, the cleanup levels were developed using soil partition coefficients and precipitation infiltration values assuming the site will be completely paved over with an impermeable material. The contaminant with the cleanup level that was mainly responsible for requiring sediment excavation was copper, with a cleanup level of 19,000 mg/kg. Concentrations of up to 23,000 mg/kg were detected in the various sediments.

2.3 IDENTIFICATION AND SCREENING OF TECHNOLOGY TYPES AND PROCESS OPTIONS

In this section, the methodology for selecting technologies and processes associated with each response action that are appropriate for use at this site will be described. An initial

selection of technologies was made utilizing recommendations contained in the following EPA publications: "Handbook of Remedial Action at Waste Disposal Sites", (USEPA, 1985b); "Guidance on Feasibility Studies Under CERCLA", (USEPA, 1985a); "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", (USEPA, 1988b); "Technology Screening Guide for Treatment of CERCLA Soils and Sludges" (USEPA 1988a); and "Guide for Decontamination Buildings, Structures and Equipment at Superfund Sites" (USEPA, 1985c). Technology types and process options were deemed appropriate for preliminary consideration by evaluating site and waste characteristics. These characteristics serve to inhibit or promote the use of certain technologies and processes for remedial activities at Circuitron. Section 2.3.1 presents the identification of technology types and process options used in the initial screening phase of the FS.

2.3.1 Identification and Screening of Technologies

Based upon a general comparison with site specific conditions present at Circuitron, technologies were either found to be initially feasible or were rejected from further consideration. A brief description of the technologies identified and their applicability for this site and the results of the preliminary screening process are presented in the paragraphs of this section. Table 2-2 presents the list of technology types identified for preliminary screening, along with the media requiring response action, including groundwater, sediments and the structure.

The remedial technology types may contain several process options that would apply to the different media. These potentially applicable process options are also identified and screened in Section 2.3.1 along with the technology types presented in Table 2-2.

2.3.1.1 Groundwater

This section presents the selection of response actions as they apply to the remediation of the groundwater underlying the Circuitron Corporation Site. As discussed previously in Section 2.1.4, this feasibility study will not consider the development of any physical remediation measures for groundwater such as pumping and treatment. Based on the analysis of the data obtained during the remedial investigation, it has been determined that the only practical selection for a groundwater response action is no action. This response action is discussed below.

2.3.1.1.1 No Action

Description: This option is intended to be used as a baseline for subsequent detailed remedial alternative analysis and comparison. It is included because it is required by the Superfund Amendments and Reauthorization Act (SARA), as amended, and the National Contingency Plan (NCP) to address the site contamination problem when no remediation measure will be taken to reduce the risk of further contamination or other health hazard. The activities that will take place during the performance of this response action include groundwater monitoring and the development of a public awareness and education program. In addition to these measures, an investigation of the sources of the upgradient contamination that may be responsible for contributing to the groundwater contamination problem at the Circuitron Corporation Site. Any additional concerns regarding the groundwater in this region may be addressed during the performance of this study. This study is also presented in Section 2.1.4.

Initial Screening: The contaminated groundwater is a source of health risk at the site as discussed in Section 1.3.4. However, the upgradient wells also showed unacceptable health risks and contaminant levels above groundwater standards. Although this action does not directly reduce the amount of contamination or the potential of exposure to the environment or public health, it must be included throughout the detailed evaluation as required by the NCP. It also provides the means for undertaking an additional investigation to study the upgradient contamination and determine its source of origin.

2.3.1.2 Sediment

This section presents the selection of the response actions and associated technologies as they apply to the remediation of the sediments.

2.3.1.2.1 No Action

Description: The description of the no action response presented previously in Section 2.3.1.1.1 for application to groundwater may also be employed for the sediment activity.

Initial Screening: The contaminated sediment is a source of contamination at the site. This matrix presents potential risks to the environment and therefore the "no action" response is not a feasible alternative. However, this alternative must be included throughout the detailed evaluation as required by the NCP.

2.3.1.2.2 Limited Action

Description: The limited action response includes legal and physical restrictions that could be implemented to reduce the potential health risk when no remediation measures will be taken. Limited actions which are applicable include land use and access restrictions. Land use restrictions may include the prohibition of future use of the property and could be used to limit the amount of excavation that could take place at the site. Access restriction would entail enclosing the site area with a suitable fence and posting warning signs along the fence.

Initial Screening: The land use restriction may require the issuance of an administrative consent order, or a change in the municipal zoning ordinances, in order to regulate or prohibit the use of the property. This action may require legal action to implement. The access restrictions for the site would be very easy to implement and would serve to reduce the potential for exposure to the contamination. This limited action option is feasible and will be retained for further analysis.

2.3.1.2.3 Containment Technologies

Containment is a remedial technology that isolates the contaminated soil portion of an aquifer from the uncontaminated portions of the aquifer. The containment of contaminated groundwater would consist of installing a subsurface barrier of low permeability and/or constructing a cap. Discussion of these containment technologies is presented below.

o Capping

Description: Capping technologies provide an impermeable layer by utilizing a cover that limits the percolation of precipitation and minimizes the leaching of contaminants from sediment into the groundwater. Capping of the contaminated site areas could be achieved by using any one or a combination of such materials as clay, asphalt, concrete, or a synthetic membrane.

Initial Screening: The majority of the Circuitron Corporation Site is paved, with a runoff collection system, and is therefore effectively covered with a cap constructed of asphalt or similar material. The roofed building also provides cover for a large portion of the site. Capping is considered a feasible technology for this site and may consist of repaving the entire site area, sealing the storm drains and other areas of possible percolation, and ensuring that the building does not allow for stormwater intrusion or percolation via roof drains or leaks and cracks in the floor. This technology is therefore retained for further consideration.

o Subsurface Barriers

Description: A subsurface barrier refers to a technology whereby walls of a low permeability are installed below grade to contain, capture or redirect groundwater, and/or to isolate contaminated soils from contact with flowing groundwater. The most common types of vertical subsurface barriers are slurry walls, grout curtains and sheet piling.

Initial Screening: This technology requires an impermeable horizontal layer (e.g., a clay layer) to anchor on so that contaminated sediment can be isolated from the aquifer. No clay layer was found beneath the site within the aquifer and bedrock is estimated to be over 2000 feet deep, therefore, no natural layer exists to anchor a subsurface wall. In addition, the contaminated sediments are above the water table and therefore it is not necessary to have the subsurface barrier in order to prevent leachates generated from this contaminated media from infiltrating the groundwater. For these reasons this technology is eliminated from further consideration.

2.3.1.2.4 Removal Technologies

Description: Removal technologies when applied to soils and sediments utilize conventional construction earthworking equipment and techniques such as a backhoe, or hand excavation. The selection of appropriate excavation equipment and procedure would depend upon site conditions.

Initial Screening: This technology would serve to reduce the amount of contamination on site and would be necessary for some on-site or off-site sediment treatment and disposal technologies. Excavation is therefore retained for further consideration during the remedial alternative selection process.

2.3.1.2.5 On-Site/Off-site Treatment Technologies

Similar treatment technologies are applicable for either on-site or off-site treatment of the contaminated sediments that are present at the site.

The applicability of on-site treatment depends primarily upon the availability of property for establishing and constructing storage and treatment facilities, and the availability and relative cost of mobilizing a transportable treatment facility. The relative cost of on-site treatment also relies on the amount of material to be treated. On-site treatment technologies usually generate operational noise, fugitive dust, and solid wastes. The site area is a commercial and light industrial zone with significant local employment and a high population density during normal business hours. Environmental and public health impacts of on-site treatment may be considered potentially significant.

The relatively minor amount of contaminated material, 53 cubic yards, is not considered significant enough to justify the acquisition of a dedicated on-site treatment facility. There is also a very limited area available at the site available for material storage, equipment staging and other uses. Approximately 10 percent of the total site area, or 3800 square feet divided into smaller portions, may be utilized for this purpose. The treatment technologies described below may apply to either on-site or off-site locations. Physical treatment technologies may be applied on-site because of the small amount to be treated. However, due to the logistical problems of utilizing the site for this purpose, only off-site options will be considered for thermal treatment technologies.

Chemical Treatment

This group of technologies involves the use of chemicals that are added to the excavated sediments to extract the contaminants from the sediment. This technology may also be combined with other treatment technologies, such as filtering, to rid the sediment of the chemical solution used to extract the contamination.

o Soil Washing/Recovery

Description: This technology would involve the extraction of the organics from the excavated soils and sediments using water, a solvent, a wetting agent, or any combination of the three. The supernatant solvent (extractant) containing the contaminants would then be further treated for organics and metals removal prior to discharge. The sediment, after washing with water for solvent recovery, would be disposed of. This technology is usually operated on-site utilizing mobile treatment equipment.

Initial Screening: The contaminants of concern in the soils and sediments at this site include volatile organic compounds, semivolatile organic compounds and metals. This mix of compounds will make the development of a washing solution to remove all the contamination a very difficult formulation. In addition, because of the varied soil partition coefficients of the compounds, which range from very low for the volatile organics to very high for the semivolatiles and metals compounds, an excessive amount of washing fluid will be required. The high organic content of the sediments will also hinder the desorption of the semivolatile compounds, such as the phthalates, which comprise a major portion of the sediment contamination. The use of large quantities of washing fluid will generate a substantial quantity of wastewater to be treated via a complex treatment procedure to remove the contaminants for subsequent disposal. This operation will generate large amounts of residual waste materials. And, as stated previously in the introductory paragraph to this section, because there is a restricted area within which to operate this on-site technology,

it may be considered unimplementable. For these reasons, this technology is considered infeasible and will not be retained for further evaluation.

o Supercritical Fluid Extraction

Description: Supercritical fluid extraction is a chemical process that uses a combination of temperature and pressure to promote solvents beyond their critical point, under which conditions they exhibit the properties of non-polar solvents. The typical system operates at 70°F to 100°F and 150 to 3000 psi. This allows more efficient extraction of organics than processes using distillation or conventional solvent extraction methods. Carbon dioxide and propane are the potential solvents to be used in supercritical fluid extraction processes. The super critical extraction consists of four processes: extraction, separation, compression and disposal of extracted contaminants. The recovered contaminants can be treated by off-site incineration.

Initial Screening: This process is very effective at removing non-polar compounds such as PCB's and PAH's, such as bis(2-ethylhexyl)phthalate. However, it has not been demonstrated that this technology can effectively remove volatile organics and metals from the sediments. In addition, a quantity of high concentration residue will be generated and will need to be treated before it can be disposed of. Because of the need for additional treatment and the uncertainty of its performance with regard to volatile organic compounds and metals, this process option is eliminated from further evaluation.

Physical Treatment

Physical treatment technologies for the sediments are utilized to bind or encapsulate the particles so as to prevent the release of the contaminants to the environment.

o Stabilization

Description: Stabilization is a physical process whereby contaminated sediments are converted into a stable cement-type matrix free of water. Cement, lime, fly ash, sodium silicate, organic polymers, pozzolan, and asphalt may be used to bind the contaminants and the sediments. Commercial proprietary agents are available for both organic and inorganic contaminant fixation. The material treated with any of these agents develops properties ranging from a loose sand or gravel to a weak concrete. The stable end product should not leach appreciable amounts of contaminants. Bench scale tests utilizing a representative sample of the waste material would be required to determine the proper additives and their ratios, and to estimate the required curing time. This class of technologies includes such other processes as fixation and solidification.

Initial Screening: This process is a conventional and acceptable method for binding the hazardous constituents with the soil into a solid mass with low permeability, thus reducing the mobility of the contaminants. Stabilization techniques are more commonly applied to inorganic compounds, such as metals, however, data suggest that silicates in combination with lime or cement can be utilized for organics or soils contaminated with solvents. There are also organophilic proprietary compounds available to bind organics to the solid matrix. This process may be utilized on-site, because of the small quantity of contaminated sediment to be treated. For these reasons, on-site stabilization will be retained for further evaluation.

o Thermoplastic Solidification

Description: This process consists of the sealing of the waste materials in a solid matrix such as asphalt, bitumen, paraffin or polyethylene. The sediment must be dried, heated and dispersed through a heated plastic matrix. The mixture is then cooled to form a rigid but deformable solid.

Initial Screening: Thermoplastic solidification is most suitable for heavy meals contaminated wastes. Some solvents can cause the asphalt material to soften and never become rigid enough for easy handling. This process also requires the use of special equipment with highly trained operators. The very high energy requirements of the thermoplastic solidification unit are further compounded by the requirement that the sediment be thoroughly dry before solidification. Because of these reasons, this process is considered infeasible and will not be evaluated further.

Thermal Treatment

This group of technologies utilizes the application of high temperatures under controlled conditions in various pieces of equipment to remove or destroy the contaminants in the sediment. The off-gas from the thermal treatment of hazardous materials requires air pollution control equipment to prevent release of undesirable substances into the atmosphere.

o Incineration

Description: Incineration units such as a multiple hearth, rotary kiln, infrared incineration and fluidized bed incineration systems are all applicable and would successfully treat the contaminated soils and sediments at a high temperature (1,500°F to 2,000°F). The incineration process will evaporate excess water from the sediment and destroy all organic matter.

Initial Screening: This process option will effectively treat the organics contained in the sediments. The metals remaining in the incinerated sediment or the emission control system of the equipment will be collected and subjected to further treatment, such as stabilization if necessary. This is a viable option and will be retained for further evaluation.

o Enhanced Volatilization

Description: This technology promotes vaporization of organic compounds from contaminated sediments to the gas phase. The off-gas containing the thermally stripped organic compounds is then either combusted in an afterburner designed to ensure complete destruction of these compounds, or passed through activated carbon adsorption units to remove the organic compounds. Typical operating temperatures are 400°-900 °F. These temperatures should be sufficient to ensure removal of the volatile and semivolatile organics in the contaminated sediment.

Initial Screening: Enhanced volatilization is similar to incineration except for the fact that the organic compounds are volatilized, instead of combusted, in the primary chamber. This technology would be effective at removing the volatile organics, specifically 1,1,1-TCA, and semivolatile organic compounds, such as BEHP, from the site sediments. However the treated sediment will require further treatment, such as stabilization, for control of metals contained in the sediment.

Because it can be shown that the semivolatile organics do not present a contamination risk, based on soil clean up levels contained in Appendix C, and the volatile organic compounds are extractable via vacuum extraction, this technology is eliminated from further considerations.

In-situ Treatment

As a alternative to excavating the contaminated soils for subsequent treatment, in-situ treatment technologies may be employed. In-situ treatment entails the use of: chemical or biological agents, or physical or thermal manipulations which will degrade, remove or immobilize contaminants; and methods for controlling the spread of contaminants and treatment reagents beyond the treatment zone.

The technologies evaluated in this category include soil flushing, biodegradation, hydrolysis, vitrification and volatilization.

o Soil Flushing

Description: Soil flushing is the in situ extraction of inorganic or organic compounds from the sediments by passing appropriate extractant solutions through the soils to dissolve or solubilize contaminants. The area to be treated must be isolated by vertical and horizontal groundwater containment barriers. Water or an aqueous solution is flooded or injected into the area of contamination, and the contaminated elutriate is collected to the surface for removal, recirculation, on-site treatment or reinjection. During elutriation, sorbed contaminants are mobilized into solution by reason of solubility, formation of an emulsion, or by chemical reaction with flushing solution. These solutions may include water, surfactants, acids or bases, chelating agents, oxidizing and reducing agents.

Initial Screening: This technology requires the installation of vertical groundwater barriers, such as slurry walls, and usually relies on an underlying clay layer to act as a horizontal barrier for complete groundwater isolation in the treatment area. Since no such underlying clay layer exists in the Upper Glacial Aquifer beneath the site in which to anchor slurry walls and which can serve as the horizontal barrier, this technology cannot be effectively implemented at the site. In-situ flushing, without the proper containment, may actually accelerate the spread of contamination throughout the Upper Glacial Aquifer, and could force contaminated groundwater into the Magothy Aquifer. In addition, this technology would not be effective in the presence of underground structures, such as leaching pools. Therefore, this technology is eliminated from further evaluation due to site limiting conditions.

o Biodegradation

Description: In situ biological treatment involves the use of native microbes or selectively adapted bacteria to degrade a variety of organic compounds. The biological processes usually involve the addition of microbes, nutrients, oxygen (aerobic bioreclamation only) and circulation of contaminated groundwater. The applicability of a bioreclamation approach is determined by the biodegradability of organic contaminants, environmental factors affecting microbial activity and site hydrology.

Initial Screening: For degradation of chlorinated volatile organic contaminated sediments, anerobic degradation under very reducing conditions appears to be a feasible approach. However, anaerobic treatment is generally not as promising for site remediation as aerobic treatment. Anaerobic processes are slower, fewer compounds can be degraded, and the logistics of

rendering the site anaerobic have not been developed to date. It is doubtful that anaerobic treatment would detoxify the chlorinated organics present at the site. The presence of elevated concentrations of copper and other metals may also prove toxic to the microorganisms that will degrade the organic substances. In addition, the site conditions as described above in the soil flushing technology would not allow for the feasible implementation of an in-situ bioremediation technology because of the lack of any underground barriers to prevent the bacteria from infiltrating the groundwater. For these reasons bioremediation is eliminated from further consideration.

o In-Situ Hydrolysis

Description: Hydrolysis is the breakdown of organic molecules to simpler, less toxic compounds. This process may take place under alkaline or acidic conditions and the acid or base catalyzed rates of hydrolysis may be accelerated through adjustment of soil pH. Classes of compounds with potential for in-situ degradation by hydrolysis are esters, amides, carbonates and pesticides. However, hydrolysis may produce unknown byproducts whose toxicities are greater than that of the initial compound.

Initial Screening: In-situ hydrolysis for hazardous wastes is in the very early developmental stages and is generally unproven at Superfund sites. Hydrolysis is not feasible due to the inability to control the process in the presence of site limiting characteristics (no confining bottom layer in the aquifer) and ineffectiveness in treating the contaminants present at the site (VOCs and semivolatiles). Therefore, this technology is eliminated from further evaluation.

o In-Situ Vitrification

Description: In-situ vitrification (ISV) is a thermal treatment process intended to provide in place stabilization of chemically contaminated sediments. ISV destroys organic compounds by pyrolysis and immobilizes inorganic contaminants such as heavy metals into a glass-like material. ISV includes a power supply system, off-gas containment, electrode support hood, off-gas treatment system and process control station.

