New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

FEB 11 1994

Tribune Company NY Holding, Inc.
Chicago, IL 60609

Dear Sir/Madam:

DEC Site #130002
Site Name: Cerro Wire and Cable Company
Site address: Robbins Lane and Miller Road
Syosset, Nassau County, 11791

The 60 day notification period and inclusive 30 day public comment period have ended. These requirements were established for the proposed deletion of sites from the New York State Registry of Inactive Hazardous Waste Disposal Sites (the Registry).

No comments have been received. Therefore, the site has been deleted from the Registry effective with receipt of this letter.

Please refer questions to Ronald Lee, Project Manager, New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation, Bureau of Hazardous Waste Control, 50 Wolf Road, Albany, NY 12233-7010 or call (518) 457-0927.

Sincerely,

Robert L. Marino
Chief, Site-Control Section
Bureau of Hazardous Site Control
Div. of Hazardous Waste Remediation

bcc: R. Lee
R. Marino
R. Dana
A. Carlson
B. Bentley
L. Concra
A. Shah, RHWRE
G. Rider

CJ/pkp

RECEIVED
FEB 15 1994
...S WASTE REMEDIATION
...SDEC REGION 1

TRIBUNE NEW YORK HOLDINGS COMPANY

PETITION TO DELIST THE FORMER CERRO CONDUIT FACILITY

PROJECT #607-2E
MARCH 1993

EDER ASSOCIATES
CONSULTING ENGINEERS, P.C.
Locust Valley, New York
Madison, Wisconsin
Ann Arbor, Michigan
Augusta, Georgia
Jacksonville, Florida
Trenton, New Jersey

eder associates
consulting engineers, p. c.

OFFICES:
Locust Valley, NY
Madison, WI
Ann Arbor, MI
Augusta, GA

March 4, 1993
File #607-2E

Mr. Earl H. Barcomb, P.E.
Bureau of Hazardous Site Control
Division of Hazardous Waste Remediation
New York State Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12233

Re: Former Cerro Wire and Cable Facility
Syosset, New York

Dear Mr. Barcomb:

Tribune New York Holdings, Inc. (Tribune) is the owner of the former Cerro Wire and Cable facility (the site). The site is listed (#130002) as a Class 4 site on the New York State Department of Environmental Conservation (NYSDEC) Registry of Inactive Hazardous Waste Sites (the Registry). Tribune has retained Eder Associates Consulting Engineers, P.C. (Eder) to assist it to prepare this petition to delist the site from the Registry, and Eder submits this report on behalf of the Tribune. This petition is made pursuant to ECL§27-1305(4)(c)(1). The Tribune believes that this petition is justified, based on the following conclusions.

Soil

- In 1991, Eder performed a baseline risk assessment of the site which concluded that the site does not pose a significant public health risk under the current and future industrial use scenarios. Under the future residential use scenario, Eder's risk assessment determined that the respective target cleanup concentrations for copper and cyanide residuals in soil at the site are 5,200 mg/kg and 3,100 mg/kg. NYSDEC and New York State Department of Health (NYSDOH) have agreed to the risk assessment findings and the target cleanup concentrations. Extensive soil sampling conducted by Avendt Group, Inc. (AGI) and Eder showed that the residential target cleanup level for copper was exceeded at only five small areas. In December 1992, soil from these areas was excavated and disposed of in accordance with NYSDEC requirements. All of the post-excavation analytical results were below the residential use target cleanup level established in Eder's risk assessment.

Continued . . .

480 FOREST AVENUE, LOCUST VALLEY, NEW YORK 11560 • (516) 671-8440 • FAX (516) 671-3349

<u>Groundwater</u>

- Eight monitoring rounds between 1987 and 1992 show that groundwater beneath the former Cerro site has not been adversely affected by Cerro's activities. Moreover, Eder's September 1991 risk assessment concludes that the potential health risk associated with a hypothetical worst case groundwater ingestion exposure route was insignificant.

In summary, the site-specific soil and groundwater data base developed between 1986 and 1992, the results of Eder's 1991 baseline risk assessment, and the remedial work performed at the facility justify removing the Cerro site from the NYSDEC Registry of Inactive Hazardous Waste Sites.

This report summarizes the soil and groundwater investigation work conducted at the site and the baseline risk assessment results.

Please call me if you have any questions.

Very truly yours,

EDER ASSOCIATES CONSULTING ENGINEERS, P.C.

Nicholas A. Andrianas, P.E.
Vice President
Senior Environmental Engineer

NAA/llv
Attmt.

cc: A. Candela, P.E.
B. Knizek, P.E.
S. Bates
P.J. Sacripanti, Esq.
K. Archer, Esq.
J. Quinn
J. Scheid

EL3161

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1.0 SITE INFORMATION

1.1 Site Location

The approximately 40-acre site is on Robbins Lane, Syosset, New York, in an area characterized by light industrial, commercial, and residential land uses (Figure 1). The site is bordered by Robbins Lane to the west and the Long Island Expressway to the south. A Town of Oyster Bay maintenance facility and the inactive Syosset landfill border the property to the east, and the Long Island Railroad borders the property to the north. The site is listed (#130002) as a Class 4 site on the NYSDEC Registry of Inactive Hazardous Waste Disposal Sites. A Class 4 site indicates that the site has been properly closed, but requires continued management.

1.2 Site History

The site was reportedly in agricultural use before 1950. Cerro constructed its plant in the early 1950s and manufactured steel electrical conduit, hot-rolled copper rod, and steel strip. Wastewater from the manufacturing process was treated on site and discharged to three on-site recharge basins. Process-generated, non-hazardous metal hydroxide sludge was disposed of on site and at various off-site locations during Cerro's operating history. In April 1982, the plant was connected to the Nassau County sanitary sewer system and the plant stopped discharging treated wastewater on site. In 1984, Cerro removed from the site approximately 70,000 cubic yards of non-hazardous wastewater treatment sludge and soil which was disposed of off site. Later that year, Cerro sold the facility to Sy Associates but continued to operate the site under a lease. Cerro terminated site activities in 1986.

1.3 Geology and Hydrogeology

Syosset is situated on a gently sloping glacial outwash plain, underlain by unconsolidated deposits. The Lloyd Aquifer, which lies directly on top of bedrock, is under artesian conditions, and the approximately 150-foot-thick Raritan Clay is the overlying confining unit. The Magothy Aquifer lies above the Raritan Clay and consists of sand, gravel, silt, and clay. The saturated thickness of the Magothy Aquifer near the site is approximately 520 feet (USGS Professional Paper 627-E, 1972), and it provides approximately 90 percent of Nassau County's public water supply. The Upper Pleistocene surficial deposits of stratified sand and gravel are up to 100 feet thick in some areas.

Regional hydrogeologic studies show a groundwater divide near the site and the horizontal groundwater flow direction is variable and probably seasonally dependent. The average flow direction is west, changing to northwest in the summer, and southwest in the winter. Depth to groundwater at the site is approximately 100 feet.

2.0 SOIL INVESTIGATIONS

2.1 Avendt Group, Inc. Soil Investigations

Cerro terminated operations in 1986 and implemented a facility decommissioning plan developed pursuant to a NYSDEC Administrative Consent Order (ACO) that required Cerro to:

- characterize wastes remaining on site;
- evaluate on and off-site soil impacts from wastes remaining on site; and
- remediate any impacted soil at the site in accordance with NYSDEC requirements.

With the exception of the stormwater recharge area and the vegetated area south of the former sludge area, Avendt Group, Inc. (AGI) conducted site-wide soil sampling outside the plant buildings (Figures 2 and 3). The samples were analyzed for heavy metals, volatile organic compounds (VOCs), and cyanide. Elevated levels of copper, extractable copper, and cyanide were found three to six feet below the bottom of the three wastewater recharge basins, and in the sidewall of recharge Basin 1. The chemical data are summarized in Table 1.

AGI also found total copper at 2,200 mg/kg approximately 25 feet below grade in soil boring B-109, near the in-ground wastewater holding tank (copper holding pond) and clarifier. AGI collected additional samples around this hot spot and determined that the elevated copper concentrations were caused by a break in an underground wastewater pipe, and that the extent of the soil contamination was limited to approximately 36 square feet.

2.2 Eder Associates Soil Investigations

In 1989, Eder conducted a limited soil investigation of the stormwater drainage basin. Two surface soil samples (SD-1 and SD-2) were collected near the outfall of two drainage pipes extending into the drainage basin (Drawing 1), and analyzed for priority pollutant metals, volatile and semivolatile organic compounds (VOCs, SVOCs), pesticides, PCBs, and total petroleum hydrocarbons (TPH) (Table 2). SD-1 contained low concentrations of total SVOCs (9.7 mg/kg) and TPH (360 mg/kg), which are typically found in stormwater run-off from asphalt-paved areas. SD-1 also contained 500 mg/kg copper, and trace concentrations of PCBs (51 μg/kg) and toluene (72 μg/kg). SD-2 contained low concentrations of TPH (81 mg/kg), and 250 mg/kg of copper. No VOCs or SVOCs were found in this sample.

In March 1990, Eder performed a soil investigation to further assess the extent of copper and cyanide residuals found during AGI's and Eder's previous soil investigations. Subsurface soil samples were collected from between 10 and 22 feet below the bottom of the three recharge basins and the stormwater recharge area, and surface soil samples were collected from the concrete outfall box in Basin 2 and from the former sludge area (Drawing 1). The samples were analyzed for total copper, extractable copper, and cyanide. The laboratory results are summarized in Table 3.

Total copper concentrations ranged from 32 to 240 mg/kg in the three recharge basins, and from 0.74 to 16 mg/kg in the stormwater recharge area. Cyanide concentrations ranged from less than 2 to 58 mg/kg in the three recharge basins, and from less than 2 to 6.5 mg/kg in the stormwater recharge area. Surface soil samples from the former sludge storage area contained copper and cyanide concentrations similar to the soil in the three recharge basins, and elevated copper and cyanide concentrations were found in the Basin 2 concrete outfall box.

In June 1991, Eder conducted a soil investigation to determine the areal extent of copper in surface soil in the stormwater drainage basin and the former sludge area (Drawing 1). Shallow subsurface soil was also sampled from the vegetated area south of the former sludge area. The laboratory results are summarized in Tables 4 through 8.

Total copper concentrations in the stormwater drainage basin samples ranged from 53 to 1600 mg/kg, and extractable copper concentrations ranged from 0.02 to 1 mg/l (Table 4). Total copper concentrations in samples from the sludge area ranged from 19 to 2000 mg/kg, and extractable copper concentrations in the three samples with the highest total copper concentrations ranged from 3.8 mg/l to 26 mg/l (Table 5).