Initial Screening: ISV is a technology that is approaching the commercialization stages for low level radioactive waste stabilization, heavy metal fixation and hydrocarbon destruction. This technology requires an exorbitant amount of electricity to be effective, leading to extremely high operating costs. The ISV system requires a significant amount of auxiliary equipment, primarily air quality control and off-gas treatment equipment, to be located on-site for the duration of the operation. Due to the limited useable land area at the site of approximately 10 percent of the site area there does not appear

to be an adequate amount of space available on-site in which to implement this technology. In addition, the presence of buried objects (leaching pools and cesspools) in and around the hot spots, and the limited space of the hot spot areas would make implementation of ISV very difficult to achieve at this site. For these reasons, and because more easily implementable technologies are available, ISV is eliminated from further consideration.

o In-Situ Volatilization

Description: In-situ volatilization enhances the vaporization of volatile organic compounds from soil to the vapor phase. Two types of commercialized systems are available for this technology. One type is a pipe vent and forced air ventilation system, and the other is a vacuum extraction system. The pipe ventilation system consists of two sets of vertical slotted pipes for air injection and extraction. A forced draft injection fan supplies air to feed the injection pipe system. An induced draft extraction fan pulls volatilized compounds from the extraction pipe system. The vacuum extraction system consists of an array of slotted collection pipes. A negative pressure gradient (vacuum) is applied within the unsaturated zone to collect volatile organics from the soil. Both systems can be installed in the hydrogeologic setting at the site, regardless of the depth to groundwater. The emissions from either system would be collected and sent through an air pollution control device in which the organics would be destroyed in an afterburner or absorbed by activated carbon and ultimately destroyed during regeneration of the carbon.

Initial Screening: Both the pipe vent and forced air ventilation system, and the vacuum extraction system have been proven to be effective in the removal of volatile organic compounds from sandy soils. Most of the volatile organic contamination at the site is in unsaturated sandy soil which is a favorable condition for implementation of this volatilization technology. However, this technology may not be feasible to implement in the site areas around the underground structures. These buried concrete structures, including the leaching pools, cesspools and storm drains, could inhibit or obstruct the air/vapor flow and by so doing, cause the development of untreated pockets of soil/sediment. Also the soil is usually compacted during the installation of such underground structures which may present unfavorable permeability conditions in these areas. This technology would be ineffective at removing metals and semivolatile organic compounds, both of which are present in the soil/sediment at concentrations of concern. For these reasons, in-situ volatilization and vacuum extraction will not be considered as a primary treatment technology for remediation of the entire site soil/sediment matrix.

However, this technology would be effective in removing the volatile organic compounds in the southwest corner of the site prior to excavation of the soil/sediment from this area for further treatment. Removal of volatile organics, specifically 1,1,1-TCA which was detected at a concentration of 100 mg/kg in this location at 20 feet below the ground, would be desirable in order to minimize the potential health risks to site workers and the nearby public from possible volatile organic emissions during excavation. Volatile organic compound concentrations in the other areas to be excavated were significantly lower, if detected at all, so that excavation in these areas should not pose this potential risk. This technology will therefore be retained for further consideration, as a pretreatment of soil and sediment in the southwest corner of the site, prior to excavation for further treatment and disposal.

2.3.1.2.6 Disposal Technologies

If any of the removal and treatment technologies are selected for inclusion into a potential remedial alternative, then the disposal of the excavated and/or treated soils and sediments must also be addressed. The requirements for disposal can be divided into two categories, hazardous and non-hazardous, depending upon the final composition of the material and the requirements of the RCRA Land Disposal Restrictions for RCRA characteristic and listed wastes. There are two approaches for disposal of the excavated material, either on-site at a new facility or by using the treated, stabilized material as backfill; or off-site at an existing or a new facility.

o On-site Disposal

Description: The use of the site for disposal would depend upon the classification of the material to be disposed of. If the treated sediment can be reclassified, then this material may be used to refill the excavated areas on-site. However, should the sediment still be considered hazardous, the construction of a RCRA Subtitle C containment facility within the site boundaries could be required. This landfill would have to meet the substantive requirements of RCRA, which would include two liners, and a leachate monitoring, collection and removal system.

Initial Screening: This option is only viable for the disposal of sediment which has been treated on-site; this is not a feasible option if the sediment is transported off-site for treatment. Since on-site stabilization of contaminated sediments is a viable technology, this disposal option will be retained for further evaluation.

o Off-site Disposal

Description: Off-site disposal options for hazardous waste include using an existing RCRA approved landfill for disposal or constructing a new landfill that meets the requirements of a RCRA facility as described above. The disposal options for non-hazardous material are utilizing an existing landfill or constructing a new facility to accept this small quantity of waste. The construction of a new facility also involves closure requirements. Although the licensing issues are not as stringent as for a hazardous landfill, Federal, State and local permits would still be necessary for construction and operation of the facility.

Initial Screening: It is not practical to construct a new landfill for the disposal of a small quantity of treated waste from the Circuitron Corporation Site. The small amount of material that would require disposal can easily be accepted at any one of a number of currently operating facilities within transporting distance, therefore this option will be retained and evaluated with regard to using an existing disposal facility in conjunction with off-site treatment.

2.3.1.2.7 Transportation

In order for the off-site disposal option described above to be implemented for the Circuitron Corporation Site, various methods for removing the waste material from the site must be evaluated. These modes of transport include trucking and utilizing rail freight.

o Truck

Description: The site is easily accessible via several main highways. It is in an area that is constantly exposed to high volumes of truck traffic because of the primarily industrial zoning of the area. Trucks will probably be used to bring in equipment and materials for the remediation activities, and water-tight containers or tankers could be used to haul material off-site. These trucks would be properly decontaminated (if required), weighed, and manifested before exiting the site. Stringent regulations and special permits necessary for hauling hazardous materials and oversized or heavy loads utilizing public highways would have to be investigated and complied with.

Initial Screening: Trucking is the most acceptable method of transportation because of the flexibility of the operation. The number and sizes of trucks that may be required can be easily altered from the initial estimates because of the actual site conditions encountered during the performance of the remedial action. This mode of transportation would not require especially complex loading facilities at the site, nor would it require special unloading facilities at the disposal site. Transportation by trucking is an easily implementable technology and is therefore retained for further analysis.

o Train

Description: Although there is a rail line located approximately 1/2 mile from the site, there is no freight handling station within several miles. The waste materials would have to be transported via truck to the freight station for loading onto rail cars. At the station, either the trucks would be off-loaded and the sediments deposited directly into gondola rail cars or tanker cars; or containerized trucking could be used from the site and the container would be lifted from the truck onto a flatbed type rail car. This type of transfer operation would be governed by the facilities available at the freight station and the disposal site.

Initial Screening: Most commercial treatment and disposal facilities are not equipped to handle rail transfer operations, therefore truck transportation could be required at both ends of the delivery route. Utilizing train transport also may not provide adequate flexibility for varying quantities of waste or delivery schedules that could be necessary to support the implementation of the remedial action. For these reasons transportation of waste materials via train to an off-site disposal site will not be considered as a feasible technology.

2.3.1.3 Structure

This section presents the selection of the response actions and technologies as they apply to the remediation of the building located on the site. The nature and extent of the contamination of the structure was discussed previously in Section 1.3.2.3.

For purposes of this discussion, the remediation of the building, or structure, will consist of the application of technologies to the interior surfaces, such as walls and floors, of the building.

2.3.1.3.1 No Action

Description: The description of the no action response presented previously in Section 2.3.1.1.1 for groundwater is also applicable for this medium.

Initial Screening: The walls and floors of the building at the site are covered with dust and dirt that is contaminated with traces of the metals used during the circuitboard manufacturing operations. Because of the contaminated dust within the building, a potential environmental and public health risk exists if the building should be used again, therefore the no action selection for this matrix is not a viable alternative. However, compliance with the requirements of the NCP necessitates the inclusion of this option throughout the detailed evaluation of potential remedial alternatives for use as a baseline comparison.

2.3.1.3.2 Limited Action

Description: The description of the limited action option presented previously in Section 2.3.1.2.2 for sediment is also applicable for this medium.

Initial Screening: The discussion of the initial screening of the limited action group of institutional controls that was presented previously in Section 2.3.1.2.2 for sediment is also applicable for this medium. This option will be retained for further consideration; however, if the building is to be used again then this option would not apply. This selection will be retained for further evaluation.

2.3.1.3.3 On-site/Off-site Treatment Technologies

The portions of the structure matrix that may be subjected to treatment technologies are the interior surfaces of the building.

o Physical Treatment

Description: The interior surfaces of the building, including the walls and other floor areas, will need to be subjected to a treatment technology to remove the contaminated dust that has accumulated. This may be accomplished by vacuuming and/or wiping these surfaces clean because it appears that the contamination has not penetrated below the surface. This was verified during the remedial investigation.

Initial Screening: This technology is readily implementable for use at a small area such as the building at this site. Conventional commercial or industrial equipment may be adapted for use at a hazardous waste site. It is a proven method for cleaning surfaces of accumulated dust and will produce a minimal amount of residual waste material. This technology will be retained for further analysis.

2.3.1.3.4 Disposal Technologies

The options available for disposal with regard to the structure are equivalent to those discussed previously for application to sediment. Because of the relatively small volume of debris that will be generated as a result of the remediation of the structure, it will be combined with the materials resulting from the excavation of the contaminated site soils and sediments. Therefore, the option that is feasible for disposal of the contaminated concrete and the dust is off-site disposal combined with the soil/sediment from the site.

2.3.1.3.5 Transportation

In order for the off-site disposal option described above to be implemented for the Circuitron Corporation Site, various methods for removing the waste material from the site must be evaluated. These modes of transport include trucking and utilizing rail freight. The descriptions and initial screenings for these modes of transportation presented previously in Section 2.3.1.2.7 for sediment applies to this medium. Transportation of the excavated debris from the site to a disposal facility will be evaluated for the trucking option only.

2.3.2 Summary of Technology Screening and Process Evaluation

The results of the screening and evaluation of various technology types and process options within those technologies, as applicable, are compiled and presented in Tables 2-4, 2-5 and 2-6. These tables identify those initial selections that are not feasible and have been eliminated from the remedial alternative development process. The technologies and processes that have been retained for further analysis will be either combined into potential remedial alternatives or taken alone and will be further evaluated. This process is discussed in Section 3.0.

TABLE 2-4

SUMMARY OF REMEDIAL TECHNOLOGY AND PROCESS SCREENING
GROUNDWATER

<u>Response Action and Remedial Technologies/ Processes</u>	<u>Further Evaluation</u>	<u>Eliminated</u>
<u>No Action</u>	X	
o Groundwater monitoring		
o Public Awareness		
o Additional Study		

TABLE 2-5

SUMMARY OF REMEDIAL TECHNOLOGY AND PROCESS SCREENING
SEDIMENT

<u>Response Action and Remedial Technologies/Processes</u>	<u>Further Evaluation</u>	<u>Eliminated</u>
<u>No Action</u>	X	
<u>Limited Action</u>	X	
<u>Containment</u>	X	
<u>Removal</u>	X	
<u>Treatment</u>		
<u>Chemical Treatment</u>		
o Soil Extraction/Recovery		X
o Supercritical Fluid Extraction		X
<u>Physical Treatment</u>		
o Stabilization	X	
o Thermoplastic Solidification		X
<u>Thermal Treatment</u>		
o Incineration	X	
o Enhanced Volatilization		X
<u>In-Situ Treatment</u>		
o In-situ Biodegradation		X
o In-Situ Soil Flushing		X
o In-Situ Hydrolysis		X
o In-Situ Vitrification		X
o In-Situ Volatilization	X	
<u>Disposal</u>		
o On-Site Disposal	X	
o Off-Site Disposal	X	
<u>Transportation</u>		
o Truck	X	
o Train		X

TABLE 2-6

SUMMARY OF REMEDIAL TECHNOLOGY AND PROCESS SCREENING
STRUCTURE

<u>Response Action and Remedial Technologies/Processes</u>	<u>Further Evaluation</u>	<u>Eliminated</u>
<u>No Action</u>	X	
<u>Limited Action</u>	X	
<u>Physical Treatment</u>		
o Wiping/Vacuuming	X	
<u>Disposal</u>		
o On-Site Disposal	X	
o Off-Site Disposal	X	
<u>Transportation</u>		
o Truck	X	
o Train		X

3.0 DEVELOPMENT OF REMEDIAL ALTERNATIVES

This section contains discussion of the development of potential remedial alternatives by combining the technologies and processes identified previously to be feasible for implementation at the Circuitron Corporation Site.

Potential remedial alternatives which may achieve the remedial action objectives are developed via a two phase process. Initially, response criteria must be established to evaluate the acceptability of the environmental and public health impacts, and the performance of the alternative. This step will qualify the applicable or relevant and appropriate requirements (ARARs) and other criteria to be considered (TBCs) during development of the performance requirements and potential risks associated with implementation of the remedial action. After the ARARs are identified, the potentially applicable technologies identified in Section 2.0 are used to develop comprehensive remedial alternatives on the basis of operation and performance compatibility, and the use of good engineering practice.

3.1 DEVELOPMENT OF REMEDIAL RESPONSE CRITERIA

The development of alternatives must comply with the requirements of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended, and to those of the National Contingency Plan (NCP) which refer to the use of ARARs in the development of remedial alternatives. Section 300.68 of the NCP specifically refers to ARARs in the development of alternatives. CERCLA Section 121(d) requires that Superfund remedial actions must attain ARARs or other Federal mandated statutes, and must also comply with State regulations that are more stringent than Federal requirements to the extent that they are applicable to the project and are identified to the USEPA in a timely manner.

CERCLA, as amended, identifies the following statutory preferences when developing and evaluating potential remedial alternatives:

- o Remedial actions that involve treatments that permanently and significantly reduce the volume, toxicity, or mobility of the contaminants of hazardous substances are preferred.
- o Off-site transport and disposal of hazardous substances or contaminated materials without treatment is considered the least-favored alternative remedial action where practical treatment technologies are available.
- o Remedial actions using permanent solutions, alternative treatment technologies, or resource recovery technologies shall be assessed.

USEPA Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (USEPA, 1988b) provides guidance regarding implementation of CERCLA amendments during the remedy selection process. The guidance states that treatment alternatives should be developed ranging from an alternative that, to the maximum degree possible, would eliminate the need for long-term management (including monitoring) at the site to alternatives involving treatment that would reduce toxicity, mobility, or volume as their principal element. The guidance also indicates that a containment option (involving little or no treatment) and a No Action alternative should be developed, if at all possible.

Based on these statutory preferences and the general response actions developed previously in Section 2.2, remedial alternatives were developed to meet the following criteria to the best extent practicable:

- o The remedial alternative is protective of human health and the environment.
- o The remedial alternative attains chemical-specific ARARs and can be implemented in a fashion consistent with location and action-specific ARARs.
- o The remedial alternative uses permanent solutions and alternative treatment technologies to the maximum extent practicable.
- o The alternatives developed are capable of achieving a remedy in a cost-effective manner.

As specified in the NCP, remedial alternatives are classified either as source control (SC) or management of migration (MM) remedial actions.

SC remedial actions primarily address situations in which hazardous substances remain at or near the areas where they were originally located and are not adequately contained to prevent migration into the environment. The purpose of SC remedies is to prevent or minimize migration of hazardous substances from the source material. These remedies seek to remove, stabilize, and/or contain the hazardous substances, and are primarily applied in cases where contaminants are in solids/soils. This is the situation that presently exists at the Circuitron Corporation Site. The contamination originated from the discharge of untreated process wastewater into the various underground structures. The liquid component has long since been flushed out of the aquifer underlying the site, however, the contaminated soil and sediment remain on-site.

Management of migration remedial actions address situations in which hazardous substances have migrated from the original source of contamination and pose a threat to the public health and welfare and also to the environment. These MM alternatives involve groundwater response actions where contaminated groundwater still exists on-site as a result of former site activities, and also may be responsible for contaminating downgradient water resources. As discussed previously in this report, groundwater treatment alternatives will not be developed for this site. The issue of groundwater contamination and remediation will be addressed in the additional study which will be performed.

3.1.1 Use of ARARs and TBCs in Remedial Alternative Development and Evaluation

Section 121(d) of the Superfund Amendments and Reauthorization Act (SARA) and the NCP (40 CFR Part 300; 1990) require that remedial actions taken under CERCLA comply with Section 121(d)(2)(c) of SARA, if they are legally enforceable and consistently enforced statewide. ARARs are used to determine the appropriate extent of site cleanup, to scope and formulate remedial action alternatives, and to govern the implementation and operation of the selected action. According to SARA, requirements may be waived by USEPA under six specific conditions, provided that protection of human health and the environment is still assured. These conditions include the following:

- o The selected remedial action is an interim remedy or portion of a total remedy that will attain the standard when complete;
- o Compliance with such requirements will result in greater risk to human health and the environment than alternative options;
- o Compliance with such requirements is technically impracticable from an engineering perspective;
- o The selected remedial action will provide a standard of performance equivalent to the standard required by the ARAR;
- o The requirement is a state requirement that has been inconsistently applied; and
- o The alternative will not provide a balance between public health and the environmental welfare and the availability of funds to respond to existing or potential threats at other sites, taking into account the relative immediacy of the threats.

In this section, the approach used to identify ARARs for the Circuitron Corporation Site is discussed and ARARs for site-specific conditions are identified.

DEFINITION OF ARARS

A requirement under CERCLA as amended may be either "applicable" or "relevant and appropriate" to a site-specific remedial action, but not both.

Applicable Requirements: Those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and Appropriate Requirements: Those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. In some circumstances, a requirement may be relevant but not appropriate for the site-specific situation.

Other Requirements To Be Considered: Federal and State guidance documents or criteria that are not generally enforceable but are advisory that do not have the status of potential ARARs. Guidance documents or advisories to be considered in determining the necessary level of cleanup for protection of human health or the environment may be used where no specific ARARs exist for a chemical or situation, or where such ARARs are not sufficient to be protective.