Six soil samples collected from the vegetated region were analyzed for VOCs, SVOCs, metals, pesticides, PCBs, and herbicides using the Toxicity Characteristic Leachate Procedure (TCLP) (Table 6). Trichloroethene was detected in sample SS-5 at 0.73 mg/l, which marginally exceeded the TCLP limit of 0.50 mg/l. Low levels of lead and cadmium were found in several samples; however, these concentrations were well below TCLP limits. To verify the presence of TCE, five additional soil samples were collected near SS-5 (Drawing 1) and analyzed for TCLP VOCs (Table 7). No VOCs were detected in these soil samples and the TCE found in SS-5 can be considered an anomaly.

Soil beneath the concrete floor slab in Buildings A, B, C, E, and G was sampled where materials could have been discharged in the past, such as at abutting floor and building sections that were constructed at different times. The samples were analyzed for asbestos, cyanide, priority pollutant metals, SVOCs, VOCs, TPH, pesticides, and PCBs (Table 8). All samples contained low levels of SVOCs, and trace levels of 4,4'-DDE (a pesticide) was detected in two samples. Low levels of priority pollutant metals were detected in all samples, and sample ACSB-10 contained 6,800 mg/kg of zinc. TPH was detected in sample CCSB-5 at 25 mg/kg, and trace concentrations of cyanide were detected in samples GCSB-2 and ECSB-3 at 0.67 and 0.60 mg/kg, respectively. VOCs, PCBs, and asbestos were not found.

3.0 BASELINE RISK ASSESSMENT AND SOIL REMEDIATION

In September 1991, Eder conducted a risk assessment to evaluate the potential health impacts of exposure to on-site soils, and to determine acceptable risk-based contaminant concentrations (Appendix A). The risk assessment calculations indicated that the respective target cleanup concentrations for copper and cyanide in soil are 5,200 mg/kg and 3,100 mg/kg under the future residential use scenario, and 41,000 mg/kg and 28,200 mg/kg under the industrial use scenario. Based on the extensive soil sampling programs conducted by AGI and Eder, the residential target cleanup concentration for copper was exceeded at only two areas in Basin 2, one area in Basin 3, one area south of the copper pond and pumphouse (B-109) and one area adjacent to Building E (Figure 4). The risk assessment showed that site conditions did not pose a significant public health risk, even under a conservative future residential use scenario. The NYSDEC and NYSDOH agreed with the risk assessment findings and the target cleanup concentration.

In October 1992, a work plan to excavate and dispose of the soil with copper concentrations above 5,200 mg/kg was submitted to NYSDEC by CDM on behalf of Cerro, and the remediation work was completed in December 1992.

3.1 Soil Excavation and Post-Excavation Sampling

From December 17 to 23, 1992, Chemical Waste Management (CWM), under the direct supervision of Cerro's consultant, Camp, Dresser and McKee, Inc. (CDM), excavated soil where copper concentrations exceeding the DEC approved 5,200 mg/kg target cleanup concentration. Eder and NYSDEC representatives oversaw the soil excavation, and post excavation samples were collected by CDM, CWM and NYSDEC to document clean closure.

Soil was excavated from Areas 1, 1A, 2A, 2B, and 3 (Figure 4) in accordance with the CDM work plan. Except at Area 2A, the concrete detention (outfall) box, post excavation samples were collected by CWM and submitted to Ecotest Laboratories, North Babylon, New York for total copper analysis. All soil was removed from Area 1A, the walls were scraped and swept to remove scale, and the floor was swept until the box was determined clean by visual inspection by Eder and CDM.

NYSDEC collected samples at the same location as CWM, and an additional sample was collected from Area 4, west of the small garage, at the south end of Building D (Figure 4). The CWM and NYSDEC sampling results are summarized in Table 9.

3.2 Soil Sampling Results

Laboratory results showed that NYSDEC's samples from the north wall of Area 1, the east wall of Area 2B, and the surface of Area 4 were above the 5,200 mg/kg clean up criterion approved by NYSDEC. An additional two feet of soil was removed from the north wall of Area 1 and the east wall of Area 2B, as required by CDM's work plan, and the walls were resampled by CWM and NYSDEC, under Eder and CDM observation. CDM directed CWM to excavate soil from Area 4 and the excavation was 15 feet long, 8 feet wide and 3 feet deep. NYSDEC then collected a sample from the floor of the excavation. Laboratory results from the additional post-excavation sampling round (Table 10) were all below the 5,200 mg/kg cleanup criterion. Blue-green stained soil was also removed from the north wall of Area 3.

All excavated soil was transported to a landfill in Elda, Ohio for disposal as non-hazardous industrial waste. CWM backfilled and graded all excavations and regraded any slopes that had been disturbed.

A copy of CDM's report describing the soil remediation work is presented in Appendix B.

4.0 GROUNDWATER INVESTIGATIONS

Eight groundwater sampling rounds were conducted at the Cerro facility between 1987 and 1992. The first four were conducted by H2M during its 1987 and 1988 Phase I and II groundwater investigations pursuant to a NYSDEC ACO issued to Sy Associates. The groundwater was analyzed for metals, cyanide, total organic halides (TOX), VOCs, and leachate indicator parameters. Eder conducted the remaining four sampling rounds in May 1990, and January, August, and September 1992. Groundwater sampled by Eder was analyzed for VOCs (May 1990 and January 1992), metals, cyanide, and nitrates (May 1990, and January, August, and September, 1992). The monitoring well locations are shown on Drawing 1.

4.1 H2M Groundwater Investigations

In 1987, H2M installed four on-site monitoring wells during its Phase I groundwater investigation, with sampling rounds in October, November, and December. Groundwater samples were collected from the four new wells (MW-1 through MW-4) and an existing well (MW-5), and analyzed for Target Compound List (TCL) metals (filtered and unfiltered samples), cyanide, TOX, and leachate indicator parameters (chloride, fluoride, hardness, ammonia, nitrate, and sulfate). The sampling results are summarized in Tables 11 and 12.

In 1988 and 1989, H2M installed three additional monitoring wells (MW-6 through MW-8) during its Phase II groundwater investigation. Groundwater samples were collected from wells MW-1 through MW-8 and analyzed for TCL metals and VOCs, TOX, cyanide, and leachate indicators. The sampling results are summarized in Table 13.

4.2 Eder Associates Investigations

In May 1990 and January 1992, Eder sampled monitoring wells MW-1 through MW-7. Monitoring well MW-8 was vandalized and could not be sampled. A new well was installed to replace MW-8 in July 1992. In May 1990, unfiltered groundwater samples were collected and analyzed for the parameters outlined in NYSDEC's February 21, 1990 letter (arsenic, cadmium, chromium, zinc, mercury, lead, cyanide, phenols, carbon tetrachloride, methylene chloride, acetone, chloroform, 2-butanone, 1,1,1-trichloroethane, toluene, trichloroethylene, nitrate, 4,4'-DDT, and 4,4'-DDD). In January 1992, unfiltered samples were collected and analyzed for the parameters outlined in NYSDEC's October 17, 1990 letter (chromium, copper, iron, lead, zinc, cyanide, and nitrates), and in August and September 1992, filtered and unfiltered samples were collected and analyzed for the same parameters. The 1990 and 1992 sampling results are summarized in Tables 14 through 17.

4.3 Groundwater Sampling Results

4.3.1 Volatile Organic Compounds

Trace levels of VOCs were detected in several samples collected during H2M's Phase I and II investigations. The concentrations of identified VOCs (methylene chloride, chloroform, and 1,1,1-TCA) were substantially below state and federal standards. In 1990, Eder found a trace of acetone in one sample; however, acetone was also found in the QA/QC trip blank, indicating that it was a laboratory contaminant.

In an October 17, 1990 letter to Eder, NYSDEC eliminated VOC analysis from the groundwater sampling program and limited the parameters to be analyzed during subsequent groundwater monitoring rounds.

4.3.2 Semivolatile Organic Compounds and Pesticides

During H2M's Phase I investigation, groundwater samples were analyzed for TOX, which identifies total volatile and nonpurgeable organic halogens. Samples containing the highest TOX concentrations (MW-1 and MW-3) were also analyzed for SVOCs; however, no SVOCs were detected. During H2M's Phase II investigation, all samples contained trace levels of bis(2-ethylhexyl)phthalate which was also found in the laboratory blank. H2M also found trace levels of the pesticides 4,4'-DDD and 4,4'-DDT; however, these compounds were not identified during Eder's 1990 sampling round.

In an October 17, 1990 letter to Eder, NYSDEC eliminated semivolatile analysis from the groundwater monitoring program and limited the parameters to be analyzed during subsequent monitoring rounds.

4.3.3 Metals

Eder's September 1991 baseline risk assessment identified copper and lead as the only metals of concern associated with a hypothetical groundwater exposure route. Copper was detected above New York State Class GA standards in an unfiltered sample collected from MW-3 during H2M's October 1987 sampling round; however, it was not detected in the filtered sample. H2M's February 1989 Phase II report concluded that MW-3 monitors perched water, and samples from this well do not reflect groundwater quality beneath the Cerro site. Slightly elevated concentrations of lead were found in unfiltered samples collected by H2M in August and October 1987; however, lead concentrations in filtered samples were well below Class GA standards. The metals concentrations found during Eder's May 1990 and January 1992 sampling rounds were similar to those reported during H2M's Phase I and II investigations.

Anomalously high metals concentrations were found in unfiltered samples collected on August 6, 7, and 10, 1992, and these concentrations were apparently due to suspended solids in the samples. The monitoring wells were resampled on August 31 and September 1, 1992, and filtered and unfiltered samples were collected for metals analysis. The metals concentrations in unfiltered samples collected on August 31 and September 1, 1992 were significantly and expectedly lower than those found during the August 6, 7, and 10, 1992 sampling round. Except for iron in MW-2, MW-3, MW-6, and MW-8, and zinc in MW-3 and MW-7, all metals concentrations in unfiltered samples were well below New York State Class GA groundwater standards. Iron concentrations in MW-2 and MW-6, and zinc concentrations in MW-3, were below Class GA standards in filtered samples.

Iron in the groundwater is attributed to the solution of regional, naturally-occurring iron-bearing minerals in the soil and these concentrations are common in the upper glacial aquifer on Long Island. Zinc concentrations in MW-3 and MW-7 were significantly below the New York State 10 NYCRR Subpart 5.1 Maximum Contaminant Level of 5 mg/l.

4.4.4 Cyanide and Nitrates

Cyanide concentrations found during all sampling rounds were well below New York State and federal guidelines. Low levels of nitrates were consistently found during H2M's and Eder's sampling rounds, and the nitrate concentration in MW-6 marginally exceeded state and federal standards in 1990 and 1992. Nitrate is a documented contaminant in the upper glacial aquifer in Nassau County and is generally related to agricultural and residential land uses.

5.0 CONCLUSIONS

Eder's September 1991 baseline risk assessment of the Cerro site concluded that the site does not pose a significant public health risk under the current and future industrial use scenarios. Under the future residential use scenario, Eder's risk assessment determined that the respective target cleanup level for copper and cyanide residuals in soil at the site are 5,200 mg/kg and 3,100 mg/kg. NYSDEC and NYSDOH agreed to the risk assessment findings and the target cleanup concentrations. Extensive soil sampling conducted by AGI and Eder showed that the residential target cleanup level for copper was exceeded at only five small areas. In December 1992, soil from these areas was excavated and disposed of in accordance with NYSDEC requirements. All of the post-excavation analytical results were less than the residential use target cleanup level established in Eder's risk assessment.

Eight monitoring rounds between 1987 and 1992 show that groundwater beneath the former Cerro site has not been adversely affected by Cerro's activities. Moreover, Eder's September 1991 risk assessment concluded that the potential health risk associated with the hypothetical groundwater ingestion exposure route was insignificant.

Given the soil and groundwater investigations conducted at the site, and the results of Eder's 1991 risk assessment study, Tribune and Eder believe that the site-specific data base developed between 1986 and 1992 supports a request to delist the former Cerro site from the NYSDEC Registry of Inactive Hazardous Waste Sites.

TRIBUNE NEW YORK HOLDINGS COMPANY

SYOSSET, NEW YORK

TABLE 17

EDER GROUNDWATER SAMPLING RESULTS - AUGUST 31 AND SEPTEMBER 1, 1992

Well ID Parameter	MW-1	MW-1(f)	MW-2	MW-2(f)	MW-3	MW-3(f)	MW-4	MW-4(f)	MW-5	MW-5(f)	MW-5(d)	MW-5(f)(d)	MW-6	MW-6(f)	MW-7	MW-7(f)	Field Blank	6 NYCRR 703 Standard
Chromium	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	<0.009	0.05
Copper	0.0055 B	0.0067 B	0.0253	0.009 B	0.0083 B	0.0031 B	0.0041 B	0.0062 B	0.0093 B	0.0067 B	0.008 B	0.009 B	0.0107 B	0.0065 B	0.0101 B	0.0139 B	0.0149 B	1
Iron	0.286	0.041 B	1.12	0.028 B	0.445	0.343	0.172	0.090 B	0.030 B	0.042 B	0.032 B	0.022 B	0.476	0.015 B	0.134	0.039 B	0.075 B	0.3
Lead	0.0033	0.0013 B	0.0054	0.0021 B	0.004	0.0035	<0.001	0.0014 B	<0.001	0.0058	0.0012 B	0.001 B	0.0013 B	<0.001	0.0011 B	0.001 B	0.0021 B	0.025
Zinc	0.213	0.014 B	0.240	0.0444	0.215	0.0278	0.246	0.0696	0.187	0.0098 B	0.193	0.206	0.196	0.0237	1.16	0.830	0.208	0.3
Nitrates	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

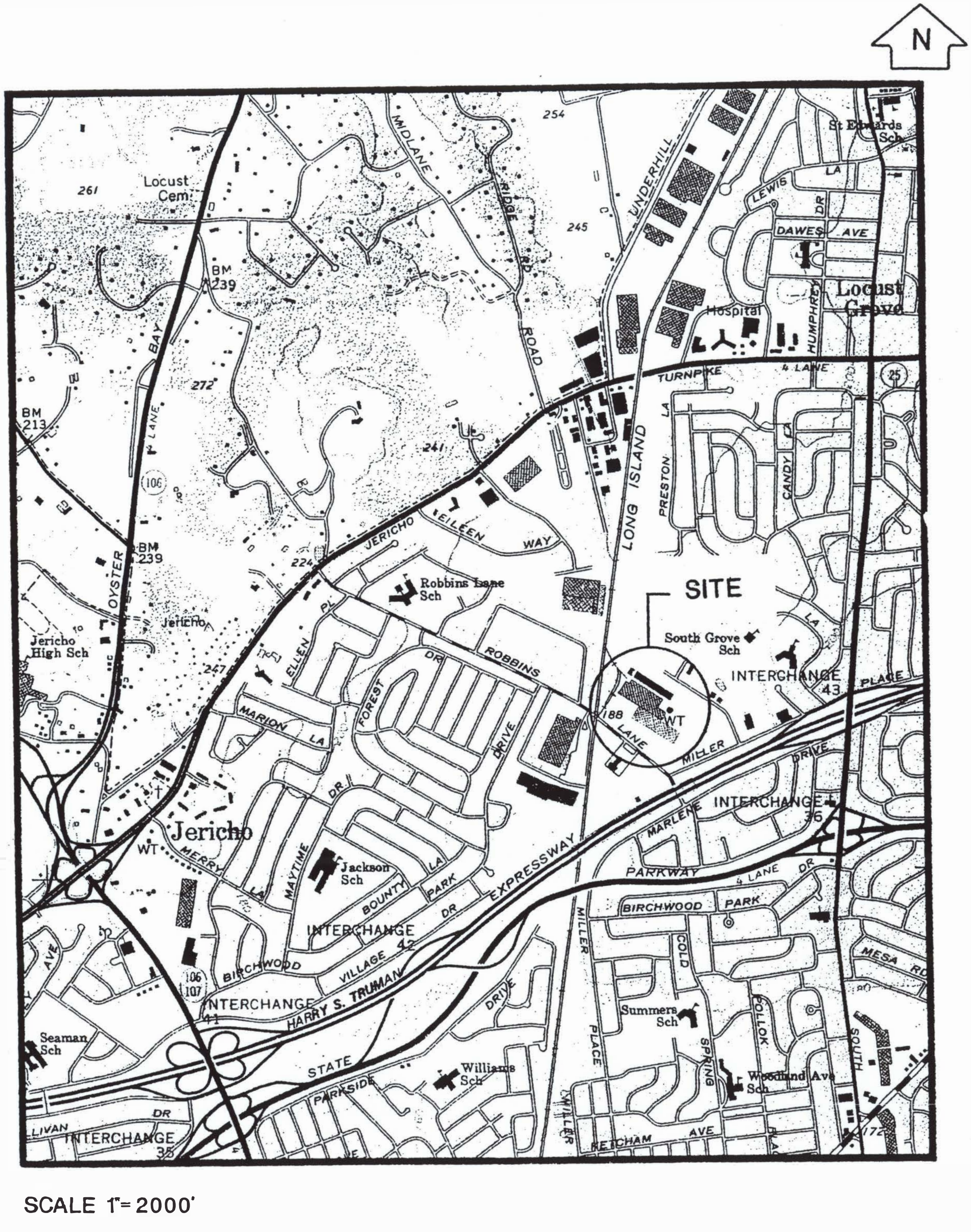
NOTES:

All results are in mg/l
(f) - Filtered samples
(d) - Duplicate sample of MW-5
B - Concentration above instrument detection limit, but below CRDL

eder associates consulting engineers, p.c.

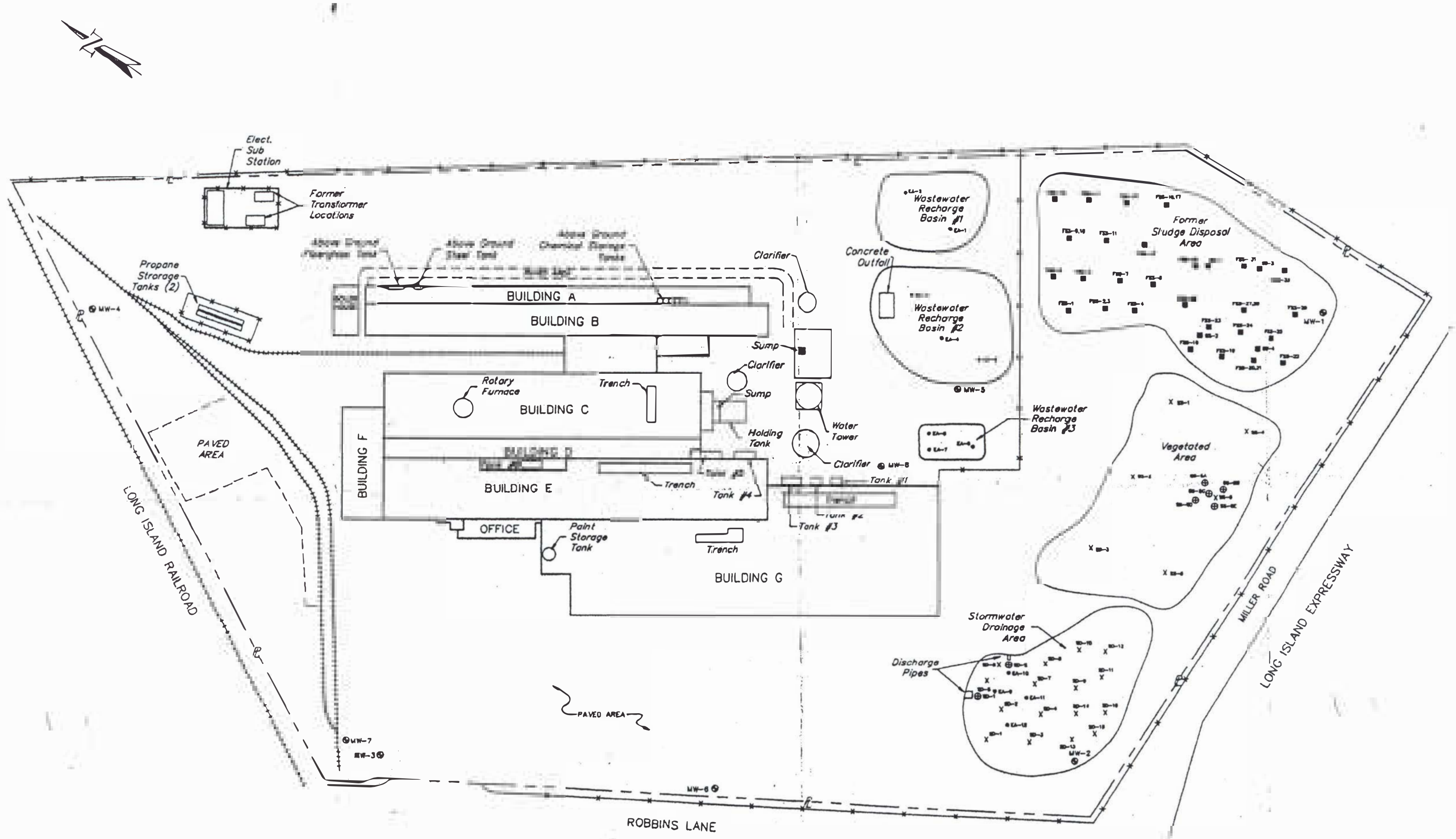
FIGURE 1

FORMER CERRO CONDUIT FACILITY
SYOSSET, NEW YORK



SCALE 1"= 2000'

LOCATION MAP



NOTE
1. Structures, Equipment, And Sampling Locations Are Shown Schematically

LEGEND
x ■ ⊕ ▲ Soil Sample Locations
⊙ Monitoring Well Location

0 80'

No.	REVISIONS	DATE

DELISTING REPORT
TRIBUNE NEW YORK HOLDING COMPANY
SYOSSET, NEW YORK

eder associates consulting engineers, p.c.