3.1.2 Identification of ARARs and TBCs

The ARAR requirements for remedial action alternatives at the Circuitron Corporation Site can be generally classified into one of the following three functional groups:

- o Chemical-specific (i.e., requirements that set protective cleanup levels for the chemicals of concern);
- o Location-specific (i.e., requirements that restrict remedial actions based on the characteristics of the site or its immediate environs); and
- o Action-specific (i.e., requirements that set controls or restrictions on the design, implementation, and performance levels of activities related to the management of hazardous substances, pollutants, or contaminants).

Chemical-specific requirements set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances. These requirements provide protective site cleanup levels as a basis for calculating cleanup levels for the chemicals of concern in the designated media. Chemical-specific ARARs are also used to indicate an acceptable level of discharge or water quality to determine treatment and disposal requirements that may occur in a remedial activity, and to assess the effectiveness of the remedial alternative.

Location-specific requirements set restrictions on the types of remedial activities that can be performed based on site-specific characteristics or location. Remedial action alternatives may be restricted or precluded based on Federal and State siting laws for hazardous waste facilities, proximity to wetlands or floodplains, or to man-made features such as existing landfills. Location-specific requirements provide a basis for assessing restrictions during the formulation and evaluation of potential location-specific remedies. There have been no location specific ARARs identified as applicable to the Circuitron Corporation Site.

Action-specific requirements are triggered by the particular remedial alternatives that are selected to accomplish the clean-up. After remedial alternatives are developed, action-specific ARARs that specify levels of residual chemicals for discharge serve to provide a basis for assessing the feasibility and effectiveness of the remedies. These action-specific ARARs may include, for example, hazardous waste transportation and handling requirements, and the RCRA landfilling and treatment requirements.

CONSIDERATION OF ARARS

ARARs were considered in the study through a two-step process.

Step one consisted of the identification of chemical-specific, and location-specific ARARs. These ARARs were used during the identification of remedial response objectives, screening of technologies and development of remedial alternatives. An inventory of potential ARARs for each category was prepared to ensure that all ARARs were considered. The list of potential ARARs was narrowed based on whether each requirement is legally enforceable at the site or over site conditions, or whether it would be reasonable to apply the requirement to site conditions if the site or remedial action was under its jurisdiction. This process was completed using checklists of potential ARARs and other requirements to be considered.

Step two consisted of the identification of action-specific ARARs that will control the implementation and/or operation of remedial actions identified for the site, so that the feasibility and effectiveness of the remedy can be assessed.

Regulations identified as chemical-specific and location-specific ARARs for existing site conditions are presented in Section 3.1.4. To be consistent with the NCP definition of ARARs and changes made by SARA, the following groups of ARARs were considered during the identification process:

- o Federal requirements (applicable, appropriate and relevant);
- o New York State Requirements;
- o Federal criteria, advisories and guidance documents; and
- o New York State Criteria, advisories and guidance documents.

3.1.3 Listing of ARARs and TBCs

The Federal, State and local ARARs and other regulatory requirements to be considered (TBCs) for the Circuitron Corporation Site are presented in Table 3-1.

3.1.4 General Discussion of Key ARARs and TBCs

o Chemical-specific ARARs

Groundwater at the Circuitron Corporation Site is designated as Class "GA" in accordance with the New York State Water Classification System. The "GA" designation is used to classify water quality suitable for potential drinking water supply. Several Federal and New York State regulations govern the quality, usage and discharge of groundwater.

Although no groundwater remediation measures are being utilized at this site, these chemical-specific ARARs will be used to develop approximate soil remediation action levels.

o Action-specific ARARs

Many of the action-specific ARARs are common to all the alternatives. Most of the RCRA ARARs and the OSHA rules are common to each alternative. They require that wastes be identified, manifested and properly monitored. The Land Disposal Restrictions and the Air Pollution Control regulations apply specifically to soil remediation.

o Location-specific ARARs

No location-specific ARARs have been identified for the Circuitron Corporation Site.

TABLE 3-1
CHEMICAL-SPECIFIC ARARS, CRITERIA, AND GUIDANCE
CIRCUITRON CORPORATION SITE

REGULATORY LEVEL	ARAR IDENTIFICATION CWA Water Quality Criteria (WQC) for Protection of Human Health and Aquatic Life	STATUS Relevant and Appropriate	REQUIREMENT SYNOPSIS Contaminant levels regulated by WQC are provided to protect human health for exposure from drinking water and from consuming aquatic organisms (primarily fish) and from fish consumption alone.
Federal	RCRA Maximum Concentration Limits (MCLs)	Relevant and Appropriate	Provides standards for 14 toxic compounds and pesticides for protection of groundwater. These standards are equal to the MCLs established by the SDWA.
Federal	SDWA Maximum Contaminant Levels (MCLs)	Relevant and Appropriate	Provides standards for 30 toxic compounds, including the 14 compounds adopted as RCRA MCLs, for public drinking system.
Federal	SDWA MCL Goals	Relevant and Appropriate	EPA has promulgated 9 contaminants and has proposed 40 others (50 FR 46936) for the public water system. The MCLGs are non-enforceable health goals and are set at levels that would result in no known or anticipated adverse health effects with an adequate margin of safety.
New York	6 NYCRR Groundwater Quality Regulations Part 703.5	Applicable	Provide quality standards for groundwater. Certain contaminant levels are specified.
New York	Ambient Water Quality Standards and Guidance Technical and Operations Guidance Series (TOGS) 1.1.1, April 1, 1987	To be con- sidered	Provide quality standards for groundwater and discharges to surface water.
New York	State Sanitary Code, Part 5	Applicable	Established Maximum contaminant levels or standards for organic contaminants.
New York	Air Pollution Control Regulations, 6NYCRR 212-257	To be con- sidered	Established air emission rates for excavation on-site.

TABLE 3-1 (Cont'd.)

ACTION-SPECIFIC ARARS
CIRCUITRON CORPORATION SITE

<u>Remedial Action</u>	<u>ARARS</u>	<u>Status</u>	<u>Regulatory Synopsis</u>
A. Common to all Alternatives			
	OSHA - General Industry Standards (29 CFR 1910)	Applicable	These regulations provide the 8-hour time weighted average concentration for water exposure to various organic compounds. Also provides for training requirements for workers at hazardous waste operations.
	OSHA - Safety and Health Standards (29 CFR 126)	Applicable	This regulation specifies the type of safety equipment and procedures to be followed during site remediation.
	OSHA - Recordkeeping, Reporting and Related Regulations (29 CFR 1904)	Applicable	This regulation outlines the recordkeeping and reporting requirements for employees under OSHA.
	RCRA - Standards for Generators of Hazardous Waste (40 CFR 262 et seq.)	Applicable	General generator requirements, outlining manifest recordkeeping and transportation requirements.
	RCRA - Standards for Transporters of Hazardous Waste (40 CFR 263)	Applicable	General transportation requirements.
	RCRA - Standards for Owners/Operators of permitted Hazardous Waste Facilities (40 CFR 264)	Relevant and Appropriate	General facility requirements outlining waste analysis, security measures, inspections and training requirements.
	RCRA - Preparedness and Prevention (40 CFR 264.30 - 264.31)	Relevant and Appropriate	This regulation outlines the requirements for safety equipment and spill control.
	New York State Hazardous Waste Manifest System Rules (6 NYCRR 372)	Relevant and Appropriate	This regulation outlines New York State manifest requirements.
	New York Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (6 NYCRR 370-373)	Relevant and Appropriate	This regulation outlines general waste facility and waste analysis requirements, security measures, and inspection and training requirements.
	New York Industrial Code Rule #53 (12 NYCRR 753)	Relevant and Appropriate	Establishes notification requirements for buried pipeline.
	USEPA Groundwater Protection - USEPA Policy Statement, August 1984	To Be Considered	Identifies groundwater quality to be achieved during remedial actions based on the aquifer characteristics and use.

TABLE 3-1 (Cont'd)

ACTION-SPECIFIC ARARS
CIRCUITRON CORPORATION SITE

Remedial Action B. Soil Treatment	ARARS RCRA - LDR (40 CFR 268)	Status Relevant and Appropriate	Regulatory Synopsis RCRA land disposal restrictions detail the requirements for the treatment and land disposal of hazardous waste. CERCLA soil and debris will be subject to these requirements after November 9, 1990.
C. Building Decontamination and Air Emissions	RCRA - Use and Management of Containers (40 CFR Subpart I)	Relevant and Appropriate	General requirements for operation and maintenance of tanks.
	New York State Guidelines for Soil Erosion and Sediment and Control	Relevant and Appropriate	Provides guidelines for soil erosion and sediment control and describes various techniques for achieving compliance.
	National Emission Standards for Hazardous Air Pollutants (NESHAP)	Applicable	These standards provide acceptable limits for emissions of specific chemicals. Requirements address operational; recordkeeping, and general emission standards that apply to matter from pumps, valves, compressors and vessels.
	New York State General Prohibitions on Fugitive Air Emissions (6 NYCRR 211)	Applicable	This regulation restricts the emission of air contaminants associated with particulate matter, fumes, mist and smoke as well as other visible emissions.
	New York Air Guide - I 7/86	Relevant and Appropriate	Provides Guidelines for the control of emissions of toxic air contaminants.

3.2 IDENTIFICATION OF ALTERNATIVES

3.2.1 Combination of Potentially Applicable Technologies into Feasible Remedial Alternatives

A review of the RI results, summarized in Section 1.0, and the technology screening presented in Section 2.0 of this FS report indicates that three basic potential remedial actions exist for the situation at this site:

- 1) No Action;
- 2) Containment; and
- 3) Removal, treatment and disposal of contaminated material.

Based on the requirements of the remedial action objectives and associated feasible remedial technologies, the potential remedial alternatives developed for the contaminated groundwater, sediment and structure at the site are identified below:

- o Alternative 1: No Action.
- o Alternative 2: Limited Action.
- o Alternative 3: Containment/Building Decontamination.
- o Alternative 4: In-Situ Vacuum Extraction/Excavation of Sediments/On-Site Stabilization and Disposal/Site Containment/Building Decontamination.
- o Alternative 5: In-Situ Vacuum Extraction/Excavation of Sediment/Off-site Incineration/Off-site Disposal/Site Containment/Building Decontamination.

Since only five remedial alternatives were developed, there was no need to perform the initial screening of the remedial alternatives. All these alternatives were subjected to the detailed evaluation described in Section 4.0. Each of these source control alternatives contains provision for continued groundwater monitoring and the performance of an additional study to investigate the origin of the upgradient groundwater contamination detected in the shallow and deep monitoring wells installed during the remedial investigation at the Circuitron Corporation Site. These measures were identified as the "no action" response action as described in Section 2.3.1.1. of this report.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

This section contains a discussion of the detailed evaluation and assessment of the potential remedial alternatives developed for the Circuitron Corporation Site. Nine evaluation criteria have been developed to address the additional technical and policy considerations that have been proven to be important for selecting among potential alternatives. These nine evaluation criteria serve as the basis for conducting the detailed analyses during the feasibility study and provide the basis for subsequently identifying a preferred alternative. These nine criteria are:

- 1) Overall protection of human health and the environment
- 2) Compliance with ARARs
- 3) Long term effectiveness
- 4) Reduction of toxicity, mobility or volume
- 5) Short term effectiveness
- 6) Implementability
- 7) Cost
- 8) State acceptance
- 9) Community acceptance

Based on the statutory preferences and the response objectives developed in Section 2.0, remedial alternatives shall meet the following requirements during evaluation and selection:

- o Protection of human health and the environment (CERCLA Section 121(b)).
- o Attainment of the applicable or relevant and appropriate requirements (ARARs) of Federal and State laws (CERCLA Section 121(d)(2)(A) or warranting a waiver under CERCLA Section 121(d)(4)).
- o Reflection of a cost-effective solution, taking into consideration short-term and long-term costs (CERCLA Section 121(a)).
- o Use of permanent solution and treatment technologies or resource recovery technologies to the maximum extent practicable (CERCLA Section 121(b)).
- o Satisfaction of the preference for remedies that employ treatments that permanently and significantly reduce the toxicity, mobility, or volume of hazardous substances as a principal element or explanation of reasons why such remedies were not selected (CERCLA Section 121(b)).

4.1 DESCRIPTION OF THE EVALUATION PROCESS

The detailed analysis follows the development of alternatives and precedes the actual selection of a remedy. The extent to which the alternatives are analyzed during this stage of the FS

are influenced by the available data, the number and types of alternatives being evaluated and degree to which the alternatives were previously analyzed during their development.

The results of this assessment are arrayed to compare the potential remedial alternatives with each other and identify the key tradeoffs among them. This approach to analyzing alternatives is designed to provide decisionmakers with sufficient information to adequately compare the alternatives, select an appropriate remedy for the site, and demonstrate satisfaction of the CERCLA remedy selection requirements in the Record of Decision.

The detailed analysis of alternatives includes the following steps:

- o Further definition of each alternative with respect to the volumes and areas of contaminated media to be addressed, the technologies to be employed and any performance requirements associated with those technologies;
- o the assessment of each alternative against the previously described nine evaluation criteria and preparation of a summary profile presenting the results; and,
- o a comparative analysis among the alternatives to assess the relative performance of each one with respect to each of the nine evaluation criteria.

4.1.1 Evaluation Criteria

The nine evaluation criteria listed above encompass statutory requirements and technical, cost, and institutional considerations that have been determined to be appropriate for a thorough evaluation. A brief description of the nine criteria presented below.

Overall Protection of Human Health and the Environment: The evaluation criterion provides an overall assessment of protection based on a composite of factors such as long-term and short-term effectiveness, and compliance with ARARs. Evaluations of the overall protectiveness address:

- o How a specific site remedial action achieves protection over time,
- o How site risks are reduced, and
- o How each source of contamination is to be eliminated, reduced, or controlled for each remedial action.

This evaluation also allows for consideration of whether an alternative poses any unacceptable short-term or cross-media impacts.

Compliance with ARARs: This evaluation criterion is used to determine how each remedial action complies with applicable or relevant and appropriate Federal and State requirements as defined in CERCLA Section 121. Each alternative is evaluated in detail for:

- o Compliance with contaminant-specific ARARs (e.g., MCLs),
- o Compliance with action-specific ARARs (e.g., RCRA minimum technology standards),
- o Compliance with location-specific ARARs (e.g., preservation of historic sites), and
- o Compliance with appropriate criteria, advisories, and guidances (i.e., "To Be Considered" material).

Long-Term Effectiveness and Permanence: This evaluation criterion addresses the results of the remedial action in terms of the risk remaining at the site after the response objectives have been met, particularly the effectiveness of the controls that will be applied to manage the risks posed by the residuals of the treatment process and/or untreated wastes. The components of this criterion include the magnitude of the remaining risks measured by numerical standards such as cancer risk levels; the adequacy and suitability of controls used to manage treatment residuals or untreated wastes; and the long-term reliability of management controls for providing continued protection from residuals, i.e., the assessment of potential failure of the technical components.

Reduction of Toxicity, Mobility or Volume: This evaluation criterion addresses the statutory preference that treatment is used to reduce the principal threats of the total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media. Factors of this criterion to be evaluated include the treatment process employed; the amount of hazardous material destroyed or treated; the degree of reduction in toxicity, mobility, or volume expected; and the type and quantity of treatment residuals.

Short-Term Effectiveness: This evaluation criterion addresses the impacts of the action during the construction and implementation phase until the remedial response objectives are met. Factors to be evaluated include protection of the community during the remedial actions, protection of workers during the

remedial actions, environmental impacts resulting from the implementation of the remedial actions, and the time required to achieve protection.

Implementability: This criterion addresses the technical and administrative feasibility of implementing a remedial action and the availability of various services and materials required during this implementation. Factors of technical feasibility include construction and operational difficulties, reliability of technology, ease of undertaking additional remedial actions, and the ability to monitor the effectiveness of the remedy. The administrative feasibility includes the ability and time required for permit approval and for activities needed to coordinate with other agencies. Factors utilized to evaluate the availability of services and materials include availability of treatment, storage, and disposal services with required capacities; availability of equipment and specialists; and availability of prospective technologies for competitive bid.

Cost: The types of costs that should be addressed include: capital costs, operation and maintenance (O&M) costs, costs of five-year reviews, where required, present value of capital and O&M costs, and potential future remedial action costs. Capital costs consist of direct and indirect costs. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Indirect costs include expenditures for engineering, financial, and other services required to complete the installation of remedial alternatives. Other annual O&M costs include auxiliary materials and energy, disposal of residues, purchased services, administrative costs, insurance, taxes, license costs, maintenance reserve and contingency funds, rehabilitation costs, and costs for periodic site reviews.

This assessment evaluated the costs of the remedial actions on the basis of present worth. Present worth analysis allows remedial actions to be compared on the basis of a single cost representing an amount that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. A required operating performance period is assumed for present worth and is a function of the discount rate and time. An operating performance period of 30 years and a discount rate of five percent is assumed for a base calculation. The "study estimate" costs provided for the remedial actions are intended to reflect actual costs with an accuracy of -30 to +50 percent.

State Acceptance: This assessment evaluates the technical and administrative issues and concerns the State may have regarding each of the remedial actions. The factors to be evaluated include features of the actions that the State supports, the State has reservations over, or the State opposes.

Community Acceptance: This assessment incorporated public input into the analysis of the remedial actions. Factors of community acceptance to be discussed include features of the supportiveness, reservations and opposition of the community.

It is anticipated that the formal comments from the state and the public will be provided during the 30-day public comment period for the FS report. These comments will then be addressed in the ROD and responsiveness summary. Therefore, only the first seven evaluation criteria were used to evaluate the potential remedial alternatives.