PROJECT
DELISTING REPORT
TRIBUNE NEW YORK HOLDING COMPANY
SYOSSET, NEW YORK

TITLE
SAMPLING LOCATIONS

eder associates consulting engineers, p.c.
LOCUST VALLEY, NEW YORK & MADISON, WISCONSIN
ANN ARBOR, MICHIGAN • AUGUSTA, GEORGIA
JACKSONVILLE, FLORIDA • TRENTON, NEW JERSEY

DRAWN BY AFG	SCALE 1" = 80'
DESIGNED BY JMB	PROJECT No. 607-2
APPROVED BY GAR	DWG. No. 1
DATE FEBRUARY, 1993	

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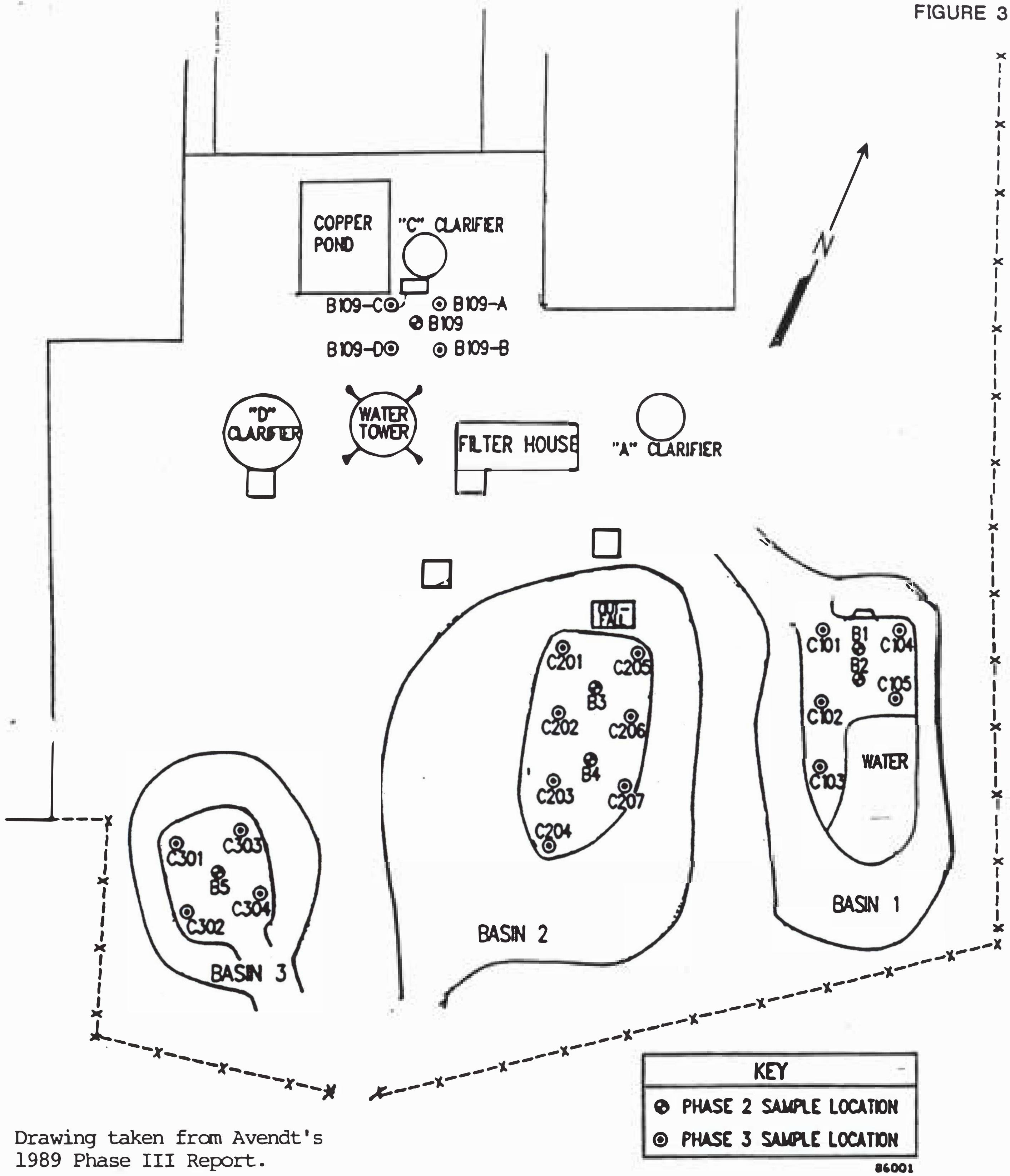
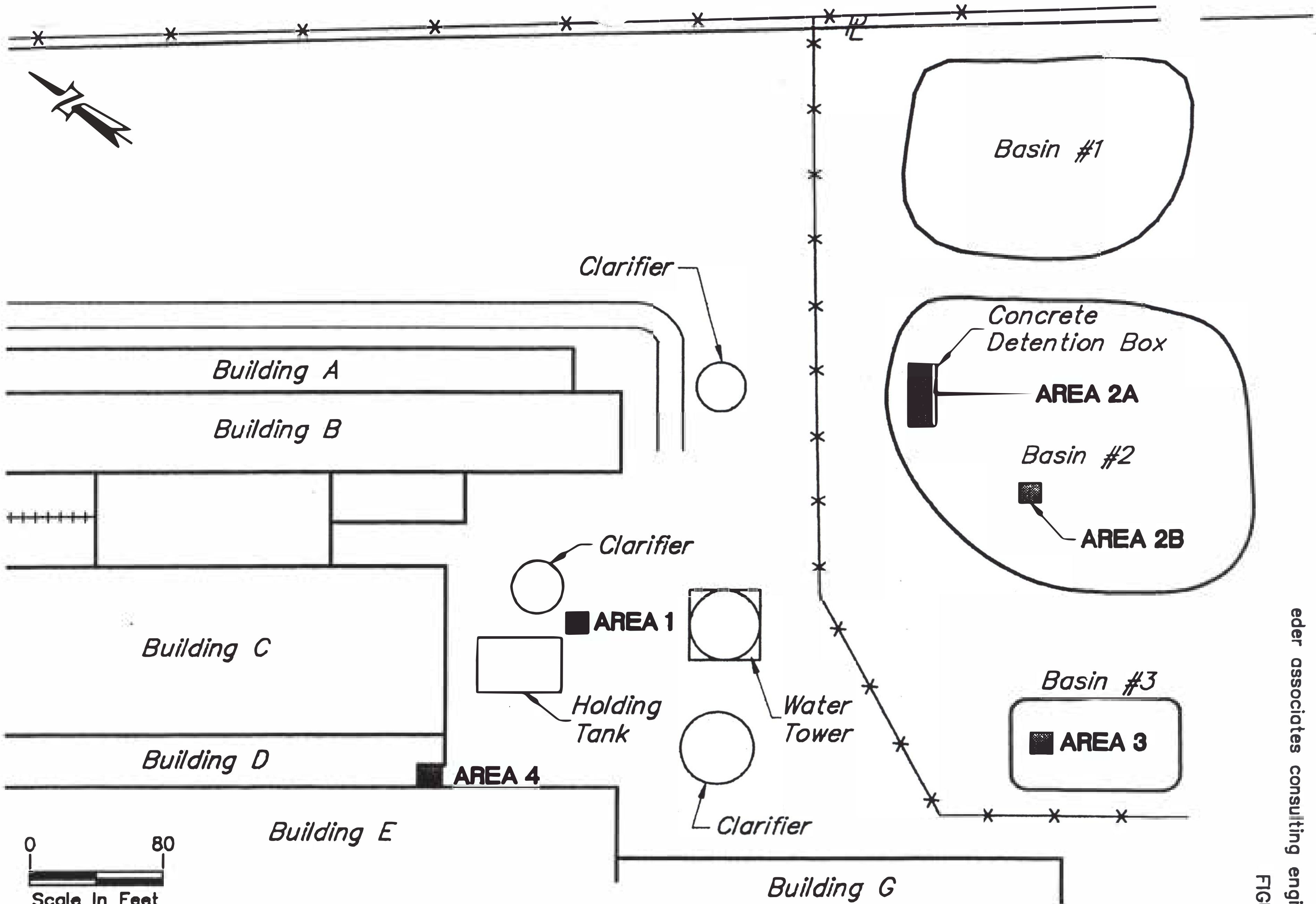


Drawing taken from Avendt's
1989 Phase III Report.