4.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

The paragraphs of this section will present the individual evaluations of the potential remedial alternatives previously developed for the Circuitron Corporation Site with the nine criteria. These alternatives include:

Alternative 1: No Action

Alternative 2: Limited Action

Alternative 3: Containment/Building Decontamination

Alternative 4: In-Situ Vacuum Extraction/Excavation of Sediments/
On-Site Stabilization and Disposal/Site
Containment/Building Decontamination

Alternative 5: In-Situ Vacuum Extraction/Excavation of Sediments/
Off-site Incineration/Off-site Disposal/Site
Containment/Building Decontamination

Although these alternatives have been developed primarily to provide source control measures, the groundwater contamination problem is also addressed. Each alternative, as discussed below, includes provision for a groundwater monitoring program and the performance of a study to identify the possible sources of the groundwater contamination detected upgradient of the Circuitron Corporation Site. The recommendation of this additional groundwater investigation was presented previously in Section 2.1.4 of this report, and is based on site specific data which revealed elevated levels of contamination in the upgradient monitoring wells installed during the remedial investigation. The results of this study could be used to employ a regional approach to the problem of groundwater contamination in the Upper Glacial Aquifer in this area of Long Island, rather than attempting to remediate smaller portions at individual sites. The identification of the specific bounds and parameters of this investigation is beyond the scope of this feasibility study and could be selected during the latter stages of the site remediation process.

4.2.1 Alternative 1: No Action

4.2.1.1 Description

The no action remedial alternative consists of a long term groundwater monitoring program in order to provide data for the assessment of the impact on the underlying groundwater of leaving contaminated materials on-site, and the performance of an additional groundwater study of upgradient contamination, as discussed in the above paragraph. The groundwater monitoring program would utilize wells installed during the remedial investigation at this site. Groundwater samples would be taken on a semi-annual basis from upgradient, on-site and downgradient shallow monitoring wells. These wells include MW-1S, MW-4S, MW-5S, MW-6S and MW-7S, and are shown on Figure 4-1.

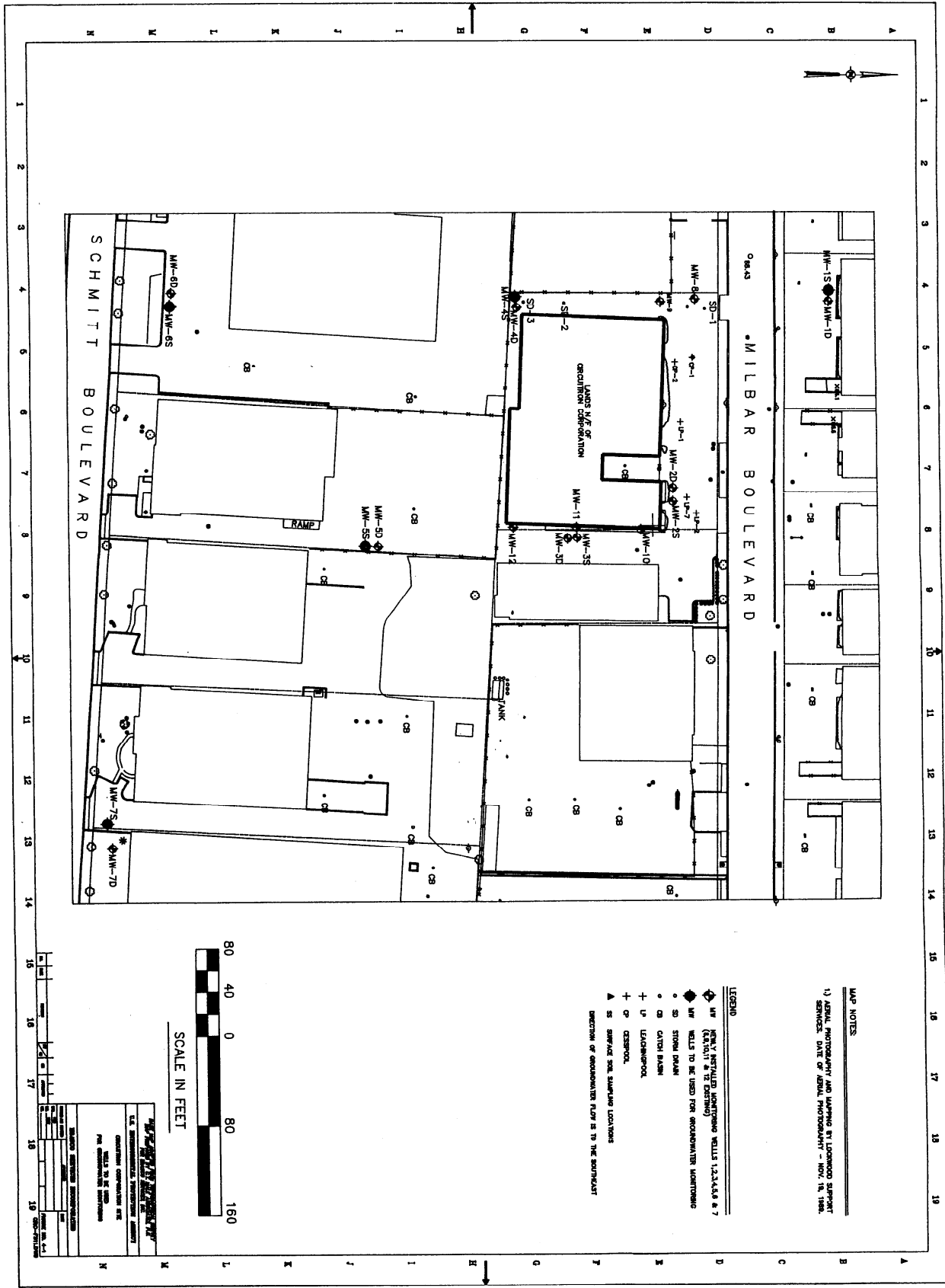
The no action response also includes the development and maintenance of a public awareness and education program for the residents and workers in the area surrounding the Circuitron Corporation Site. This program would include the preparation and distribution of informational press releases and circulars and the convening of public meetings. These activities will serve to enhance the public's knowledge of the conditions existing at the site. This alternative will also require the involvement of local government, and various health departments and environmental agencies.

Because this alternative does not include contaminant removal, the site will have to be reviewed every five years for a period of 30 years per CERCLA requirements, as amended. These five year reviews would include the reassessment of human health and environmental risks due to the contaminated material left on-site, using data obtained from the groundwater sampling program.

4.2.1.2 Evaluation

Overall Protection of Human Health and the Environment

The No-Action alternative does not include provisions for the treatment, removal or containment of on-site contaminated materials. Therefore, it would not provide adequate protection of human health and the environment since there would be no immediate reduction in the toxicity, mobility or volume of the contaminants. The contaminated soil and sediment would remain in place, and the leaching of contamination into the groundwater will continue. Contaminated building dust, and contaminated sediments beneath the plating room floor would remain, making the building unuseable. This alternative does nothing to reduce the risk of direct contact with contaminated sediment. For these reasons, this alternative does not meet any of the remedial action objectives. It provides a baseline against which all other potential remedial alternatives may be compared.

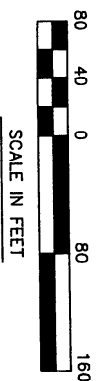


MAP NOTES

1) AERIAL PHOTOGRAPHY AND MAPPING BY LORRINO SURVEY SERVICE, DATE OF AERIAL PHOTOGRAPHY - NOV. 18, 1968.

LEGEND

- ◆ MONY INSTALLED MONITORING WELLS 1,2,3,4,5,6 & 7 (RELINQUISH & 12 EXISTING)
- ◆ MONY WELLS TO BE USED FOR OBSERVATION MONITORING
- STONE DRAIN
- CATCH BASIN
- LEACHING POOL
- CEMENTOIL
- ▲ SURFACE SOIL SAMPLING LOCATIONS
- DIRECTION OF OBSERVATION FLOW IS TO THE SOUTHEAST



U.S. GEOLOGICAL SURVEY	
WATER RESOURCES DIVISION	
SOUTH-WESTERN REGIONAL OFFICE	
DISTRIBUTION INFORMATION SHEET	
WELLS TO BE USED FOR OBSERVATION MONITORING	
DATE	1968 NOV 18
BY	W. J. LORRINO
FOR	U.S. GEOLOGICAL SURVEY
PROJECT	WATER RESOURCES DIVISION
MAP NO.	W-1000
SCALE	1" = 160'
DATE	1968 NOV 18
BY	W. J. LORRINO
FOR	U.S. GEOLOGICAL SURVEY
PROJECT	WATER RESOURCES DIVISION

Compliance with ARARs

This alternative fails to eliminate the source of contamination or remediate the existing site conditions. It does not satisfy any of the ARARs or TBCs.

Long-Term Effectiveness and Permanence

Because this alternative does not address the reduction of the mobility or concentration of the contaminants in the sediments at the site, it does not satisfy the remedial action objectives developed for the site. It provides no means for lowering the existing contaminant concentration levels in the groundwater to those levels found in upgradient wells. The potential for contaminant migration from site soil and sediment into the groundwater will still exist. Leaching from infiltration of precipitation is somewhat minimized by the asphalt pavement which covers 95% of the site. Some run-off/precipitation can infiltrate into contaminated sediment through the storm drains and cracks/holes in the pavement. Groundwater contaminant concentrations could actually increase due to this continued migration. Over the long term, however, the contamination level in the groundwater underlying the site may equilibrate to upgradient levels by natural flushing. For these reasons, the implementation of this potential remedial alternative will adversely impact the environment and public health, and is not considered to be an effective or permanent solution.

Reduction of Toxicity, Mobility or Volume

This alternative does not involve any containment, removal, treatment or disposal actions. It would leave the contaminated sediment intact. Migration of contaminants from sediments into groundwater would continue by natural processes. Leaching of contaminants over time may result in the reduction of their concentrations in sediment, however, they would be transported into the Upper Glacial Aquifer below the site. The No-Action alternative would not result in the near-term reduction in the toxicity, mobility or volume (TMV) of contaminants. Over the long-term, the TMV of contaminants in the groundwater may equilibrate to upgradient levels by natural flushing. This alternative does not result in any reduction in TMV of contaminants inside the building, such as dust.

Short-Term Effectiveness

This alternative does not include any construction or other physical site activity. As a result, there would be no short-term threats to neighboring communities and no significant

impacts on the environment or public health during its implementation. Implementation of this alternative would not result in a substantial improvement over current site conditions.

Implementability

o Technical Feasibility

This alternative does not require the installation of any additional equipment. The sampling of the existing groundwater monitoring wells and subsequent laboratory analysis of the samples is readily implementable. The public education and awareness program, consisting of mailing printed notices to advise all private residences, businesses, and public agencies of the status of the site and convening public meetings, could be easily implemented. The services and materials required to successfully utilize this program are readily available in the area. Numerous vendors would be available for competitive bids.

o Administrative Feasibility

Implementation of this alternative would require a considerable amount of institutional management. The long-term groundwater monitoring program, public education program and the five year site status reviews would require administrative and regulatory attention from local and State agencies on a periodic basis to ensure adequate information is being distributed and used. In addition, the development and performance of the groundwater investigation will necessitate the involvement of many environmental and public health agencies, including USEPA, NYSDEC and SCDHS.

Cost

The total present worth of this alternative is estimated to be \$508,408. This cost includes a capital cost of \$128,250 and an annual cost of \$22,920. The capital cost estimate includes drum removal. The annual cost for this alternative includes the semi-annual groundwater sampling program, the convening of public meetings on a periodic basis (dependent upon public interest), newspaper submittals and literature distribution, and the site status review every five years. The detailed information used to calculate these costs is contained in Appendices A and B. A cost estimate for the additional groundwater investigation was not developed because the detailed scope of this study of upgradient contamination is not addressed in this report.

4.2.2 Alternative 2: Limited Action

4.2.2.1 Description

The Limited Action alternative combines a program of groundwater monitoring with site access and use restrictions. The shallow aquifer groundwater monitoring wells installed during

performance of the RI would be utilized to obtain samples for laboratory analysis. The sampling would take place on a semi-annual basis for a period of 30 years. The analytical results of the groundwater samples would then be evaluated to determine the degree of natural attenuation taking place. The monitoring wells to be utilized for the sampling are shown on Figure 4-1.

The site access restriction portion of this alternative consists of surrounding the entire site with conventional chain-link fencing. This would require approximately 820 feet of fencing. Along the fence, at appropriate intervals, various warning signs would be placed that would caution the public as to the Superfund status of the site. One access gate would be provided, which would be kept locked, to allow for the use of the site for sampling and review purposes. In addition to the access restrictions, institutional controls will be implemented to restrict the use of the land and building because of the threat of contamination.

Also, as stated previously in Alternative 1, a review of the site status would have to be conducted every five years for 30 years because there will be contamination remaining on-site. The five year reviews would include evaluation of sampling analytical data, reassessment of human health and environmental risks, and addressing public compliance with the institutional controls. A public awareness program would be implemented as described in Alternative 1. In addition to these measures, the Limited Action alternative includes an investigation into the sources of upgradient groundwater contamination. This study is discussed in the description of the No Action alternative in Section 4.2.1.1.

4.2.2.2 Evaluation

Overall Protection of Human Health and the Environment

This Limited Action alternative does not include provision for the treatment, removal or containment of on-site contaminated materials. Therefore, it would not provide adequate protection of human health and the environment since there would be no immediate reduction in the toxicity, mobility or volume of the contaminants. The contaminated sediment would remain in place, and the leaching of contamination into the groundwater will continue. Contaminated building dust and sediment underlying the building floor would remain, making the building unuseable. Although this alternative consists of the installation of a fence to isolate the site and the use of institutional controls to restrict the future use of the property, it does not meet any of the remedial action objectives. It will only further reduce the risk of direct contact with contaminated sediment by restricting site use, and provide more information to the public regarding the groundwater contamination.

Compliance with ARARs

This alternative fails to eliminate the source of contamination or remediate the existing site conditions. It does not satisfy any of the ARARs or TBCs.

Long-Term Effectiveness and Permanence

This alternative does not satisfy the remedial action objectives developed for the site because it does not address the reduction of the mobility or concentration of the contaminants in the sediments at the site. It provides no means for lowering the existing levels in the groundwater to those levels found in upgradient wells. The potential for contaminant migration into the groundwater will still exist. Groundwater contaminant concentrations in the near term could actually increase due to this continued migration. Over the long term, the contamination level in groundwater underlying the site will equilibrate to upgradient levels by natural flushing. For these reasons, the implementation of this Limited Action alternative will adversely impact the environment and public health, and is considered to be neither an effective nor a permanent solution to the problem at the Circuitron Corporation Site.

Reduction of Toxicity, Mobility or Volume

This Limited Action alternative does not include any measures to provide containment, removal, treatment or disposal of the contamination at the site. It would leave the contaminated sediments intact. Migration of contaminants through the subsurface soil and sediment and into groundwater would continue via natural transport processes. Leaching of contaminants over time may result in the reduction of their concentration in sediments, however, they would be transported into the Upper Glacial Aquifer below the site. The Limited Action alternative would not result in the near-term reduction in the toxicity, mobility or volume of contaminants. Over the long term, the level of contaminants in the groundwater may attain those of the upgradient groundwater due to natural flushing. This alternative does not result in any reduction in TMV of contaminants inside the building (dust).

Short-Term Effectiveness

This alternative does not include any substantial construction activity. The only physical site activity would be the installation of the new security fence surrounding the perimeter of the site and the occasional sampling of the on-site groundwater monitoring wells. There would be no short-term threats to neighboring communities and no significant impacts on the environment or public health during the implementation of these limited activities. The workers performing the remediation work consisting of fence installation, well sampling and site inspection activities, may potentially be exposed to contaminated

materials. However, these personnel will be trained for work at hazardous waste sites and in the use of the proper protective equipment for this site. This training will minimize the risk of direct contact with contaminated groundwater and sediment. Implementation of this alternative would not result in a substantial improvement over current site conditions. Approximately six months would be required to install the fence and warning signs, including time for engineering and contractor procurement.

Implementability

o Technical Feasibility

The installation of the new security fence is an easily implementable task. The sampling of the existing groundwater monitoring wells, and subsequent analysis of the samples, and the five year site status reviews could also be accomplished with little difficulty. Since only the perimeter of the site will be disturbed by construction activity, the implementation of additional remedial action at this location would be quite easy to undertake.

Monitoring the effectiveness of this alternative would be accomplished by the evaluation of the analytical results of the groundwater samples and the reassessment of the risks associated with the site during the five year reviews. In order to ensure compliance with the access and use restrictions enacted for the property, periodic surveillance of the site could be conducted by local agencies. The public education program would increase the effectiveness of this alternative because the community would be informed of the potential hazards of the site.

o Availability of Services and Materials

The services and materials required to successfully implement this alternative are readily available in the area. The initial work required to install the fence could be completed in a short period of time. Numerous local contractors would be available to submit competitive bids for the performance of the work related to this alternative.

o Administrative Feasibility

Implementation of this alternative would require a considerable amount of long term institutional management. Local law enforcement agencies may be enlisted to perform visual site inspection on a periodic basis to ensure the integrity of the security fence. The use restrictions on the property would require the attention of local municipal planning and zoning authorities to be enacted and enforced. In addition, the public education program, the groundwater monitoring program and the five year

site status reviews would require administrative and regulatory attention from local and State agencies on a periodic basis to ensure adequate information is being utilized. The development and performance of the additional groundwater investigation will require the involvement and cooperation of many environmental and public health agencies, including USEPA, NYSDEC and SCDHS.

Cost

The total present worth of this alternative is estimated to be \$540,403. This cost includes a capital cost of \$160,245 for the installation of the new fence and the implementation of use restrictions, and an annual cost of \$22,920. The capital cost includes drum removal. The annual costs for this alternative include the groundwater sampling and laboratory analysis, maintenance of the fence and warning signs, the public education program and the site status review every five years. The detailed information used to calculate these costs is contained in Appendices A and B. A cost estimate for the additional groundwater investigation was not developed because the detailed scope of this study of upgradient contamination is not addressed in this report.

4.2.3 Alternative 3: Containment/Building Decontamination

4.2.3.1 Description

The containment alternative includes repaving the site and decontaminating the building. The purpose of this alternative is to prevent further infiltration of precipitation/run-off through the contaminated site sediment which may be a major source of site-related groundwater contamination. This will be accomplished by eliminating the current pathways for infiltration; namely, the storm drains and any gaps/cracks in the existing asphalt pavement. The building will also be decontaminated to allow for its future reuse by removing the metals contaminated dust and pouring a new concrete floor over the damaged floor in the plating room.

In this alternative the storm drains would be filled with clean fill material. The entire site area, outside the building, would be repaved with asphalt using conventional construction methods. The filled storm drains would also be paved. Approximately 1740 square yards of asphalt would be required.

Precipitation run-off from the building will be diverted into the street for collection in existing municipal storm drains. The site area will also be repaved in such a way so as to direct surface run-off to the street/municipal storm drains.

The metals contaminated dust inside the building will be removed by vacuuming the walls and floors using conventional industrial equipment adapted for use at a hazardous waste site. Approximately 5 cubic yards of dust will be collected and

transported to an off-site facility for treatment and disposal. This facility will most likely be an off-site, RCRA stabilization/landfill facility. The plating room floor in the building, which shows evidence of deterioration, will be covered with a new, poured concrete floor. The new floor will be approximately 4200 square feet in area and 2-inches thick.

This alternative also includes a long-term groundwater monitoring and five-year review program as well as an investigation into the sources of upgradient groundwater contamination, as described in Alternatives 1 and 2. One purpose of this program would be to evaluate the effectiveness of the site containment at eliminating the current major source of site-related groundwater contamination; that is, infiltration of precipitation through contaminated site soils. The new pavement would also require regular inspection and maintenance to prevent and/or repair cracks/gaps in the pavement.

4.2.3.2 Evaluation

Overall Protection of Human Health and the Environment

The containment alternative would eliminate the major pathway for site-related groundwater contamination by preventing infiltration of precipitation through contaminated soil and sediment. If effective, this alternative could provide a reduction, over time, in the toxicity, mobility and volume (TMV) off site-related contamination in the groundwater. Paving over the storm drains would essentially eliminate the current risk of direct contact with sediment. However, contaminated soil and sediment would remain on-site so there would be no reduction in toxicity or volume of contaminants in these media although mobility would be reduced. Also, if the containment fails i.e. if the maintenance program is deficient and holes or cracks develop in the asphalt pavement, contaminants could resume their leaching from soil into the groundwater. This alternative would provide for removal of contaminated building dust and a resurfacing of the plating room floor which would essentially contain the underlying contaminated concrete and sediments. The decontaminated building could possibly be reused in the future.

Compliance with ARARs

This alternative does not directly eliminate the source of contamination in site sediments, so it will not fully satisfy the chemical-specific ARARs and TBCs. It would comply with action-specific ARARs/TBCs. However, it does remove contaminated building dust and could satisfy the TBCs for the building.

Long-Term Effectiveness and Permanence

This alternative could partially satisfy the remedial action objectives for the site because it does reduce the mobility of contaminants in the sediments at the site. It could provide an accelerated means for lowering existing levels of contamination in the groundwater to those levels found upgradient, by eliminating leaching of contaminants from sediments into groundwater via precipitation infiltration. It does not, however, reduce the volume or concentrations of these contaminants and should the containment system fail; i.e., holes or cracks develop in the asphalt that are not repaired, leaching of contaminants from sediment into groundwater could resume. Also, fluctuations in the water table, which can be up to 3 feet (Ebasco 1990) could cause additional leaching of contaminants from the soil directly above the water table level. This may be especially significant in the area of SD-3/MW-4 where high levels of 1,1,1-TCA were found just above the water table at 20'-22' (See Figures 1-8 and 1-10). Therefore, this alternative may not be a permanent solution to the site-related groundwater problem.

This alternative would be effective in removing contaminated dust from the building and repairing the plating room floor. The building could potentially be suitable for reuse. Future operations may need to be restricted to ensure that the contaminated sediments beneath the plating room floor would not be uncovered and/or disturbed. Future site operations should be restricted to preclude any construction which would require excavation or disturbance of the sediment.

Reduction of Toxicity, Mobility or Volume

This alternative could effectively reduce the mobility of the site sediment contaminants but will not reduce the toxicity or volume of these contaminants. The toxicity, mobility and volume (TMV) of the site-related groundwater contamination could be reduced to upgradient levels via natural flushing, at an accelerated rate in comparison with Alternatives 1 and 2, since the site groundwater would be subject to minimal leaching of contaminants from site sediment. This condition could be reversed if the containment system fails. This alternative would be effective at reducing the TMV of contaminants inside the building.

Short-Term Effectiveness

Repaving the site involves standard construction activities and should present no health threats to workers or the public. Some short-term risks to workers from inhalation of dust during the building decontamination may exist, but these can be mitigated by the use of proper personnel protective equipment and operational procedures. Some short-term impacts to the area due to an increase in construction equipment, traffic and noise may result but these are expected to be minimal.

Implementability

o Technical Feasibility

All components of this alternative involve standard commercially available construction methods and equipment. Repavement of the site is a technically feasible means for effectively covering or "capping" the entire site area outside the building to prevent precipitation infiltration into the underlying sediments.

o Availability of Services and Materials

Numerous contractors are available for competitive bidding to perform the work included with this alternative. All the work may be performed by one contractor, or individual contracts may be developed for the asphalt pavement and building decontamination portions of the alternative. Several RCRA permitted facilities are available for the proper treatment (stabilization) and disposal of the collected building dust.

o Administrative Feasibility

Implementation of this alternative would involve restriction of access to the site, especially the building, during construction. Significant long-term management of an inspection and maintenance program for the asphalt pavement would be required. Institutional management of the long-term groundwater monitoring and five year review program would also be required as described in Alternatives 1 and 2. The additional groundwater investigation will require the involvement and cooperation of many environmental and public health agencies, including USEPA, NYSDEC and SCDHS.

Cost

The direct and indirect capital costs of this alternative are estimated to be \$163,790 and \$57,327 respectively. The annual operating and maintenance cost for this alternative is estimated to be \$26,525 which includes the inspection and maintenance program for the asphalt pavement and the groundwater monitoring program. The total present worth of this alternative is estimated to be \$656,695. This cost includes drum removal. The detailed information used to calculate these costs is contained in Appendices A and B.

4.2.4 Alternative 4: In-situ Vacuum Extraction/Excavation of Sediments/On-Site Stabilization and Disposal/Site Containment/Building Decontamination

4.2.4.1 Description

This alternative consists of the use of in-situ vacuum extraction in the southwest corner of the site; the excavation and removal of the contaminated sediments within all of the underground structures inside and outside the building;

treatment of the excavated sediments via stabilization and disposal on-site; site containment via capping; and building decontamination. The aspects of each of these alternative components are described below.

In order to reduce the levels of 1,1,1-TCA in the soil in the southwest corner of the site, which includes SD-3 and MW-4, in-situ vacuum extraction will be used. The concentration of 1,1,1-TCA in the soil samples taken from MW-4D were found to range up to 100,000 ppb, which is above the soil cleanup level presented in Appendix C of 1000 ppb. In-situ vacuum extraction will be applied to an approximate area of 20' x 20' surrounding SD-3/MW-4. The application of this system will include the installation of two vacuum wells in the area, with a maximum depth of 25 feet or the top of the water table. The wells are connected via a piping system to a skid mounted vacuum pump which pulls air through the contaminated soils and sediment within a radius of 10-20 feet of each well, depending upon the soil composition, volatility of the contaminants, and the capacity of the pump. The air containing the stripped volatile organic compounds is treated in a vapor phase carbon adsorption system. The spent carbon will be transported to an off-site disposal or regeneration facility. Site specific testing may be required during the design phase to determine the amount of treatment time and optimum extraction well placement. It is expected that this system can be installed and operated to effectively reduce levels of volatile organic compounds, notably 1,1,1-TCA, to acceptable levels within a few months. Confirmational sampling may be required during the remedial action to determine the duration and success of the clean-up. This work may be performed while remediation activities at other areas of the site are being conducted.

The excavation of the sediments from within the underground structures is intended to remove metals that are present in concentrations above soil cleanup levels. The areas and volumes to be excavated are described in Section 2.2.1 Remediation Target Areas and Volumes, are shown on Figure 2-1, and are summarized in Table 2-3. Conventional construction equipment and procedures, including manual excavation, will be utilized for this stage of the remedial action. The remediation of the various areas is defined as follows:

1) Beneath the Plating Room Floor

As discussed previously, there are several perforated drums, tanks or other structures beneath the plating room floor that were used during facility operation for leaching liquid wastes into the ground. The sediments of these structures will be removed and subjected to treatment. In order to accomplish this, the concrete floor in the plating room must be demolished and removed, and the leaching structures located. This will be done during the implementation of the remedial action. Once the contaminated sediments have been identified, they will be excavated to a depth of approximately 2 feet, or to whenever all obvious signs of contamination have been removed, such as when a

layer of undisturbed, clean sandy soil is observed by the site geologist. The leaching structures, piping, drums and any other buried materials will remain in place. The contaminated sediments and other soil removed for excavation will be stockpiled at the site for treatment via stabilization. The excavated areas will be backfilled, and the concrete floor will be replaced. It is estimated that 7 cubic yards of sediment, from 5 areas, will be removed and require treatment.

2) Leach Pools, Cesspools, and Storm Drains

These underground structures all lie beneath the asphalt paving of the parking area and alongside the building. Their approximate locations are shown in Figure 2-1 and are identified as LP-1, LP-2, LP-7, CP-1, CP-2, SD-1, SD-2 and SD-3. The interiors of these pools will be exposed, and the sediments at the bottoms of the structures will be removed and stockpiled for treatment. As described above, the sediments will be excavated to a depth of approximately 2 feet below their surface, or until clean sandy soil is observed by the site geologist. After the contaminated sediments have been removed, the structures will be filled with soil or stabilized material and prepared for accepting a layer of asphalt pavement. It is estimated that 31 cubic yards of contaminated material will be generated as a result of this excavation.

The contaminated sediments that have been removed from the ground will be subjected to treatment via stabilization to reduce the leachability of the contaminants. This stabilization process can take place at the site because of the relatively small quantity of material involved and relatively minor amount of space required for the process equipment. The on-site stabilization process includes the addition of Portland cement, fly ash, lime, silicate and other reagents that may be considered necessary. A small scale treatability test would be conducted during the remedial design or remedial action phase to determine the proper additives and optimum quantities to be mixed with the contaminated sediments. The mixture is then conveyed to a concrete mixing truck, pug mill, or any other high shear mixing equipment where water is added, and the mixture is thoroughly blended.

This treatment process is useful for on-site application because it requires a small area for equipment staging, stabilized material curing, and contaminated sediment storage. The treated material volume will increase by 50-100 percent due to the addition of hydration water and dry reagents.

Once the sediments have been stabilized and cured for the proper time and then tested via TCLP methods, they may be considered suitable for use as fill and buried on-site within the underground structures, which are hollow. This is possible after samples have been taken of the stabilized material and analyzed for the full range of compounds employing the TCLP guidelines.

Clean soil for backfill will be required to completely fill the underground structures up to surface grade elevations.

After all the excavation, stabilization and on-site disposal activities have taken place, the site contaminant remediation activities will take place. As described in the text for Alternative 3, the site containment will include asphalt paving of the site, and sealing all openings currently existing in the site pavement, such as those for storm drains and catch basins. The site pavement will be graded in such a way as to allow all stormwater runoff and snow melt to drain into the municipal storm system located in the street along Milbar Blvd. This site containment activity will include all currently paved and unpaved areas.

If the building is to be used in the future, a new septic system will need to be installed. This may require the excavation and installation of new septic pits or cesspools for disposal of sanitary wastes, or hook-up to a municipal system if one exists. For purposes of this Feasibility Study, these details have been omitted, and the cost for performance of this work has not been included in the cost estimate for implementation of this alternative.

In addition to the work outside and beneath the building, this potential remedial alternative includes provision for decontamination of the building. As presented previously, this will consist of vacuuming the walls and floors of the building to remove dust which contains traces of metals contamination. This activity may generate approximately 5 cubic yards of metals contaminated dust, which will be combined with the sediments for stabilization.

The additional groundwater investigation of upgradient sources of contamination is also included with this alternative.

4.2.4.2 Evaluation

Overall Protection of Human Health and the Environment

This alternative includes provision for the removal of the contaminated sediments from the site and the decontamination of the interior of the building. These measures will greatly reduce the environmental and public health risks currently associated with the site. The contaminated materials removed from the site will be stabilized on-site and disposed of on-site. No secondary waste management would be required on-site except for disposal of decontamination water from equipment and personnel decontamination activities and spent carbon from the in-situ vacuum extraction system. All of the contaminated sediment would be removed from the underground structures and stabilized to prevent leaching, and the groundwater would be allowed to flush itself of contamination attributed to on-site sources. The contaminated building dust

would also be removed and the plating room floor replaced to allow future reuse of the building. The entire site would be paved over to prevent any precipitation infiltration into the soil and stabilized sediments. This alternative would eliminate the adverse impacts of the site conditions with regard to the environment and the public health.

Compliance With ARARs

This alternative would provide a means of compliance with the chemical-specific ARARs identified for this site since the sources of contamination would be removed. Because of this source removal and stabilization, the threat to human health and the environment would be eliminated, and the on-site groundwater would attenuate itself to upgradient levels. Action-specific ARARs would be considered and complied with during the implementation of the remedial activities.

Long-Term Effectiveness and Permanence

This removal and treatment alternative satisfies the remedial action objectives developed for the site because it includes actions that reduce the mobility and concentration of the contaminants in the sediments at the site. It provides a means for lowering the existing risk levels in the groundwater to those levels found in upgradient wells via the elimination of the source of on-site contamination. The potential for contaminant migration into the groundwater will be practically nonexistent due to the removal of the contaminated sediments in the leach pools, cesspools, and storm drains, and stabilization and backfilling these areas with clean soil and stabilized material. The contaminated sediment removed will be treated in such a way as to prevent the release of the contamination to the environment. In addition, the building would be completely decontaminated to allow for its future reuse. For these reasons, the implementation of this alternative will protect the environment and the public health, and may be considered to be both an effective and a permanent solution to the problem at the Circuitron Corporation Site.

Reduction of Toxicity, Mobility or Volume

The removal and subsequent treatment by stabilization of the contaminated sediment from the site will effectively eliminate the volume of contaminated material at the site. The toxicity and mobility of the hazardous compounds of the material will be substantially reduced after treatment. The volume of volatile organic contamination will be substantially reduced by the use of in-situ vacuum extraction in the area of SD-3/MW-4 where most of the 1,1,1-TCA was found. The treated sediments should meet TCLP standards. Because of the removal and stabilization of the contaminated sediments, the on-site groundwater will not be exposed to additional sources of contamination and the toxicity

of the groundwater will be reduced to equal that of upgradient levels. The toxicity, mobility and volume of contaminants inside the building will be completely reduced by removal and treatment/disposal of the metals contaminated building dust.

Short-Term Effectiveness

The potential health threats to workers in the area would include direct contact with contaminated sediment and inhalation of fugitive dust generated as a result of the excavation, building dust removal activities and on-site stabilization. Dust control measures would be taken to minimize the potential for fugitive particulate emissions during the excavation and stabilization process. Risk from volatile emissions during excavation will be minimized by the prior application of in-situ vacuum extraction in the area of SD-3/MW-4 which contained high concentrations of 1,1,1-TCA (up to 100,000 ug/kg). However, application of in-situ vacuum extraction may present some short-term risk to workers due to possible vapor leaks from the system, although proper operation should minimize this risk. Air monitoring for particulates and volatile organic vapors will be conducted at the site. The workers performing the remediation activities would be properly equipped for this activity. This would include being properly trained and utilizing personal protective equipment to reduce the risk of dermal contact with, inhalation and ingestion of contaminated sediment. Short-term impacts to the area may arise from the increase in vehicular and truck traffic and noise levels due to the site remediation activities. It is expected that this work could be completed in 12 to 18 months. This includes all engineering, site preparation and on-site remediation work.

Implementability

o Technical Feasibility

All components of this alternative are commercially proven and readily available. The excavation of the contaminated material may be performed utilizing conventional earthworking equipment and techniques. Stabilization of the soil into an inert, cementitious mass may be accomplished by the addition of standard dry reagents as Portland cement, fly ash and lime, with proprietary reagents included as necessary. Treatability tests may be performed to determine the optimum formulation of stabilizing agents.

In-situ vacuum extraction has somewhat limited operational data and although commercially available, it has not been widely used. In-situ vacuum extraction units have been demonstrated for unsaturated sandy soils contaminated with volatile organics, as is the case at this site. In-situ vacuum extraction units utilize very little equipment; the pump and carbon adsorption units are usually skid-mounted, and sufficient site space should

be available. Testing may be required to determine the optimum system configuration and length of treatment time.

o Availability of Services and Materials

Numerous contractors are available for competitive bidding to perform the work included with this alternative. All the work of this alternative may be performed by one contractor, or individual contracts may be developed for smaller portions of the project. Several soil stabilization facilities are located at RCRA permitted landfills which would eliminate the cost of transporting treated soil for disposal at another location. The transportable enhanced volatilization units are commercially available to be placed on property located at an approved RCRA facility. The non-hazardous debris generated as a result of implementing this alternative may be disposed of locally at a conventional municipal landfill.

o Administrative Feasibility

Implementation of this alternative would require restriction of access to the site during the remediation activities. Coordination with local municipal agencies would be necessary to regulate the additional traffic resulting from the site work and transportation of the contaminated soil to the off-site facility. Permits and other authorizations for the use of the enhanced volatilization unit at an off-site location and the transport of hazardous material must be obtained.

Cost

The direct and indirect capital costs of Alternative 4, which includes on-site stabilization and disposal and also drum removal, are estimated to be \$381,310 and \$133,450, respectively. The annual maintenance cost for this alternative is estimated to be \$3,850, which includes maintenance of the site containment. The total present worth of this alternative is estimated to be \$573,945. The detailed information used to calculate these costs is contained in Appendices A and B. A cost estimate for the additional groundwater investigation was not developed because the detailed scope of this study of upgradient contamination is not addressed in this report.

4.2.5 Alternative 5: In-situ Vacuum Extraction/Excavation of Sediments/Off-site Incineration and Disposal/Site Containment/Building Decontamination

4.2.5.1 Description

The elements of this potential remedial alternative are similar to those of Alternative 4 described previously, with the exception of the use of off-site incineration and disposal in place of on-site stabilization and disposal.