Phase 3 Soil Sampling Program - Sample Locations



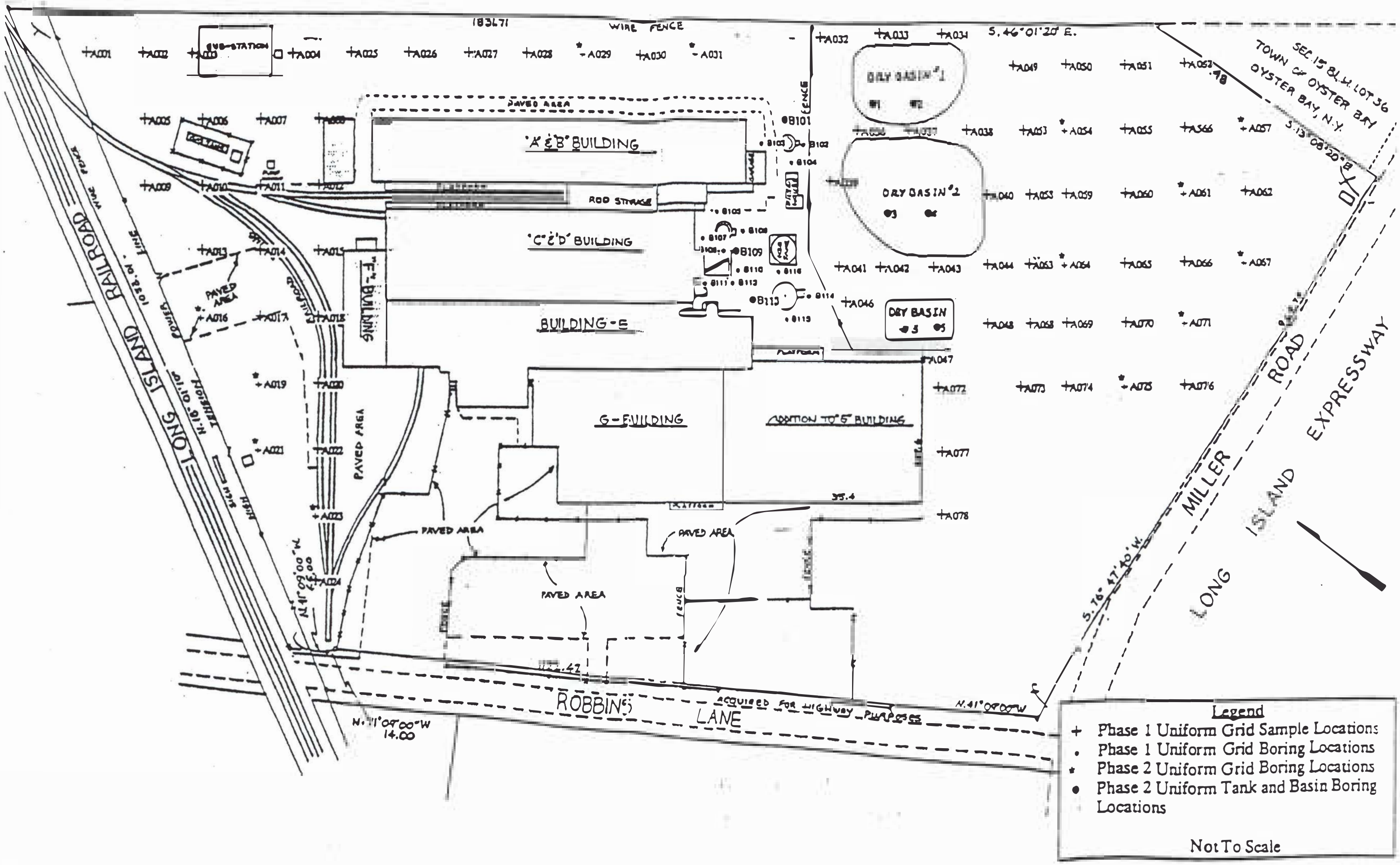
SITE PLAN

TRIBUNE NEW YORK HOLDING COMPANY
SYOSSET, NEW YORK

SK607-2F
010893

FIGURE 4

eder associates consulting engineers, p.c.



Drawing taken from Avendt's
1988 Phase II Report

Phases 1 and 2 Soil Sample Locations

TRIBUNE NEW YORK HOLDINGS COMPANY
SYOSSET, NEW YORK

TABLE 1

AVERAGE CONTAMINANT CONCENTRATIONS
IN WASTEWATER RECHARGE BASINS

Location	Depth (ft)	Total Copper (mg/kg)	Extractable Copper (mg/l)	Total Cyanide (mg/kg)
Basin 1	3 6	506 285	4.299 3.388	21.9 12.7
Basin 2	3 6	538 216	5.421 1.788	18.8 4.6
Basin 3	3 6	834 559	5.233 3.740	12.0 4.5

TRIBUNE NEW YORK HOLDINGS COMPANY
SYOSSET, NEW YORK

TABLE 2

STORMWATER DRAINAGE AREA - SOIL SAMPLING RESULTS

Sample ID	SD-1	SD-2
Parameters		
Metals mg/kg		
Antimony	ND	ND
Arsenic	ND	4.9
Beryllium	ND	ND
Cadmium	ND	ND
Chromium	ND	6.7
Copper	500	250
Lead	83	79
Mercury	ND	ND
Nickel	ND	ND
Selenium	ND	ND
Silver	ND	ND
Thallium	ND	ND
Zinc	130	240
Volatile Organic Compounds (μg/kg)		
Toluene	72	ND
Semi-Volatile Organic Compounds (μg/kg)		
Phenanthrene	330	ND
Di-n-butylphthalate	1400	ND
Fluoranthene	200	ND

Table 2 Continued . . .

Sample ID	SD-1	SD-2
Pyrene	140	ND
Butylbenzylphthalate	2200	ND
Bis(2-Ethylhexyl)phthalate	1200	ND
Di-n-octylphthalate	3800	ND
Pesticides/PCBs (μg/kg)		
PCB1254	51	ND
Petroleum Hydrocarbons (mg/kg)	360	81

TRIBUNE NEW YORK HOLDINGS COMPANY
SYOSSET, NEW YORK

TABLE 3

WASTEWATER RECHARGE BASIN - SOIL SAMPLING RESULTS

Location	Sample I.D.	Sample Depth (ft)	Total Copper (mg/kg)	Extractable Copper (mg/l)	Total Cyanide (mg/kg)
Basin No. 1	EA-1	10-12	130	6.4	46
		15-17	110	4.3	24
		20-22	NA	NA	28
	EA-2	10-12	140	7.6	14
		15-17	240	12	16
		20-22	110	NA	8
Basin No. 2	EA-3	10-12	100	4.9	18
		15-17	46	1.9	58
		20-22	NA	NA	24
	EA-4	10-12	110	4.5	3
		15-17	35	2.8	<2
	EA-5	10-12	190	6.6	6.5
		15-17	100	4.6	8
Basin No. 3	EA-6	10-12	240	1.4	6
		15-17	34	1.6	<2
	EA-7	10-12	65	2.7	6.5
		15-17	32	0.94	<2
	EA-8	10-12	57	2.6	<2
		15-17	60	3	<2

Table 3 Continued . . .

Location	Sample I.D.	Sample Depth (ft)	Total Copper (mg/kg)	Extractable Copper (mg/l)	Total Cyanide (mg/kg)
Stormwater Basin	EA-9	5-7	6.0	NA	<2
		10-12	2.5	0.04	<2
		15-17	4.7	0.12	<2
	EA-10	5-7	4.0	NA	<2
		10-12	4	<0.02	<2
		15-17	3.5	<0.02	<2
	EA-11	5-7	2.9	NA	<2
		10-12	1.8	0.03	<2
		15-17	4.1	0.05	<2
	EA-12	5-7	4.6	NA	6.5
		10-12	0.74	<0.02	<2
		15-17	16	0.23	<2
Former Sludge Storage Area	SS-1	Surface	180	5.5	3.5
	SS-2	Surface	230	6.5	3.5
	SS-3	Surface	600	24	16
	SS-4	Surface	890	12	27
Basin No. 2	Concrete Outfall	Surface Composite	13000	125	21

<u>NOTE:</u>

1. NA - Not Analyzed

TRIBUNE NEW YORK HOLDINGS COMPANY

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TABLE 4

STORMWATER DRAINAGE BASIN - SOIL SAMPLING RESULTS

Sample No.	Total Copper (mg/kg)	Extractable Copper (mg/l)
SD-1	53	0.32
SD-2	280	0.47
SD-3	480	0.11
SD-4	350	0.23
SD-5	680	3.9
SD-6	180	0.1
SD-7	1600	7.8
SD-8	360	0.21
SD-9	450	0.26
SD-10	220	0.06
SD-11	81	0.02
SD-12	63	0.03
SD-13	760	1
SD-14	160	0.22
SD-15	340	0.09
SD-16	110	0.03

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TABLE 5

FORMER SLUDGE AREA - SOIL SAMPLING RESULTS

Sample No.	Total Copper (mg/kg)	Extractable Copper (mg/l)
FSS-1	92	NA
FSS-2**	300	NA
FSS-3**	290	NA
FSS-4	170	NA
FSS-5	96	NA
FSS-6	150	NA
FSS-7	880	NA
FSS-8	1300	NA
FSS-9**	480	NA
FSS-10**	370	NA
FSS-11	1700	10
FSS-12	900	NA
FSS-13	240	NA
FSS-14	82	NA
FSS-15	19	NA
FSS-16**	570	NA
FSS-17**	420	NA
FSS-18	800	NA
FSS-19	390	NA
FSS-20**	600	NA
FSS-21**	660	NA

Table 5 Continued . . .

Sample No.	Total Copper (mg/kg)	Extractable Copper (mg/l)
FSS-22	120	NA
FSS-23	450	NA
FSS-24	1300	NA
FSS-25	450	NA
FSS-26	1300	3.8
FSS-27**	480	NA
FSS-28**	440	NA
FSS-29	200	NA
FSS-30	530	NA
FSS-31	420	NA
FSS-32	2000	26

NOTES:

NA - Not Analyzed
** - QA/QC Duplicate Samples

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TABLE 6

VEGETATED AREA - SOIL SAMPLING RESULTS

Sample I.D.	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
Parameter						
Volatile Organic Compounds (mg/l)						
Benzene	ND	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND
Methyl ethyl ketone	ND	ND	ND	ND	ND	ND
Tetrachloroethylene	ND	ND	ND	ND	ND	ND
Trichloroethylene	ND	ND	ND	ND	0.73	ND
Vinyl Chloride	ND	ND	ND	ND	ND	ND

Table 6 Continued . . .