The contaminated sediments would be excavated from the underground structures, in the same manner and quantities as presented previously, and would be stockpiled for transportation to an approved RCRA incineration and disposal facility. At the facility, incineration of the approximate 53 cubic yards of contaminated material would destroy the organic compounds (such as BEHP and 1,1,1-TCA) contained in the sediment and dust. The metals that are present will remain with the combustion residue. This residue will be stabilized at the facility and disposed of in a RCRA landfill.

The excavated material would be packed into appropriate containers for shipment to the incineration facility, and transported via truck. For cost purposes of this feasibility study, a facility which accepts bulk material will be utilized (some facilities require the use of fiber pack drums). The incineration facility would also be responsible for all necessary pre- and post-treatment of the contaminated material, including ash stabilization and disposal of the treated material. This small quantity of material is not expected to cause any handling, transportation or treatment difficulties.

The remaining components of the previous alternative, such as site containment, building decontamination and the groundwater investigation program, are the same as presented in the description of Alternative 4.

4.2.5.2 Evaluation

Overall Protection of Human Health and the Environment

This alternative would essentially result in the same degree of protection of human health and the environment as Alternative 4, by the removal of on-site contaminated soil and sediment and thus, the elimination of the site's source of groundwater contamination. The site would be completely paved over with an impermeable layer of asphalt to minimize the possibility of precipitation infiltration. The contaminated building dust would also be removed and plating room floor replaced, to allow for future reuse of the building. This alternative involves treatment (incineration) which would totally reduce the toxicity, mobility and volume of hazardous contaminants. As in Alternative 4, no secondary on-site waste management except for the disposal of decontamination fluids and spent carbon from in-situ vacuum extraction, would be required, thus this alternative does not present any additional risk to the public health or environment which may be present from on-site treatment such as on-site incineration where air emissions may be of concern.

Compliance With ARARs

This alternative would provide a means of compliance with the chemical-specific ARARs identified for this site since the

sources of contamination would be removed. Because of this source removal, the threat to human health and the environment would be eliminated, and the on-site groundwater contamination would attenuate to upgradient levels. Action-specific ARARs would be considered and complied with during the implementation of the remedial activities.

Long-Term Effectiveness and Permanence

This alternative has essentially the same long-term effectiveness and permanence as Alternative 4. The removal of contaminated sediments for off-site treatment and subsequent paving of the site achieves the remedial objectives of reducing the mobility of the contaminants in the sediments and eliminating the on-site source of groundwater contamination. The contaminated sediment will be treated in such a way so as to prevent the further release of the contaminants into the environment. In addition, the building would be completely decontaminated to allow for future reuse. Incineration provides permanent destruction of organic contaminants, and long-term reduction in the mobility of inorganics by stabilization of the combustion residue at the treatment facility.

Reduction of Toxicity, Mobility and Volume

As in Alternative 4, the removal of contaminated sediment from the site and dust from the building, will effectively eliminate the toxicity, mobility and volume (TMV) of contaminants in these media, at the site. The subsequent incineration of the contaminated material achieves complete reduction in TMV of organic contaminants and a significant reduction in the mobility of inorganics which can be determined by TCLP testing of the ash. Should the ash fail TCLP testing, additional stabilization may be required prior to RCRA landfilling the ash. Overall, this alternative achieves complete reduction in TMV in on-site sediments. As in Alternative 4, the on-site groundwater will not be exposed to additional sources of on-site contamination, so the TMV of contaminants in groundwater will be reduced to upgradient levels.

Short-Term Effectiveness

The short-term effectiveness of this alternative is similar to that of Alternative 4. Potential short-term risks include risk to on-site workers from direct contact with contaminated sediment and inhalation of fugitive dust and organic vapors during excavation, and potential vapor leaks from the in-situ vacuum extraction system. Short-term effects on public health and the environment include potential exposure risks from accidental spills during transport and short-term impacts from the increase in vehicular traffic in the area. These risks can be mitigated through the use of proper controls, safe work practices and monitoring as described in Alternative 4. Risks

to workers from volatile emissions during excavation are essentially mitigated by the application of in-situ vacuum extraction as in Alternative 4. It is expected that the time for on-site remediation, including all engineering, site preparation and on-site remediation work is 18 to 24 months.

Implementability

o Technical Feasibility

Most components of this alternative are commercially proven and readily available. Excavation and transportation of contaminated material may be performed using conventional equipment and techniques. The contaminated sediment should be acceptable for incineration at a number of facilities. The volume of contaminated material, 53 cubic yards, is small enough to enable the incineration facility to mix it with other wastes to lower the influent metal concentration levels if these levels are of concern based on the facility's individual permit requirements. As discussed in Alternative 4, in-situ vacuum extraction is commercially available, but its use, although increasing, has been limited. Site containment activities in the form of asphalt paving require standard materials and procedures.

o Availability of Services and Material

As in Alternative 4, numerous contractors are available for competitive bidding to perform the required remediation work. Several commercial incineration facilities are available and the volume of material is small enough so that off-site capacity should not be a problem. The debris generated as a result of implementing this alternative, such as concrete and asphalt, may be disposed of locally at a conventional municipal landfill.

o Administrative Feasibility

Administrative efforts required for this alternative are identical to those for Alternative 4 which include restriction of site access during remediation, coordination with municipal and State authorities to regulate transportation activities and obtain permits, and management of the additional upgradient groundwater investigation.

Cost

The direct and indirect capital costs of this alternative are estimated to be \$427,660 and \$149,680, respectively. The capital cost includes drum removal activities. The annual maintenance cost, which includes maintenance of the site containment, is \$3,850. The total present worth cost for this alternative, based on a 5% interest rate for 30 years is \$636,525. The detailed information used to calculate these costs is contained in Appendices A and B. A cost estimate for

the additional groundwater investigation was not developed because the detailed scope of this study is not addressed in this report.

4.3 COMPARATIVE ANALYSIS

This section contains discussions of the key factors of each of the alternatives and differences among them relative to each of the nine evaluation criteria. Table 4-1 presents a summary of the comparison of the potential remedial alternatives.

4.3.1 Overall Protection of Human Health and the Environment

Alternatives 1 and 2 do not respond favorably to the remedial objectives developed for the site and do not include any measures to hasten the natural flushing of the groundwater to upgradient conditions. Alternatives 3, 4 and 5 provide source control measures that will prevent further migration of contaminants from sediment into groundwater thus allowing the groundwater of the Upper Glacial Aquifer to flush itself of the contamination due to on-site sediments to equal upgradient levels. Alternative 3 may not be a permanent solution if the containment system fails since the contaminated source (sediment) remains on-site. Both of the Removal and Treatment alternatives (Alternatives 4 and 5) would result in permanent and long term effective solutions to the contamination problem at the site in that they both involve removal of the probable source of on-site groundwater contamination from the site and site containment to greatly reduce the potential for precipitation infiltration. Neither the No Action, the Limited Action nor the Containment Alternatives provide for the protection of the environment since the contamination would be left on-site in an untreated condition. Alternatives 4 and 5 would provide for protection of both the environment and the public health by removing the contaminated materials, and subsequently treating them to reduce the toxicity and mobility of the contaminants. Alternatives 3, 4 and 5 provide for building decontamination to allow for its future reuse.

4.3.2 Compliance With ARARs

None of the alternatives developed for this site will enable the direct achievement of chemical-specific ARARs identified for the groundwater because of the presence of upgradient groundwater contamination above the levels specified by these ARARs. Alternative 3 may allow for attainment of upgradient levels in the on-site groundwater by reducing the leaching of contaminants from sediments, but this could be a reversible process if the containment system should fail. Both of the Removal and Treatment alternatives will enable the attainment of the upgradient concentrations for groundwater by eliminating the sources of on-site contamination and utilizing groundwater-based soil cleanup limits, as presented in Appendix C, to determine

the actual extent of source removal. Alternatives 3, 4 and 5 will meet the action-specific ARARs during implementation.

4.3.3 Long-Term Effectiveness and Permanence

Alternatives 4 and 5 would provide for permanent removal of the contaminated sediment and treatment to either destroy or immobilize the contaminants. This activity would effectively eliminate the on-site contribution to the groundwater contamination. The No Action and Limited Action alternatives do not provide for a long term solution to the groundwater, sediment or building contamination problem. Alternative 3 may mitigate the leaching of contaminants from on-site sediment into groundwater but will require long-term maintenance and monitoring to ensure its effectiveness since the contaminated sediment is left on-site and the asphalt paving not be a permanent barrier to precipitation infiltration. Also, fluctuations in the water table elevation may cause some additional leaching of contaminants from soil directly above the average water table level.

4.3.4 Reduction of Toxicity, Mobility or Volume

The No Action and Limited Action alternatives do not include any additional measures other than natural long-term flushing to reduce the level of contamination in the groundwater. In the No Action and Limited Action Alternatives, groundwater concentrations could actually increase due to migration of contaminants from sediments into the groundwater. Alternative 3 - Containment allows for a reduction in the mobility of soil contaminants by providing a barrier to precipitation infiltration which is the primary cause of contaminant leaching from sediments into groundwater. Alternatives 4 and 5 would reduce the toxicity and mobility of the contaminants in the sediments by the application of in-situ vacuum extraction for volatiles removal, excavation of on-site contaminated material, and treatment and subsequent disposal of the waste material. On-site groundwater contaminant concentrations would become equivalent to upgradient concentrations once the sources of on-site contamination are removed.

4.3.5 Short-Term Effectiveness

Alternatives 1 and 2 require no major construction activities to be performed at the Circuitron Corporation Site and therefore do not present any risks to the community or workers resulting from work at the site. Alternative 3 involves standard on-site construction (asphalt paving) which will present minimal risk to workers and the public. The excavation and treatment alternatives (Alternatives 4 and 5) require excavation and handling of contaminated soil and sediment. Risks to the public and on-site

TABLE 4-1

SUMMARY COMPARISON OF ALTERNATIVES

Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Containment/Building Decontamination
Key Components	Groundwater monitoring, public awareness and education program, 5-year site reviews.	Groundwater monitoring, security fencing, public awareness, land use restrictions, 5-year site reviews	New asphalt pavement over entire site, fill-in storm drains and pave-over, building decontamination, groundwater monitoring and 5-year reviews, long-term inspection and maintenance program.
1) <u>Overall Protection of Human Health and the Environment</u>	There is no reduction in toxicity, mobility or volume of contaminants. Risk from contaminant migration is monitored but not reduced. Future exposure is not prevented	Same as Alternative 1. In addition, institutional controls will restrict site usage, and fencing will provide site access restrictions.	Contaminated soil/sediment remains on-site. Leaching of contaminants from soil/sediment into groundwater could be significantly reduced.
2) <u>Compliance With ARARS</u>	Chemical-specific ARARS may be attained over time, depending upon upgradient concentrations. Action-specific ARARS not applicable.	Same as Alternative 1.	Attainment of chemical-specific ARARS for groundwater could be hastened due to reduced leaching but is dependent upon upgradient concentrations. Action-specific ARARS will be complied with during implementation.
3) <u>Long-Term Effectiveness</u>			
o Magnitude of Residual Risks	Source has not been removed. Existing risk will remain. Future risk for groundwater greater due to contribution of on-site sources. Eventually natural attenuation and dilution may decrease risk, dependent upon upgradient conditions.	Same as Alternative 1.	Leaching of contaminants from soil/sediment into groundwater could resume if contaminant system fails (holes, cracks develop in asphalt). Water table fluctuations could cause some additional leaching. This alternative may not be a permanent solution.
o Adequacy of Controls	Public awareness and education program may reduce risk of contact with site. Requires 5-year site reviews.	Institutional Controls, fence, warning signs and public awareness program will minimize risk of direct contact with site. Requires 5-year site reviews.	Risks from contaminated soil/sediment remain if site is disturbed in future. The groundwater monitoring program will be used to evaluate effect on aquifer.

TABLE 4-1

SUMMARY COMPARISON OF ALTERNATIVES

Criteria	<u>Alternative 4</u> <u>Excavation/On-Site</u> <u>Stabilization/Site Containment</u>		<u>Alternative 5</u> <u>Excavation/Off-Site</u> <u>Incineration/Site Containment</u>	
	Key Components		Key Components	
1) <u>Overall Protection of Human Health and the Environment</u>	Excavation of source areas, stabilization and disposal, building decontamination, site containment		Excavation of source areas, transportation to off-site incineration and disposal, building decontamination, site containment	
	This alternative would achieve overall protection of human health and the environment. It would reduce the toxicity and mobility of contaminants and reduce the volume at the site. Upgradient contamination is monitored.		Same as Alternative 4.	
2) <u>Compliance With ARARS</u>	Attainment of chemical-specific groundwater ARARS will be hastened by source removal, dependent upon upgradient concentrations. Action-Specific ARARS will be complied with during implementation.		Same as Alternative 4.	
3) <u>Long-Term Effectiveness</u>	Risk from contaminants in sediment would be reduced significantly due to excavation/removal. Groundwater contamination would be the result of upgradient sources.		Same as Alternative 4.	
o Magnitude of Residual Risks				
o Adequacy of Controls	Risk of direct contact with contaminated material on-site is eliminated. Groundwater monitoring to evaluate effect on aquifer.		Same as Alternative 4.	

TABLE 4-1 (Cont'd)

SUMMARY COMPARISON OF ALTERNATIVES

Criteria	Alternative 1			Alternative 2		Alternative 3	
	No Action			Limited Action		Containment	
o Reliability of Controls	These measures are not fully protective and do not guarantee site risk reduction.			Fence, warning signs and monitoring wells susceptible to vandalism; periodic inspection and repair is necessary. These measures provide a greater degree of protection than Alternative 1.		If properly maintained, asphalt paving could be effective at reducing leaching from precipitation infiltration. Groundwater monitoring is effective for evaluating performance of this contaminant alternative.	
4) <u>Reduction of Mobility, Toxicity or Volume</u>	No contaminant treatment or disposal. Groundwater flow and leaching will gradually reduce contaminant volume in subsurface soil. Toxicity levels will eventually equal upgradient conditions.			Same as Alternative 1.		Reduction in mobility of soil/sediment contaminants but no reduction in toxicity or volume. Groundwater contaminants would reach upgradient TMV levels.	
5) <u>Short-term Effectiveness</u>							
o Protection of Community During Remedial Actions	Risk to community not increased. No protection required.			Same as Alternative 1.		Little or no risk to community from paving or building decontamination activities, no protection required other than restricting site access.	
o Protection of workers during remedial actions	No significant risk. Protection required against direct contact during site reviews.			Same as Alternative 1. Protection required for fence installation and groundwater monitoring.		Protection against dust inhalation during building decontamination standard safe construction practices enforced with training for hazardous waste site work.	
o Environmental impacts	Continued impact from existing conditions.			Same as Alternative 1.		Some increase in traffic/noise due to on-site construction.	
o Time for implementation of remedial action	Development of groundwater monitoring and public education programs may be accomplished within 1-2 months. Site reviews to occur every 5 years for a period of 30 years.			Installation of fence and warning signs may be accomplished within 2-3 months. Institutional controls may also be performed within that time. Other portions same as Alternative 1.		Repavement and building decontamination expected to require 6 to 12 months including engineering, procurement and site work.	

TABLE 4-1 (Cont'd)

SUMMARY COMPARISON OF ALTERNATIVES

Criteria	Alternative 4 Excavation/On-Site Stabilization/Site Containment		Alternative 5 Excavation/Off-Site Incineration/Site Containment	
o Reliability of Controls	Stabilization technologies are reliable and proven. Long-term leaching potential of stabilized soil is minimal.		Incineration technologies are reliable and proven. Metals contained in incinerator residue may need to be stabilized.	
4) <u>Reduction of Mobility, Toxicity or Volume</u>	Removal of contaminated sediments from leach structures. Stabilization reduces the mobility and toxicity of contaminants. Volume of stabilized material will increase.		Same as Alternative 4, except for incineration will destroy the organic contaminants of sediments. Ash may need to be stabilized to prevent leaching of inorganics.	
5) <u>Short-term Effectiveness</u>				
o Protection of Community During Remedial Actions	Temporary increase in dust production through site activities, contaminated sediments stabilized on-site.		Same as Alternative 4.	
o Protection of workers during remedial actions	Protection required against dermal contact and inhalation of dust during construction.		Same as Alternative 4.	
o Environmental impacts	Increase in traffic, noise and dust due to construction and on-site stabilization activities.		Same as Alternative 4. Potential air quality impacts due to incineration at off-site facility.	
o Time for implementation of remedial action	The overall remediation period will require 12-18 months, including engineering, procurement and site work.		The overall remediation period will require approximately 18-24 months.	