Sample I.D.	SS-1	SS-2	SS-3	SS-4	SS-5	SS-6
Semivolatile Organic Compounds (mg/l)	ND	ND	ND	ND	ND	ND
Chlorinated Pesticides (μg/l)	ND	ND	ND	ND	ND	ND
Herbicides (μg/l)	ND	ND	ND	ND	ND	ND
Metals (mg/l)						
Silver	ND	ND	ND	ND	ND	ND
Arsenic	ND	ND	ND	ND	ND	ND
Barium	0.89	0.17	0.12	0.12	0.07	0.008
Cadmium	0.04	ND	ND	ND	ND	0.09
Chromium	ND	ND	ND	ND	ND	ND
Mercury	ND	ND	ND	ND	ND	ND
Lead	1.4	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND

NOTE:

ND - None Detected

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TABLE 7

VEGETATED AREA - ADDITIONAL SOIL SAMPLING RESULTS

Parameters (mg/l)	Sample No.				
	SS-5A	SS-5B	SS-5C	SS-5D	SS-5E
Benzene	ND	ND	ND	ND	ND
Carbon Tetrachloride	ND	ND	ND	ND	ND
Chlorobenzene	ND	ND	ND	ND	ND
Chloroform	ND	ND	ND	ND	ND
1,2-Dichloroethane	ND	ND	ND	ND	ND
1,1-Dichloroethene	ND	ND	ND	ND	ND
Methyethyl ketone	ND	ND	ND	ND	ND
Tetrachloroethene	ND	ND	ND	ND	ND
Trichloroethene	ND	ND	ND	ND	ND
Vinyl Chloride	ND	ND	ND	ND	ND

NOTE:

ND - Not detected

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TABLE 8

SOIL SAMPLES COLLECTED BENEATH BUILDING FLOOR SLAB

Sample I.D.	Bldg. G GCSB-1	Bldg. G GCSB-2	Bldg. E ECSB-3	Bldg. E ECSB-4	Bldg. C CCSB-5	Bldg. C CCSB-6	Bldg. B BCSB-7	Bldg. B BCSB-8	Bldg. A ACSB-9	Bldg. A ACSB-10
Parameter										
Volatile Organic Compounds (µg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Semivolatile Organic Compounds (µg/kg)										
Bis(2-Ethylhexyl)phthalate	260.0 J	81.0 J	200.0 J	67.0 J	80.0 J	ND	88.0 J	100.0 J	86.0 J	74.0 J
Di-n-butyl phthalate	120.0 JB	60.0 JB	52.0 JB	ND	ND	ND	160.0 JB	91.0 JB	69.0 JB	150.0 JB
Diethyl phthalate	26.0 J	20.0 J	ND	ND	ND	36.0 J	ND	ND	ND	ND
Dimethyl phthalate	ND	ND	23.0 J	ND	ND	ND	ND	ND	ND	ND
Di-n-octhyl phthalate	ND	ND	ND	120.0 J	90.0 J	ND	ND	ND	ND	ND
Fluoranthene	ND	ND	ND	84.0 J	24.0 J	ND	ND	18.0 J	ND	ND
Naphthalene	ND	60.0 J	24.0 J	15.0 J	55.0 J	13.0 J	50.0 J	17.0 J	28.0 J	ND
Phenanthrene	ND	ND	ND	44.0 J	14.0 J	ND	8.0 J	ND	ND	ND
Pyrene	ND	ND	ND	78.0 J	17.0 J	ND	ND	ND	ND	ND
Chlorinated Pesticides (µg/kg)										
4,4'-DDE	ND	23.0	24.0	ND	ND	ND	ND	ND	ND	ND
Polychlorinated Biphenyls (µg/kg)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (mg/kg)										
Silver	2.2	0.8	ND	2.6	6.4	1.8	0.8	14.0	ND	7.0
Arsenic	2.1	2.4	1.9	1.8	1.0	1.4	2.2	2.0	2.0	3.1
Beryllium	ND	ND	ND	ND	ND	ND	0.3	0.3	ND	0.4

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Table 8 continued . . .

Sample I.D.	Bldg. G GCSB-1	Bldg. G GCSB-2	Bldg. E ECSB-3	Bldg. E ECSB-4	Bldg. C CCSB-5	Bldg. C CCSB-6	Bldg. B BCSB-7	Bldg. B BCSB-8	Bldg. A ACSB-9	Bldg. A ACSB-10
Cadmium	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.2
Chromium	4.8	3.5	3.8	4.2	2.4	4.6	7.9	10.0	4.8	7.8
Copper	20.0	18.0	36.0	25.0	150.0	17.0	12.0	23.0	10.0	31.0
Mercury	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	3.1	2.3	3.0	3.2	2.7	2.8	5.8	10.0	3.8	7.0
Lead	5.6	7.7	32.0	11.0	7.8	4.4	6.0	14.0	6.6	62.0
Antimony	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	36.0	83.0	22.0	12.0	21.0	8.0	18.0	27.0	10.0	6800.0
Cyanide	ND	0.7	0.6	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (mg/kg)										
Asbestos (%)	ND	ND	ND	ND	25.0	ND	ND	ND	ND	ND
Amosite	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysotile	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

NOTES:

NA - Not Analyzed
ND - None Detected
J - Detected, but below quantitation limit; estimated value
B - Compound detected in method blank associated with this sample

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TABLE 9

COPPER CONCENTRATION IN POST EXCAVATION SOIL SAMPLES - ROUND ONE

Sample ID	Date Sampled	Sample Location	Depth Below Grade (feet)	Copper* (mg/kg)
1A-1	12/17/92	Area 1, Northwall	3-4	2,600
1A-2	12/17/92	Area 1, Eastwall	3-4	3,900
1A-3	12/17/92	Area 1, Southwall	3-4	4.2
1A-4	12/17/92	Area 1, Center of Floor	3-4	3,900
1A-5	12/17/92	Area 1, Westwall	3-4	10
2A-1	12/17/92	Area 2B, Northwall	3-4	750
2A-2	12/17/92	Area 2B, Eastwall	3-4	2,200
2A-3	12/17/92	Area 2B, Southwall	3-4	1,400
2A-4	12/17/92	Area 2B, Center of Floor	3-4	2,000
2A-5	12/17/92	Area 2B, Westwall	3-4	560
3A-1	12/17/92	Area 3, Northwall	8-9	91
3A-2	12/17/92	Area 3, Southwall	8-9	160
3A-3	12/17/92	Area 3, Eastwall	8-9	170
3A-4	12/17/92	Area 3, Westwall	8-9	330
3B-1	12/21/92	Area 3, Center of Floor	12-13	61
3B-2	12/21/92	Area 3, Northwall	12-13	26
3B-3	12/21/92	Area 3, Southwall	12-13	40
3B-4	12/21/92	Area 3, Eastwall	12-13	110
3B-5	12/21/92	Area 3, Westwall	12-13	64

Table 9 Continued . . .

Sample ID	Date Sampled	Sample Location	Depth Below Grade (feet)	Copper# (ppm)
Sample 1	12/18/92	Area 4, Surface	0-.5	16,300
Sample 2	12/18/92	Area 1, Southwall	3-4	40
Sample 3	12/18/92	Area 1, Center of Floor	3-4	2,400
Sample 4	12/18/92	Area 1, Eastwall	3-4	2,800
Sample 5	12/18/92	Area 1, Northwall	3-4	6,700
Sample 6	12/18/92	Area 2, Westwall	3-4	660
Sample 7	12/18/92	Area 2, Eastwall	3-4	7,300
Sample 8	12/18/92	Area 1, Westwall	3-4	35
Sample 9	12/22/92	Area 3, Center of Floor	12-13	27.7

NOTES:

* Samples collected by CWM and analyzed by Ecotest Laboratories
# Samples collected by NYSDEC and analyzed by Environmental Testing Laboratories

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SYOSSET, NEW YORK

TABLE 10

COPPER CONCENTRATION IN POST EXCAVATION SOIL SAMPLES - ROUND TWO

Sample ID	Date Sampled	Sample Location	Depth Below Grade (feet)	Copper* (mg/kg)
1B-1	12/22/92	Area 1, Northwall	5-6	2,400
2B-1	12/22/92	Area 2B, Eastwall	5-6	260
Sample ID	Date Sampled	Sample Location	Depth Below Grade (feet)	Copper# (ppm)
Sample 1	12/22/92	Area 1, Northwall	5-6	1,570
Sample 2	12/22/92	Area 4, Center of Floor	3-4	872
Sample 3	12/22/92	Area 2B, Eastwall	5-6	531

NOTES:

* Samples collected by CWM and analyzed by Ecotest Laboratories

\# Samples collected by NYSDEC and analyzed by Environmental Testing Laboratories

TRIBUNE NEW YORK HOLDINGS COMPANY
SYOSSET, NEW YORK

TABLE 11

H2M PHASE I GROUNDWATER SAMPLING RESULTS
AUGUST 1987

Parameter	MW#1	MW#2	MW#3	MW#4	Field Blank	Trip Blank	New York State Groundwater Standard(a)
Aluminum	2.340	0.490	0.990	0.210	ND	ND	
Arsenic	0.005	--	0.007	ND	ND	ND	0.025
Barium	0.270	0.390	0.300	0.320	ND	ND	1.0
Beryllium	0.003	0.003	0.004	0.004	ND	ND	
Cadmium	0.003	0.006	0.004	0.004	ND	ND	0.01
Calcium	8.600	4.710	9.280	9.410	0.070	0.110	
Cobalt	ND	0.010	0.011	ND	ND	ND	
Copper	0.210	0.535	0.406	0.043	ND	ND	1.0
Iron	1.087	0.395	1.166	0.623	ND	ND	0.3
Lead	0.058	0.128	0.047	0.025	0.021	0.004	0.025
Magnesium	88.400	1.490	3.890	1.750	ND	ND	
Manganese	0.093	0.102	0.601	0.171	ND	ND	0.3

Table 11 Continued . . .

Parameter	MW#1	MW#2	MW#3	MW#4	Field Blank	Trip Blank	New York State Groundwater Standard(a)
Mercury	0.0015	0.0025	ND	ND	ND	ND	0.002
Potassium	2.810	0.769	2.403	0.707	ND	ND	
Sodium	13.500	8.540	26.770	7.350	0.130	0.140	
Vanadium	0.250	ND	0.420	0.990	0.090	0.080	
Zinc	0.180	0.282	0.189	0.226	0.007	0.004	5.0
TOX	0.904	0.238	0.380	0.296	0.023	ND	
Conductivity	750	80	250	105	NA	NA	
pH	7.33	5.97	7.16	5.05	NA	NA	

NOTES:

NA - Not Measured
ND - Not Detected
(a) - N.Y.S. Groundwater Quality Standards, 6 NYCRR 703

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TABLE 12

H2M PHASE I GROUNDWATER SAMPLING RESULTS
OCTOBER AND DECEMBER 1987

Parameter	Date	MW#1	MW#2	MW#3	MW#4	MW#5	New York State Groundwater Standard(a)
Unfiltered Silver	Oct. 29	ND	ND	ND	ND	ND	0.05
Unfiltered Arsenic	Oct. 29	0.013	0.008	0.011	0.007	0.005	0.025
Unfiltered Barium	Oct. 29	ND	ND	ND	ND	ND	
Unfiltered Calcium	Oct. 29	8.9	5.4	11.7	9.4	53.7	
Unfiltered Cadmium	Oct. 29	ND	ND	0.015	ND	ND	
Filtered Cadmium	Dec. 2	ND	ND	ND	ND	ND	0.01
Unfiltered Chromium	Oct. 29	ND	ND	0.15	ND	ND	
Filtered Chromium	Dec. 2	ND	ND	ND	ND	ND	
Unfiltered Copper	Oct. 29	0.36	0.51	3.49	0.10	0.09	
Filtered Copper	Dec. 2	0.03	0.07	ND	0.05	ND	1
Unfiltered Iron	Oct. 29	2.68	2.74	24.0	1.17	0.40	
Filtered Iron	Dec. 2	ND	ND	0.38	0.14	0.03	0.3
Unfiltered Mercury	Oct. 29	0.0008	ND	ND	ND	ND	0.002
Unfiltered Magnesium	Oct. 29	95	1.8	9.6	2.0	11.4	
Unfiltered Manganese	Oct. 29	0.07	0.14	4.91	0.19	ND	
Filtered Sodium	Dec. 2	ND	0.06	0.02	0.10	0.03	0.3
Unfiltered Sodium	Oct. 29	19.4	10.8	31.5	12.0	67.3	
Unfiltered Nickel	Oct. 29	ND	ND	0.14	ND	ND	
Unfiltered Lead	Oct. 29	0.015	0.032	0.110	0.008	0.007	

Table 12 Continued . . .