TABLE 4-1 (Cont'd)

SUMMARY COMPARISON OF ALTERNATIVES

Criteria	Alternative 1 No Action	Alternative 2 Limited Action	Alternative 3 Containment
6) <u>Implementability</u>			
o Technical Feasibility	No construction or treatment technology involved. If site status reviews determine that more action is necessary, implementation of additional remedial measures is easily accomplished.	Installation of fence and warning signs is easily accomplished. Groundwater monitoring is highly reliable. Long-term monitoring will be required. Implementation of additional remedial measures is easily accomplished, if required.	Repaving would utilize conventional equipment and methods. Long-term effectiveness of asphalt pavement as containment requires inspection, maintenance and monitoring. Building decon would utilize standard industrial methods adapted for hazardous materials. Groundwater monitoring is highly reliable.
o Administrative Feasibility	Coordination required with various agencies for long period of time for reviewing the site and developing public education program.	Same as Alternative 1. More coordination required due to groundwater monitoring, institutional controls, and periodic inspection of the fence.	Extensive long-term institutional management of inspection and maintenance program as well as groundwater monitoring and 5-year reviews. Restrictions on future site activity (excavation) require controls as well as groundwater monitoring and 5-year reviews.
o Availability of Services and Materials	All facilities and materials required for implementation are readily available locally.	Same as Alternative 1	Standard construction techniques are utilized. Multiple contractors are available for this work. Off-site treatment/disposal capacity available for building dust.
7) <u>Costs</u>			
o Total Construction Cost	\$128,250	\$160,245	\$221,117
o Annual Operation And Maintenance Cost	\$ 22,920	\$ 22,920	\$ 26,525
o Present Worth (based on 5% discount rate and 30 years period)	\$508,408	\$540,403	\$656,695

TABLE 4-1 (Cont'd)

SUMMARY COMPARISON OF ALTERNATIVES

<u>Criteria</u>	<u>Alternative 4</u>		<u>Alternative 5</u>	
	<u>Excavation/On-Site</u>	<u>Stabilization/Off-Site</u>	<u>Excavation/On-Site</u>	<u>Stabilization/Off-Site</u>
6) <u>Implementability</u>				
o <u>Technical Feasibility</u>	Conventional earthworking equipment required for excavation of sediment and paving of site. Stabilization technologies are highly reliable, but the long term effect of stabilized soil is unknown. No additional site reviews are required.		Same as Alternative 4 applied to incineration.	
o <u>Administrative Feasibility</u>	Permits for transportation, treatment and disposal would be obtained by Contractor.		Same as Alternative 4.	
o <u>Availability of Services and Materials</u>	Standard construction techniques are utilized. Contractors available for performance of entire project or smaller portions.		Same as Alternative 4. Off-site incineration facilities and disposal capacities are available	
7) <u>Costs</u>				
o <u>Total Construction Cost:</u>	\$514,760		\$577,340	
o <u>Annual Operation And Maintenance Cost</u>	\$ 3,850		\$ 3,850	
o <u>Present Worth (based on 5% discount rate and 30 years period)</u>	\$573,945		\$ 636,525	

workers from volatile emissions during excavation will be mitigated by the prior application of in-situ vacuum extraction. Alternatives 3, 4 and 5 also involve the removal of contaminated building dust for treatment and disposal. Proper procedures and construction techniques will be utilized both at the Circuitron Corporation site and at the treatment and disposal facilities to minimize the short-term risks to the nearby public and workers from fugitive dust and any treatment process emissions.

4.3.6 Implementability

o Technical Feasibility

Alternatives 1 and 2 involve minimal on-site activities; fence installation and groundwater monitoring in Alternative 2 are easily implemented. Alternative 3 includes more on-site activity in order to repave the site and decontaminate the building but this involves standard construction methods which are easily implementable. Alternatives 4 and 5 involve on-site excavation and removal activities which should be readily implementable. Alternatives 4 and 5 also involve treatment and disposal using commercially available stabilization equipment and processes, incineration and landfill facilities.

o Administrative Feasibility

Alternative 1 requires administrative coordination of public awareness and groundwater monitoring programs and five-year reviews. Alternative 2 requires more extensive administration coordination for the above activities as well as site access and use controls. Alternative 3 requires even more extensive long-term institutional management of an inspection and maintenance program for the contaminant system, as well as the activities in Alternative 1. Alternatives 4 and 5 require controls during site remediation activities, and also for obtaining permits for the transportation of hazardous waste.

o Availability of Services and Materials

All services and materials required to conduct the limited activities in Alternatives 1 and 2 are available. Standard construction equipment and techniques can be utilized for the repaving in Alternative 3 and the excavation/removal activities in Alternatives 4 and 5 although proper health and safety procedures for work on a hazardous waste site will be implemented. Off-site locations for incineration/ disposal facilities are available and although capacity is somewhat limited, it should not be a problem for the minor volume of material, 53 cubic yards, to be generated at this site. Building decontamination services required in Alternatives 3, 4 and 5 are readily available.

4.3.7 Cost

Cost estimates were calculated for each of the 5 alternatives. This data is presented in Appendix B of this report. Present worth estimated costs for each of the 5 alternatives, based on an interest rate of 5%, and 30 year time interval, are as follows:

- o Alternative 1 - \$508,408
- o Alternative 2 - \$540,403
- o Alternative 3 - \$653,695
- o Alternative 4 - \$573,945
- o Alternative 5 - \$636,525

These cost estimates do not include any allowance for the additional groundwater investigation of upgradient contamination. The detailed scope of this investigation is not addressed in the Feasibility Study Report for the Circuitron Corporation Site. The capital costs for each alternative do contain an estimate for removal of 300 drums of remedial investigation wastes from the site.

5.0 REFERENCES

- Ebasco Services Inc. (Ebasco), 1989; "Final Remedial Investigation/Feasibility Study Work Plan, Circuitron Corporation Site", report prepared for USEPA.
- Ebasco Services Inc. (Ebasco), 1990; "Draft Remedial Investigation Report, Circuitron Corporation Site; report prepared for USEPA.
- Suffolk County Department of Health Services (SCHDS), 1984; "SCD #5-Order of Consent", No. IW84-46.
- Suffolk County Department of Health Services (SCHDS), 1985; "SCD #5-Finding of Fact, Stipulated Agreement on the Record Order", DHS #IW0885.
- U.S. Environmental Protection Agency (USEPA), 1985a; "Guidance on Feasibility Studies Under CERCLA"; EPA/540/G-85/003.
- U.S. Environmental Protection Agency (USEPA), 1985b; "Handbook of Remedial Action at Waste Disposal Sites", (Revised); EPA/625/6-85/006.
- U.S. Environmental Protection Agency (USEPA), 1985c; "Guide for Decontaminating Buildings, Structures and Equipment at Superfund Sites"; EPA/600/2-85/028.
- U.S. Environmental Protection Agency (USEPA), 1988a; "Technology Screening Guide for Treatment of CERCLA Soils and Sludges"; EPA/540/2-88/004.
- U.S. Environmental Protection Agency (USEPA), 1988b; "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA", Interim Final, OSWER Dir. 9355.3-01.
- U.S. Environmental Protection Agency (USEPA), 1989a; "Analytical Report-Planned Remedial Action", TAT-02-F-05483, Contr. No. 68-01-7367.
- U.S. Environmental Protection Agency (USEPA), 1989b; "Sampling Plan for Removal Operations at Circuitron Corporation", report prepared by TAT Weston and ERCS-O.H. Materials.
- U.S. Environmental Protection Agency (USEPA), 1990; "On-Scene Coordinator's Report - Removal Action, Circuitron", report prepared by the USEPA Emergency and Remedial Response Division, and the USEPA TAT - Roy F. Weston, Inc.

APPENDIX A

BREAKDOWN OF MAJOR FACILITIES AND
CONSTRUCTION COMPONENTS FOR REMEDIAL ALTERNATIVES

TABLE A-1

ALTERNATIVE 1: NO ACTION

MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

<u>FACILITY/CONSTRUCTION</u>	<u>ESTIMATED QUANTITIES</u>	<u>DESCRIPTION</u>
I. GROUNDWATER MONITORING PROGRAM	5 wells	Develop and perform a groundwater monitoring program consisting of sampling 5 shallow wells.
II. PUBLIC AWARENESS PROGRAM	L.S.	Hold public meetings, prepare handouts for neighboring community, prepare press releases.

TABLE A-2
 ALTERNATIVE 2: LIMITED ACTION
 MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	DESCRIPTION
I. SECURITY FENCE		
1. Perimeter Fence	820 ft	8 ft high chain link fence with triple-stand barbed wire top
2. Gate	1	20 ft wide, 8 ft high, double frame
3. Warning Signs	8	2 ft x 3 ft PVC signs posted on perimeter fence
II. INSTITUTIONAL CONTROLS	L.S.	Establish land use and groundwater use restrictions
III. GROUNDWATER MONITORING PROGRAM	5 wells	Develop and perform a groundwater monitoring program consisting of sampling 5 shallow wells.
IV. PUBLIC AWARENESS PROGRAM	L.S.	Hold public meetings, prepare handouts for neighboring community, prepare press releases.

TABLE A-3
 ALTERNATIVE 3: CONTAINMENT/BUILDING DECONTAMINATION
 MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	DESCRIPTION
I. GROUNDWATER MONITORING PROGRAM	(As described in Table A-1)	
II. SITE CONTAINMENT		
1. Repave entire site	1,740 sy	An asphalt cap of 2" thickness will be placed over all the exterior areas of the site to prevent infiltration of stormwater runoff. The storm drains will also be paved over.
2. Cover Plating Room floor	4,000 sf	The plating room will be covered with a 2" thick layer of concrete to prevent contact with the contaminated portion of the floor.
III. BUILDING DECONTAMINATION	5 cy	The dust from the interior surfaces of the building will be vacuumed and removed, and disposed of.

TABLE A-4

ALTERNATIVE 4: EXCAVATION OF SEDIMENTS/ON-SITE STABILIZATION AND DISPOSAL/SITE CONTAINMENT

MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	DESCRIPTION
I. SUPPORT FACILITIES		
1. Office Trailer	1 ea	Lease for 1 year Contractor office available for EPA, NYSDEC and Engineering use Size: 30 ft L x 7.5 ft x 7 ft H
2. Decontamination Trailer	1 ea	Lease for 1 year Health & Safety trailer with shower facilities Size: 30 ft L x 7.5 ft x 7 ft H
II. DECONTAMINATION AND DEMOLITION WITHIN BUILDING		
1. Remove dust from building via vacuuming & dispose of dust with contaminated soil	5 cy	Building is approximately 135 ft x 190 ft x 10 ft frame building with concrete floor divided into five main rooms
2. Demolish and remove concrete	1 ea	Plating room concrete floor approximately 40 ft x 100 ft x 6 in. to yield approximately 80 cy.
III. IN-SITU VACUUM EXTRACTION	1 ea	Utilize in-situ vacuum extraction in area of SD-3/MW-4 for removal and treatment of high levels of volatile organic compounds prior to sediment removal.
IV. CONTAMINATED/SEDIMENT EXCAVATION		
1. Area below plating room floor	7 cy	5 areas of contaminated sediments below removed area of concrete floor in plating room to be located and excavated. Any other material contained in soil, such as piping or drums, to be left in place.
2. SD-1, SD-2, SD-3	3 cy	Storm drain grates to be removed and contaminated sediments contained within the concrete structure are to be removed via hand excavation.

TABLE A-4 (Cont'd)

ALTERNATIVE 4: EXCAVATION/ON-SITE STABILIZATION AND DISPOSAL/SITE CONTAINMENT

MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	DESCRIPTION
3. Cesspools CP-1 and CP-2	10 cy	Asphalt covering of cesspool manhole entrances to be removed and contaminated sediments from within the structure to be removed via hand excavation.
4. Leaching Pools LP-1, LP-2 and LP-7.	18 cy	Access to these structures to be located and uncovered. Sediments from within the structures to be excavated.
V. ON-SITE STABILIZATION		
1. On -Site Stabilization	53 cy 79.5 tons	Stabilization including building dust, to be performed on-site, includes testing and mobilization of equipment.
2. Disposal of Stabilized Soil	106cy	Disposal of stabilized soil on-site; stabilization to result in 100 percent volume increase.
VI. BACKFILL		
1. BACKFILL	254 cy	Backfill underground structures with clean fill/soil and compact.
VII. OFF-SITE DISPOSAL OF NON-HAZARDOUS ASPHALT & CONCRETE		
1. Transportation	80 cy	Truck transportation to off-site facility (non-hazardous).
2. Disposal	80 cy (160 tons)	Disposal of demolished concrete and asphalt pavement in off-site facility (non-hazardous).

TABLE A-4 (Cont'd)

ALTERNATIVE 4: EXCAVATION/ON-SITE STABILIZATION AND DISPOSAL/SITE CONTAINMENT

MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

<u>FACILITY/CONSTRUCTION</u>	<u>ESTIMATED QUANTITIES</u>	<u>DESCRIPTION</u>
VIII. REINSTALL CONCRETE FLOOR IN PLATING ROOM	4,000 sf 80 cy	Installation of new concrete flooring in plating room: 40 ft x 100 ft x 6 in thick
IX. Site Containment		An asphalt cap of 2" thickness will be placed over the entire area of the site to prevent infiltration of stormwater runoff.
1. Repave entire site	1,740 sy	All storm drains, catch basins, and other underground structures will be sealed and runoff will be directed into the street.

TABLE A-5

ALTERNATIVE 5: EXCAVATION OF SEDIMENTS/OFF-SITE INCINERATION/OFF-SITE DISPOSAL/SITE CONTAINMENT

MAJOR FACILITIES AND CONSTRUCTION COMPONENTS

<u>FACILITY/CONSTRUCTION</u>	<u>ESTIMATED QUANTITIES</u>	<u>DESCRIPTION</u>
ITEMS I. THROUGH IV. - SAME AS ALTERNATIVE 4, TABLE A-4		
VI. TRANSPORTATION	53 cy 79.5 tons	Truck transportation of excavated sediment to off-site incineration facility approximately 1000 miles from site.
VII. OFF-SITE INCINERATION		
1. Incineration	53 cy	Off-site incineration at RCRA permitted facility including testing, monitoring and secondary waste management
2. Disposal	53 cy	Disposal of treated incinerated soil including stabilization of flyash, if required, in an off-site facility

ITEMS VIII THROUGH XI - SAME AS ALTERNATIVE 4 ITEMS VI THROUGH IX, TABLE A-4

APPENDIX B

DETAILED BREAKDOWN OF ESTIMATES FOR
CAPITAL COST AND OPERATING AND MAINTENANCE EXPENSES

TABLE B-1

ALTERNATIVE 1: NO ACTION

CAPITAL COST ESTIMATES (1991 DOLLARS)

<u>FACILITY/CONSTRUCTION</u>	<u>ESTIMATED QUANTITIES</u>	<u>MATERIAL. \$</u>		<u>INSTALLATION \$</u>		<u>DIRECT COST \$</u>
		<u>UNIT PRICE</u>	<u>COST</u>	<u>UNIT PRICE</u>	<u>COST</u>	
I. PUBLIC AWARENESS PROGRAM	L.S.	Incl.			5,000	5,000
II. DRUM DISPOSAL	300 Drums	Incl.		300	90,000	90,000
		Total Direct Cost (TDC)			95,000	
		Contingency @ 20% of TDC			19,000	
		Planning/Preparation @ 10% of TDC			9,500	
		Legal and Administrative @ 5% of TDC			<u>4,750</u>	
		Total Construction Cost			128,250	

TABLE 8-2

ALTERNATIVE 2: LIMITED ACTION

CAPITAL COST ESTIMATES (1991 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL. \$		INSTALLATION \$		DIRECT COST \$
		UNIT PRICE	COST	UNIT PRICE	COST	
I. ACCESS RESTRICTIONS						
1. Fence	820 L.F.	Incl.		20.00	16,000	16,000
2. Gate	1	Incl.		2,500	2,500	2,500
3. Warning Signs	8	Incl.		25.00	200	200
II. INSTITUTIONAL CONTROLS	L.S.	Incl.			5,000	5,000
III. PUBLIC AWARENESS PROGRAM	L.S.	Incl.			5,000	5,000
IV. DRUM DISPOSAL	300 Drums	Incl.		300	90,000	90,000
Total Direct Cost (TDC)						118,700
Contingency @ 20% of TDC						23,740
Planning/Preparation @ 10% of TDC						11,870
Legal and Administrative @ 5% of TDC						<u>5,935</u>
Total Construction Cost						160,245

TABLE B-3

ALTERNATIVE 3: CONTAINMENT/BUILDING DECONTAMINATION

CAPITAL COST ESTIMATES (1991 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL \$		INSTALLATION \$		DIRECT COST \$
		UNIT PRICE	COST	UNIT PRICE	COST	
I. SUPPORT FACILITIES						
1. Office Trailer (and utilities)	1	25,000	25,000	Incl.		25,000
II. SITE CONTAINMENT						
1. Repave entire site	1740 sy	Incl.		20.00	34,800	34,800
2. Cover plating room floor	26 cy	125	3,250	190	4,940	8,190
III. BUILDING DECONTAMINATION						
1. Vacuum Interior	80 hrs	Incl.		35.00	2,800	2,800
2. Transportation of Dust Assume 1 cy dust = 1 ton Assume 1 load	5 tons 400 miles	Incl.		4.00/mi/load	1,600	1,600
3. Stabilization/Disposal	5 tons	Incl.		280	1,400	1,400
IV. DRUM DISPOSAL	300 Drums	Incl.		300	90,000	90,000
	Total Direct Cost (TDC)				163,790	
	Contingency @ 20% of TDC				32,758	
	Engineering @ 10% of TDC				16,379	
	Legal and Administrative @ 5% of TDC				<u>8,190</u>	
	Total Construction Cost (\$)				221,117	

Key

sy = square yards
cy = cubic yards

TABLE B-4

ALTERNATIVE 4: EXCAVATION ON-SITE STABILIZATION AND DISPOSAL/SITE CONTAINMENT

CAPITAL COST ESTIMATES (1991 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, \$		INSTALLATION \$		DIRECT COST \$
		UNIT PRICE	COST	UNIT PRICE	COST	
I. SUPPORT FACILITIES						
1. Office Trailer (and utilities)	1	25,000	25,000	Incl.		25,000
2. Decon Trailer (and utilities)	1	100,000	100,000	Incl.		100,000
3. Equipment Mobilization	L.S.	Incl.		25,000		25,000
II. BUILDING DECONTAMINATION						
1. Vacuum Interior	80 hrs	Incl.		35.00	2,800	2,800
2. Demolish and Remove Concrete	80 cy	Incl.		190	15,200	15,200
3. Concrete Disposal	80 cy	Incl.		80.00	6,400	6,400
III. IN-SITU VACUUM EXTRACTION						
1. Perform in-situ vacuum extraction in area of SD-3/MM-4	370 cy	Incl.		21.00	7,770	7,770
IV. SEDIMENT EXCAVATION						
1. Area below plating room floor	7 cy	Incl.		80.00	560	560
*2. Area of SD-1, SD-2 and SD-3	3 cy	Incl.		80.00	240	240
*3. Area of CP-1, CP-2	10 cy	Incl.		80.00	800	800
*4. Areas of LP-1, -2, and -7	18 cy	Incl.		80.00	1,440	1,440

* Note: Items IV.4 through IV.4 include asphalt removal costs, as described in Table A-4.

ALTERNATIVE 4: EXCAVATION OF SEDIMENTS/ON-SITE STABILIZATION AND DISPOSAL/SITE CONTAINMENT

CAPITAL COST ESTIMATES (1991 DOLLARS)						
FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL. \$		INSTALLATION \$		DIRECT COST \$
		UNIT PRICE	COST	UNIT PRICE	COST	
V. ON-SITE STABILIZATION						
1. Stabilization	79.5 tons(1)	Incl.		500	39,750	39,750
2. Disposal (included in above)						
VI. BACKFILL						
1. Backfill/Compaction	254 cy	15.00	3,810	10.00	2,540	6,350
VII. REPLACE CONCRETE FLOOR IN PLATING ROOM						
1. Replace Concrete Floor	80 cy	125	10,000	190	15,200	25,200
VIII. SITE CONTAINMENT						
1. Repave entire site	1740 sy	Incl.		20.00	34,800	34,800
IX. DRUM DISPOSAL						
	300 Drums	Incl.		300	90,000	90,000
Total Direct Cost (TDC)						381,310
Contingency @ 20% of TDC						76,260
Engineering @ 10% of TDC						38,130
Legal and Administrative @ 5% of TDC						<u>19,060</u>
Total Construction Cost (\$)						514,760

sf = square feet
cy = cubic yards
sy = square yards

Note (1) 53 cy x 1.5 ton/cy = 79.5 tons
Includes 5 cy of building dust.

TABLE B-5

ALTERNATIVE 5: EXCAVATION/OFF-SITE INCINERATION/OFF-SITE DISPOSAL/BUILDING DECONTAMINATION

CAPITAL COST ESTIMATES (1991 DOLLARS)

FACILITY/CONSTRUCTION	ESTIMATED QUANTITIES	MATERIAL, \$		INSTALLATION \$		DIRECT COST \$
		UNIT PRICE	COST	UNIT PRICE	COST	
ITEMS I-IV - SAME AS ALTERNATIVE 4, TABLE B-4						
V. TRANSPORTATION FOR OFF-SITE INCINERATION TO SAUGET, IL	4 loads 1,000 miles	Incl.		Incl.		136,060
Estimate 1,000 miles Load = 22 tons 53 cy x 1.5 ton/cy = 79.5 tons 79.5 tons/22 tons per load = 4 loads		Incl.		4.00/mi/load	16,000	16,000
VI. OFF-SITE INCINERATION						
1. Incineration	79.5 tons	Incl.		1,500		119,250
2. Disposal (Incl. with Incin.)						
ITEMS VII - X SAME AS ALTERNATIVE 4, TABLE B-4, ITEMS VI - IX						
		Incl.		Incl.		156,350
Total Direct Cost (TDC)						
						427,660
Contingency @ 20% of TDC						85,530
Engineering @ 10% of TDC						42,770
Legal and Administrative @ 5% of TDC						<u>21,380</u>
Total Construction Cost (\$)						577,340

TABLE B-6

ALTERNATIVE 1 - NO ACTION
ANNUAL OPERATING AND MAINTENANCE EXPENSE ESTIMATES (1991 DOLLARS)

<u>COST COMPONENT</u>	<u>BASIS OF ESTIMATE</u>	<u>O&M EXPENSE ESTIMATE(\$)</u>	<u>YEARS APPLICABLE</u>
1. Groundwater Monitoring			
a. Site visit, Sampling and Report	1 person \$60 /hr 48 hrs/yr	2,880	1-30
b. Laboratory Analysis	16 water samples \$1,000/sample	16,000	1-30
c. Analytical Report	1 person \$60 /hr 48 hrs/yr	2,880	1-30
	SUBTOTAL	21,760	1-30
2. Public Information Requests	1 person \$60 /hr 24 hrs/yr	1,440	1-30
3. Contingency: 5% of O&M Expense		1,160	1-30
	TOTAL ANNUAL EXPENSE:	22,920	1-30

Comment:

A review once every 5 years for a period of 30 years estimated to cost \$10,000 is included as part of the present worth analysis.

TABLE B-7

ALTERNATIVE 2 - LIMITED ACTION
ANNUAL OPERATING AND MAINTENANCE EXPENSE ESTIMATES (1991 DOLLARS)

<u>COST COMPONENT</u>	<u>BASIS OF ESTIMATE</u>	<u>O&M EXPENSE ESTIMATE(\$)</u>	<u>YEARS APPLICABLE</u>
1. Groundwater Monitoring			
a. Site visit, Sampling and Report	1 person \$60 /hr 48 hrs/yr	2,880	1-30
b. Laboratory Analysis	16 water samples \$1,000/sample	16,000	1-30
c. Analytical Report	1 person \$60 /hr 48 hrs/yr	2,880	1-30
	SUBTOTAL	21,760	1-30
2. Public Information Requests	1 person \$60*/hr 24 hrs/yr	1,440	1-30
3. Contingency: 5% of O&M Expense		1,160	1-30
	TOTAL ANNUAL EXPENSE:	22,920	1-30

Comment:

A review once every 5 years for a period of 30 years estimated to cost \$10,000 is included as part of the present worth analysis.

TABLE B-8

ALTERNATIVE 3 - CONTAINMENT/BUILDING DECONTAMINATION
 ANNUAL OPERATING AND MAINTENANCE EXPENSE ESTIMATES (1991 DOLLARS)

<u>COST COMPONENT</u>	<u>BASIS OF ESTIMATE</u>	<u>O&M EXPENSE ESTIMATE(\$)</u>	<u>YEARS APPLICABLE</u>
1. Groundwater Monitoring			
a. Site visit, Sampling and Report	1 person \$60 /hr 48 hrs/yr	2,880	1-30
b. Laboratory Analysis	16 water samples \$1,000/sample	16,000	1-30
c. Analytical Report	1 person \$60 /hr 48 hrs/yr	2,880	1-30
	SUBTOTAL	21,760	1-30
2. Cap Maintenance	10% of Capital Cost	3,500	1-30
3. Contingency: 5% of O&M Expense		1,265	1-30
	TOTAL ANNUAL EXPENSE:	26,525	1-30

Comment:

A review once every 5 years for a period of 30 years estimated to cost \$10,000 is included as part of the present worth analysis.

TABLE B-9

ALTERNATIVE 4 - EXCAVATION/ON-SITE STABILIZATION/SITE CONTAINMENT
ANNUAL OPERATING AND MAINTENANCE EXPENSE ESTIMATES (1991 DOLLARS)

<u>COST COMPONENT</u>	<u>BASIS OF ESTIMATE</u>	<u>O&M EXPENSE ESTIMATE(\$)</u>	<u>YEARS APPLICABLE</u>
1. Cap Maintenance	10% of Capital Cost	3,500	1-30
2. Contingency:	10% of O&M Expense	350	1-30
TOTAL ANNUAL EXPENSE:		3,850	1-30

TABLE B-10

ALTERNATIVE 5 - EXCAVATION/OFF-SITE INCINERATION/SITE CONTAINMENT
ANNUAL OPERATING AND MAINTENANCE EXPENSE ESTIMATES (1991 DOLLARS)

<u>COST COMPONENT</u>	<u>BASIS OF ESTIMATE</u>	<u>O&M EXPENSE ESTIMATE(\$)</u>	<u>YEARS APPLICABLE</u>
1. Cap Maintenance	10% of Capital Cost	3,500	1-30
2. Contingency:	10% of O&M Expense	350	1-30
TOTAL ANNUAL EXPENSE:		3,850	1-30

APPENDIX C
SOIL CLEAN-UP LEVELS
BASED ON GROUNDWATER ARARS

APPENDIX C

CIRCUITRON CORPORATION SITE SOIL/SEDIMENT CLEAN-UP LEVELS

Soil clean-up levels were calculated for selected organic and inorganic compounds that were chosen by USEPA as potential hazards, and were determined to be contaminants of concern as presented earlier in this Feasibility Study report. These goals were identified utilizing the MULTIMED groundwater model, run by USEPA, which uses the soil partition coefficients of compounds, the precipitation infiltration rate, and the desired resultant groundwater concentration of the compounds to calculate the allowable soil concentration of the compounds which will cause acceptable groundwater concentrations due to leaching.

As shown on Table C-1, calculations were performed for various infiltration rates, and soil clean-up levels determined. An infiltration rate of 35 percent was selected to identify the soil clean-up levels at the Circuitron Corporation Site. This rate is conservative because the entire site will be covered with an impervious layer of asphalt paving to prevent such infiltration, and the MULTIMED model was used to calculate the post-containment clean-up levels. The maximum contaminant levels (MCLs) for groundwater were chosen as the resultant groundwater concentrations for the selected compounds. In addition, these clean-up levels are based on chosen groundwater concentrations at the nearest possible receptor point, which is approximately 1,500 feet away from the site.

These clean-up levels were applied to the conditions present within the site soils and sediments, and it was determined that the sediments contained within the underground structures are contaminated with levels of copper above these limits, therefore the sediments must be subjected to remedial action.

TABLE C-1

CIRCUITRON CORPORATION
Soil/Sediment Clean-up Levels

Infiltration rates*
(% of annual rainfall)

ORGANICS

Component	5%	10%	15%	20%	35%
1,1 Dichloroethane	283	144	95	72	41
1,1 Dichloroethene	2170	1104	731	552	311
TCA	5076	2583	1711	1291	728
Tetrachloroethene	12156	6186	4098	3093	1745
TCE	4207	2141	1418	1071	604
Benzene	783	398	264	199	112

INORGANICS

Copper	132,000	67,000	45,000	34,000	19,000
Cadmium	190	96	64	48	27
Mercury	58	30	20	15	8

PHTHALATES
(X E +6)

Bis (2-ethyl hexyl) phthalate	15.	8.	5.	4.	2.
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* Average annual rainfall - 44 inches

All concentrations for organics reported in parts per billion (ppb)

All concentrations for inorganics and phthalates reported in parts per million (ppm)

MCLs for all organics 5ppb

MCL for Copper 1.3 ppm

MCL for Cadmium 0.010 ppm

MCL for Mercury 0.002 ppm

MCL for Bis(2-ethylhexyl)phthalate 0.0042 ppm

APPENDIX D
PRESENTATION OF AIR EMISSIONS

APPENDIX D

CIRCUITRON CORPORATION SITE PRESENTATION OF AIR EMISSIONS

Potential air emissions which could be expected during soil/sediment handling and paving activities at the Circuitron Corporation Site were calculated using guidance found in the USEPA documents "National Technical Guidance Study Series Volume III - Estimation of Air Emissions from Cleanup Activities at Superfund Sites" and "Compilation of Air Emission Factors Volume I: Stationary Point and the Area Sources". Estimated emissions for particulate matter and volatile organic compounds were quantified. The estimated emissions apply to Alternatives 3, 4, and 5, where soil and sediment excavation, stabilization, and paving is proposed. A summary of emission rates by hour and 8 hour workday is presented in Table 1 along with total emissions expected during the remedial effort.

This discussion does not address the emissions associated with off-site incineration of contaminated sediments, as presented in Alternative 5 of this Feasibility Study Report.

The analysis revealed that approximately 2.4 kg of particulate matter would be released during excavation activities, of which approximately 0.5 kg would be particulate matter <15 um in diameter. VOC emissions during excavation would be somewhat greater. The greatest source of potential VOC emissions would occur during paving activities in Alternative 3, 4, 5 where 9570 kg of VOC's would be released as the cutback asphalt diluent evaporates. This source of VOC's could be greatly minimized and nearly eliminated by the use of emulsified asphalts or asphalt cement, which release only minor amounts of VOC's (USEPA, 1985).

A search of the literature for emissions which would occur during vacuuming of the walls did not reveal any useful data. However, the amount of dust to be vacuumed is small (5 yds³). Further, vacuuming involves a negative pressure process, and little, if any, fugitive emissions would be expected.

The New York State Air Pollution control regulations (Parts 212-257) were reviewed to determine applicability to potential emissions during remedial activities at the Circuitron Superfund site. Parts 212, 218 and 257 addressed possible activities at the site.

Part 212 addresses process emission sources, which for this project would be the in-situ volatilization unit. This unit will be used on a limited basis on site in removing VOC's from soils with the greatest degree of contamination. Extracted compounds will be scrubbed via a vapor phase activated carbon bed, which will achieve a removal efficiency of 99%. Subpart 212.9 specifies the degree of air cleaning required for process emission sources in the New York City Metropolitan area. Assuming all emissions will have an environmental rating of "A", which is defined as "an air contaminant whose discharge results, or may result, in serious adverse affects on receptors or the environment", then a 99% removal efficiency is required. The in-situ volatilization unit will therefore be in compliance with Part 212.

Part 218, which addresses emissions from diesel engines, exempts construction activities under subsection 218.3(c) and therefore is not applicable to the project. Part 257 addresses ambient air quality standards. Potential emissions from this project would be in the form of particulates and VOC's (photochemical oxidants). Specific standards exist for these pollutants in the form of daily and hourly limits, respectively. These standards would apply to a specific receptor. Determining compliance with these standards would require continuous monitoring at offsite receptors. This type of monitoring would quantify pollutant levels at a receptor, but would not reveal the contribution to ambient levels from the Circuitron site since many other sources of these pollutants would be present in the area. Hourly or daily emission rates are not addressed by Part 257 of the code.

- I. EMISSIONS DURING EXCAVATION - A total of 50 yds³ will be excavated (3 yds³/day for 17 days)

A. PARTICULATE EMISSIONS

Site Conditions (Ebasco, 1990): Soil Moisture Content = 3%

Silt Content = 2.25%

1. Total suspended particulates <30 um

$$\text{Emission factor} = 2.6 (s)^{1.2} (M)^{-1.3} \text{ Kg/hr}$$

Where s = silt content (%)

M = moisture content (%)

$$\begin{aligned} \text{EF} &= 2.6 (2.25)^{1.2} (3)^{-1.3} \text{ Kg/hr} \\ &= 0.018 \text{ Kg/hr} \\ &= 0.14 \text{ Kg/8 hr day} \\ &= 2.38 \text{ Kg/17 days} \end{aligned}$$

2. Particulate matter <15 um

$$\begin{aligned} \text{EF} &= 0.45 (s)^{1.5} (M)^{-1.4} \text{ Kg/hr} \\ &= 0.004 \text{ Kg/hr} \\ &= 0.03 \text{ Kg/8 hr day} \\ &= 0.54 \text{ Kg/17 days} \end{aligned}$$

B. VOC EMISSIONS

1. Area and volume of soil pile (assume pile always 50 yds³):

Assume soil in pile is in hemispherical shape

$$\text{so: } V = \frac{2}{3} \pi r^3$$

$$50 \text{ yds}^3 = \frac{2}{3} \pi r^3$$

$$r = 2.9 \text{ yds}$$

$$\begin{aligned} \text{Area of hemisphere} &= \frac{1}{2} \pi D^2 \\ \text{Area of soil pile} &= 52.8 \text{ yds}^2 = 44.2 \text{ m}^2 \end{aligned}$$

2. Emissions

Emission Factor = $380 \text{ ug/m}^2\cdot\text{min}$

EF = $(380 \text{ ug/m}^2\cdot\text{min}) (63)$ (soil agitation factor for
dozer - conservative
assumption)

EF = $23940 \text{ ug/m}^2\cdot\text{min}$
or $0.024 \text{ g/m}^2\cdot\text{min}$

Soil will be exposed in soil pile for 8 hours per day.

Emission rate = (Emission factor)(surface area of soil
(time exposed) pile)
= $(0.024 \text{ g/m}^2\cdot\text{min}) (44.2\text{m}^2) (480 \text{ min})$
= 509.2 g/day

Total Emissions = 509.2 g/day X 17 days
= 8.7 Kg of VOC's

II. PARTICULATE EMISSIONS DURING STABILIZATION (CONCRETE BATCHING)

A. ALTERNATIVE 4 ONLY

Particulate emission factor = 0.31 Kg/metric ton

Stabilization to be performed after all soil excavated
(50 yds³)

Density of soil = 1.5 tons/yd³

Therefore:

$50 \text{ yd}^3 = 75 \text{ tons} = 68 \text{ metric tons}$

TOTAL PARTICULATE EMISSIONS = 68 metric tons X $\frac{0.31 \text{ Kg}}{\text{metric ton}}$ = 21.1 Kg

III. VOC EMISSIONS DURING ASPHALT PAVING

Assume:

Use of 35% rapid cure cutback asphalt (i.e. 35% diluent by volume), where 95% of diluent will evaporate within first 4 months.

Density of Asphalt:

Asphalt cement = 1.1 Kg/liter

Diluent = 0.7 Kg/liter

A. ALTERNATIVES 3-5

Area of 0.4 acres to be paved with 1" thick layer of asphalt.

(1 acre = 4840 yd²)

1936 yd² X .0278 yd = 53.8 yd³ of asphalt

(1 yd³ = 764.6 liters)

41,118 liters of asphalt

41,118 liters X .35 = 14,391 liters of diluent
(35% asphalt cutback)

(95% evaporates in first 4 months)

14,391 liters X .95 = 13,671 liters

13,671 liters X 0.7 Kg/liter = 9,570 Kg of VOC

- Sources: (1) USEPA, 1989. Air/Superfund National Technical Guidance Study Series Volume III - Estimation of Air Emissions From Cleanup Activities at Superfund Sites.
- (2) USEPA, 1985. Compilation of Air Emission Factors Volume I: Stationary Point and the Area Sources, Fourth Edition.
- (3) Ebasco, 1990. Circuitron Corporation Site. Site Remedial Investigation Report.

TABLE 1

SUMMARY OF ESTIMATED EMISSIONS
FROM REMEDIAL ACTIVITIES
AT CIRCUITRON CORPORATION SITE

<u>TYPE OF OPERATION</u>	<u>EMISSION RATE</u>		<u>TOTAL</u>
	<u>Kg/hour</u>	<u>Kg/8 hr day</u>	<u>EMISSIONS (Kg)</u>
<u>Soil Excavation</u>			
Volatile Organic Compounds	0.064	0.509	8.7
Total Suspended Particulates	0.018	0.14	2.4
Particulate Matter <15 um*	0.004	0.03	0.54
<u>Asphalt Paving</u>			
Volatile Organic Compounds**			
Alternative 3,4,5	-	-	9,570

* Amount of particulate matter <15 um as part of total suspended particulates.

** Short-term emission rates not provided since the greatest evaporation occurs initially and decreases with time.