Parameter	Date	MW#1	MW#2	MW#3	MW#4	MW#5	New York State Groundwater Standard(a)
Filtered Lead	Dec. 2	ND	ND	ND	ND	ND	0.025
Unfiltered Antimony	Oct. 29	ND	ND	ND	ND	ND	
Unfiltered Selenium	Oct. 29	ND	ND	ND	ND	ND	0.02
Unfiltered Thallium	Oct. 29	ND	ND	ND	ND	ND	
Unfiltered Zinc	Oct. 29	0.11	0.20	0.95	0.20	0.09	5
Chloride	Oct. 29	51	6	5	18	4	250
Cyanide	Oct. 29	0.090	0.010	ND	ND	0.194	0.2
Fluoride	Oct. 29	0.16	ND	ND	ND	0.36	1.5
Hardness	Oct. 29	411.75	20.88	68.61	31.70	180.99	
Ammonia	Oct. 29	ND	ND	0.05	0.20	ND	
Nitrate	Oct. 29	7.8	3.3	1.2	1.9	1.2	10
Sulfate	Oct. 29	80	10	15	15	20	250
Suspended Solids	Oct. 29	2580	1440	5570	600	100	
Total Dissolved Solids	Oct. 29	460	80	250	90	400	
pH	Oct. 29	6.94	5.64	6.66	5.61	7.95	
Spec. Conductivity	Oct. 29	784	84	177	108	641	
pH	Dec. 2	7.02	5.69	6.64	5.44	7.31	
Spec. Conductivity	Dec. 2	690	86	140	130	ND	

NOTES:
ND - Below Detection Limit
NA - Not Measured
(a) - N.Y.S. Groundwater Quality Standards, 6 NYCRR 703

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TABLE 13

H2M PHASE II GROUNDWATER SAMPLING RESULTS - NOVEMBER AND DECEMBER 1989

METAL COMPOUNDS								
Parameter	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	6 NYCRR 703 Standards(a)
Aluminum	1.42	ND	ND	ND	0.299	ND	ND	
Antimony	ND	ND	ND	ND	ND	ND	ND	
Arsenic	ND	ND	ND	ND	.013	ND	ND	0.025
Barium	ND	ND	ND	ND	ND	ND	ND	1.0
Beryllium	ND	ND	ND	ND	ND	ND	ND	
Cadmium	ND	ND	ND	ND	ND	ND	ND	0.01
Calcium	7.26	2.878	9.01	37.67	43.22	21.6	47.2	
Chromium	0.013	ND	ND	ND	ND	ND	ND	0.05
Cobalt	ND	ND	ND	ND	ND	ND	ND	
Copper	0.312	0.069	ND	0.026	ND	ND	0.049	1.0
Iron	1.709	ND	0.28	0.30	0.302	0.584	0.123	0.3
Lead	0.056	ND	ND	0.005	ND	ND	ND	0.025
Magnesium	63.82	ND	ND	10.0	ND	6.33	12.78	
Manganese	0.065	0.083	0.087	0.02	0.028	1.65	0.017	0.3
Mercury	ND	ND	ND	ND	ND	ND	ND	0.002
Nickel	ND	ND	ND	ND	ND	ND	ND	
Potassium	ND	ND	ND	ND	ND	ND	ND	
Selenium	ND	ND	ND	ND	ND	ND	ND	0.02

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Table 13 Continued . . .

METAL COMPOUNDS

Parameter	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	6 NYCRR 703 Standards(a)
Silver	ND	ND	ND	ND	ND	ND	ND	0.05
Sodium	7.953	ND	6.640	24.2	84.8	64.2	65.0	
Thallium	ND	ND	ND	0.067	ND	ND	ND	
Vanadium	ND	ND	ND	ND	0.015	ND	ND	
Zinc	0.198	0.092	ND	ND	0.026	0.871	0.1	5.0

VOLATILE ORGANICS (PPM)

Compound	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	Method Blank	Field Blank	Trip Blank	NYS Water Quality(b)
Methylene Chloride	0.008 B	ND	0.013 B	0.024 B	0.026 B	0.007 B	0.029 B	0.018	0.023 B	0.025 B	0.050(2)
Acetone	0.020 B	ND	0.013 B	0.029 B	0.035 B	0.019 B	0.027 B	0.028	0.079	0.079	
Chloroform	ND	ND	ND	ND	0.005	ND	0.013	ND	ND	ND	0.10 (1)
2-Butanone	ND	ND	ND	ND	0.011 B	0.011 B	0.011 B	0.010	0.041 B	0.021 B	
1,1,1-Trichloroethane	ND	ND	ND	0.028 B	0.018 B	ND	0.034 B	0.004 J	0.016 B	0.024 B	0.050(1)
Toluene	ND	ND	0.018 B	0.039 B	0.028 B	0.028 B	0.030 B	0.024	0.030 B	0.035 B	0.050(2)
Trichloroethene	ND	ND	ND	ND	ND	ND	0.005	ND	ND	ND	0.010(1)

PESTICIDE ORGANICS

Compound	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	Method Blank	6 NYCRR 703 Standard(a)
4,4-DDT	ND	ND	ND	ND	0.00022	0.00007	0.00041	ND	Not Detectable
4,4'-DDD	ND	ND	ND	ND	ND	ND	0.00008	ND	Not Detectable

able 13 Continued . . .

SEMIVOLATILE ORGANICS										
Compound	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	Method Blank 429	Method Blank 430	Method Blank 436	6 NYCRR 703 Standard(a)
bis(2-Ethylhexyl)phthalate	0.012 B	0.010 JB	0.074 B	0.082 B	0.008 JB	0.014 B	0.053 B	0.014	0.027	0.007 J	4.2

CYANIDE AND LEACHATE INDICATOR COMPOUNDS (PPM)								
Compound	MW-1	MW-2	MW-4	MW-5	MW-6	MW-7	MW-8	6 NYCRR 703 Standards(a)
Cyanide	0.062	<0.010	<0.010	0.028	<0.010	<0.010	<0.010	0.2
Ammonia	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	
Chloride	<2.0	<2.0	2.0	25.0	86.0	98.0	92.0	250.0
Fluoride	0.25	<0.10	<0.10	0.53	1.40	0.14	2.0	1.5
Nitrate	2.0	1.6	1.4	5.90	9.90	5.60	10.3	10.0
Sulfate	205.0	13.0	21.0	75.0	105.0	75.0	115.0	250.0

NOTES:

ND - Not Detected
B - Analyte found in Method Blank(s) Samples
J - Estimated Value
(a) - NYSDEC Groundwater Classification, Quality Standards; September 1978
(b) - NYSHOD Drinking Water Standards; January 1989
1 - Standard Value
2 - Guideline Value

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TABLE 14

EDER GROUNDWATER SAMPLING RESULTS - MAY 1990

Well ID / Parameter	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-7A(a)	Trip Blank	6 NYCRR 703 Standard
Volatiles Organics (mg/l)										
Methylene Chloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Acetone	ND	ND	ND	ND	0.011 B	ND	ND	ND	0.023	
Chloroform	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.1
2-Butanone	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Carbon Tetrachloride	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.005
TCE	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.010
Toluene	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Pesticides										
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	NA	
4,4'-DDD	ND	ND	ND	ND	ND	ND	ND	ND	NA	
Total Metals (mg/l)										
Arsenic	0.0027 B	ND	ND	ND	ND	0.004 B	0.0023 B	0.0025 B	NA	0.025
Cadmium	0.003 B	0.003 B	ND	ND	0.003 B	ND	0.003 B	ND	NA	0.01

eder associates consulting engineers, p.c.

Table 14 Continued . . .

Well ID Parameter	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-7A(a)	Trip Blank	6 NYCRR 703 Standard
Chromium	0.034	0.005 B	0.005 B	0.005 B	0.006 B	0.008 B	0.004 B	ND	NA	0.05
Lead	0.0176	0.0091	0.005	0.0048	0.0144	0.008	0.006	0.0057	NA	0.025
Mercury	ND	ND	ND	0.00042	ND	ND	ND	ND	NA	0.002
Zinc	0.101	0.221	0.074	0.193	0.19	0.081	1.35	1.4	NA	5.0
Inorganics (mg/l)										
Cyanide	ND	ND	ND	ND	ND	ND	0.005	ND	NA	0.2
Phenols	ND	ND	ND	ND	ND	ND	ND	ND	NA	0.001
Nitrate	1.9	0.6	1.3	1.3	5.9	11	5	4.6	NA	10

NOTES:

ND - Not Detected
NA - Not Analyzed
B - Compound found in QA/QC blank (organics analysis). Concentration above instrument detection limit, but below CRDL (inorganics analysis)
(a) MW-7A is the QA/QC duplicate of MW-7

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SYOSSET, NEW YORK

TABLE 15

EDER GROUNDWATER SAMPLING RESULTS - JANUARY AND FEBRUARY 1992

Well ID Parameter	MW-1	MW-10	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	Field Blank	6 NYCRR 703 Standard
Chromium	0.012	ND	ND	0.011	ND	ND	ND	ND	ND	0.05
Copper	0.044	0.029	0.011 B	0.019 B	0.055	0.026	0.008 B	0.006 B	ND	1.0
Iron	1.8	1.22	0.404	1.96	1.02	0.316	0.126	0.098 B	ND	0.3
Lead	0.0081	0.005	0.0027	0.0044	0.0099	0.0026 B	0.0019 B	0.0019 B	0.0021 B	0.025
Zinc	0.16	0.168	0.227	0.316	0.104	0.072	0.082	1.46	0.053	0.3
Cyanide	ND	0.0105	ND	ND	0.0114	0.036	0.0141	ND	ND	0.1
Nitrates-Nitrites (as N)	2.1	2.0	1.0	1.3	1.2	3.8	11	4.6	ND	10.0

NOTES:

ND - Not Detected
B - Concentration above instrument detection limit but below CRDL
MW-10 is a duplicate of MW-1
All results in mg/l

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TABLE 16

EDER GROUNDWATER SAMPLING RESULTS - AUGUST 6, 7 AND 10, 1992

Well ID Parameter	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-7	MW-7(d)	MW-8	MW-8(f)	6 NYCRR 703 Standard
Chromium	0.020	<0.008	<0.008	0.013	0.009	0.053	<0.008	0.011	0.0115	<0.009	0.05
Copper	0.150	0.153	0.065	0.100	0.146	0.928	0.153	0.143	0.0491	0.0034 B	1.0
Iron	19.0	3.18	1.10	1.67	2.06	81.4	5.10	5.32	3.19	0.020 B	0.3
Lead	0.021	0.19	0.009	0.016	0.015	0.042	0.017	0.016	0.0073	<0.001	0.025
Zinc	0.189	0.518	0.046	1.04	0.450	0.282	1.11	1.12	0.0977	0.0432	0.3
Nitrate	2.0	1.0	1.1	1.3	3.4	15	3.6	3.6	0.4	NA	10
Cyanide	<0.005	0.0094	<0.005	<0.005	0.0156	<0.005	0.0052	0.009	0.0211	NA	0.1

NOTES:

All results are in mg/l
MW-7(d) is a duplicate of MW-7
(f) - Filtered sample
B - Concentration above instrument detection limit but below CRDL
NA - Not Analyzed

APPENDIX A

EDER ASSOCIATES CONSULTING ENGINEERS, P.C.
BASELINE RISK ASSESSMENT REPORT

TRIBUNE NEW YORK HOLDINGS COMPANY
NEW YORK, NEW YORK

BASELINE RISK ASSESSMENT REPORT
FORMER CERRO CONDUIT SITE
SYOSSET, NEW YORK

PROJECT #607-2E
SEPTEMBER 1991

EDER ASSOCIATES
CONSULTING ENGINEERS, P.C.
Locust Valley, New York
Madison, Wisconsin
Ann Arbor, Michigan
Augusta, Georgia

MW1490 093091

TRIBUNE NEW YORK HOLDINGS COMPANY
NEW YORK, NEW YORK

BASELINE RISK ASSESSMENT REPORT
FORMER CERRO CONDUIT SITE
SYOSSET, NEW YORK

PROJECT #607-2E
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EDER ASSOCIATES
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1.0 INTRODUCTION

1.1 OVERVIEW

This baseline risk assessment for the former Cerro Conduit facility in Syosset, New York was performed to evaluate the nature and extent of potential health impacts associated with various waste management areas and to determine acceptable risk-based concentrations of waste residuals in soil. This report is based on information from the Avendt Group, Inc. (AGI) Phase I, II and Phase III studies, the H2M groundwater investigation, and site investigations conducted by Eder Associates Consulting Engineers, P.C. (EA).

1.2 SITE DESCRIPTION AND HISTORY

1.2.1 Site Location

The approximately 40 acre site is located on Robbins Lane, Syosset, New York in an area characterized by light industrial and commercial establishments and residences. The site is bordered on the south by the Long Island Expressway service road and on the east by Robbins Lane. A Town of Oyster Bay maintenance facility and the inactive Syosset landfill border the property on the east, and the Long Island Railroad borders the property to the north (Figure 1).

1.2.2 Site History

The site was reportedly in agricultural use before Cerro constructed the plant in the early 1950's. Cerro manufactured steel electrical conduit, hot-rolled copper rod and steel strip. The primary wastewater generating processes were caustic cleaning, acid pickling, acid zinc/cyanide zinc electroplating and rinsing. The plant generated approximately 600,000 gallons of wastewater per day. After treatment, metals were removed from the wastewater in outdoor clarifier tanks and the treated effluent was discharged to three on-site recharge basins. During the plant's operating lifetime, metal hydroxide sludge, which probably contained primarily copper, iron and zinc, was removed from the clarifiers and disposed of in the southeast corner of the property (according to NCDH records) and at various off-site disposal locations by permitted waste haulers. In April 1982, Cerro was connected to the Nassau County sanitary sewer and the plant ceased the on-site discharge of treated effluent. Cerro terminated its activities at the site in 1986.

The site is listed on the New York State Department of Environmental Conservation (NYSDEC) "Registry of Inactive Hazardous Waste Disposal Sites" (Site #130002) as a Class 4 site.

1.2.3 Significant Site Reference Points

Soil investigations conducted by Cerro's consultant, AGI and by EA identified four areas of concern due to elevated copper and cyanide concentrations: the three wastewater recharge basins located southeast of the Cerro buildings; the stormwater drainage area located at the south corner of the property; the sludge area located at the southeast corner of the property; and the area at Boring B109 which is near the wastewater clarifier.

1.3 SCOPE OF RISK ASSESSMENT

This baseline risk assessment was prepared in accordance with the procedures in the United States Environmental Protection Agency (USEPA) Risk Assessment Guidance for Superfund Volume I Human Health Evaluation Manual and Volume II Environmental Evaluation Manual (USEPA, 1989a and b) and evaluates current and future human health risk associated with the areas identified in Section 1.2.3.

1.4 ORGANIZATION OF THE RISK ASSESSMENT REPORT

This risk assessment is comprised of six sections. Section 1.0, Introduction, provides background information on the location and facility operations and describes the scope of this assessment.

Section 2.0, Identification of Chemicals of Potential Concern, summarizes previous site investigations, presents a statistical summary of the data describing each area of concern and identifies the constituents for quantitative evaluation.

Section 3.0, Exposure Assessment, characterizes the exposure setting, identifies the actual and potential exposure pathways of concern, and quantifies constituent intake via these pathways.

Section 4.0, Toxicity Assessment, describes the critical toxicity values of the constituents of concern and explains how these toxicity values are used in the risk assessment.

Section 5.0, Risk Characterizations, integrates the information developed in the three preceding sections. Carcinogenic and non-carcinogenic human health risks are quantified and presented for each area of concern, along with a discussion of the uncertainties in the analysis.

Section 6.0, Summary, summarizes the results of this risk assessment report.

Toxicological profiles for the constituents of concern are presented in Appendix A. Risk calculations are presented in Appendix B.

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

2.1 SUMMARY OF SITE SAMPLING ACTIVITIES

Site investigations were conducted by AGI (AGI 1988, 1989), H2M and EA . Detailed information on the methodology and analytical data from the previous site investigations can be obtained from the various reports (Advent Group, Inc. 1988, 1989; and H2M, 1989). Drawings 1 through 3 and Figures 2 and 3 show the soil sampling locations, monitoring well locations, and areas of concern.

2.2 CONTAMINATION CHARACTERIZATION

This section presents the sampling results for each area of concern and for each sampled media. The contaminants are summarized by frequency of detection (the number of samples in which the chemical was detected over the number of samples analyzed), the maximum and minimum values of the constituent, the geometric mean, and the upper 95 percent confidence limit of the geometric mean. Where the upper 95 percent limit was greater than the maximum detected value (due to variability in the measured concentrations), maximum values were used in lieu of the calculated upper 95 percent limits.

The guideline for including or excluding constituent data used in calculating the geometric means and upper 95 percent limits were based on criteria in the Risk Assessment Guidance for Superfund (U.S. USEPA, 1989). Data were grouped according to types of analysis conducted and media sampled for each area of concern and the contaminants were evaluated based on the following criteria:

1. When a contaminant was not positively detected in a sample, one-half of the detection limit was used to represent the concentration of those samples in the calculations.

2. If blank samples contained detectable levels of common laboratory contaminants, sample results were considered positive only when the concentration exceed 10 times the maximum amount detected in any blank. USEPA considers acetone, 2-butanone, methylene chloride, toluene, and the phthalate esters as common laboratory contaminants.

3. If the blank contained detectable levels of organic or inorganic chemicals that USEPA does not consider common laboratory contaminants, the results were considered positive only if the contaminant concentration exceeded five times the maximum amount detected in any blank. Where sample results did not exceed five times the amount in the blank, the sample was considered a non-detect and the concentration in the blank was considered to be the detection limit for the contaminant in the sample. If all samples contained less than five times the level of contamination noted in the blank, the contaminant was eliminated from the set of sample results.

4. Data with qualifiers that indicate uncertain concentration were included in the calculation.

5. For duplicate samples, the larger value was used in the calculations as a conservative approach to the variable data.

2.2.1 Site-Wide Soil Surface (Grid Soil Samples)

The results of AGI's Phase I soil sampling program are summarized in Table 2-2. The samples were analyzed for metals using EP methodology and volatile organic compounds. In Phase II, thirteen soil samples were collected on a grid pattern at 3' or 6' depths at locations previously sampled in Phase I and analyzed for total metals and cyanide. The analytical results are summarized in Tables 2-3 and 2-4. The data shows that total metal concentrations in soil were within background and that cyanide was only detected in one sample at low concentration.

2.2.2 Area Around Clarifier

Three soil samples (B101, B109, and B113) were collected in the vicinity of the clarifiers during Phase II (Table 2-5). Only copper was found at a concentration exceeding soil background at B109, adjacent to the clarifier. Additional soil samples were collected in the area of boring B109 during the Phase III sampling (B109A, B109B, B109C, and B109D) (Figure 3). As shown in Table 2-6, the concentrations of copper in these samples were within background. Cyanide was not detected in these soil samples.

2.2.3 Wastewater Recharge Basins

The three wastewater recharge basins and the sludge in the Basin #2 concrete headwall distribution structure were sampled during the site investigations. During AGI's Phase II soil investigation, five samples were taken at 6' depths and 32 samples were collected at 3' and 6' depths on a 50-foot center uniform grid. During EA's soil investigation, samples were collected in eight locations at various depths. The concentrations of total copper, cyanide and EP copper in each wastewater basin at each depth during the AGI Phase III and EA's sampling programs were combined and are shown in Tables 2-7, 2-8 and 2-9. The sludge sampling data for the Basin #2 concrete inlet structure are not included in the risk assessment because the sludge will be removed from the structure and disposed of off-site in accord with Federal and State regulations.

2.2.4 Stormwater Drainage Basin

Soil samples were collected in four locations at various depths (5-7', 10-12', 15-17') from the stormwater drainage area during EA's 1991 soil investigation and analyzed for total copper, EP copper and cyanide. A soil sample was also collected at each of the two stormwater discharge pipe outfalls at 0 to 6 inches and analyzed for TPH, TCL metals, volatile organics, semi-volatile organics, pesticides and PCBs. In addition, 4 borings were drilled and soil samples collected at 0-22' depths from the stormwater drainage area and analyzed for total and EP copper. The constituents detected in surface soil from the stormwater outfall area are shown in Table 2-10. Table 2-10 shows copper and cyanide concentrations in soil samples from the stormwater drainage area. Copper concentrations exceed background only in surface samples.

2.2.5 Former Sludge Area

Surface soil samples were collected from 36 locations in the former sludge area during EA's soil investigation and analyzed for total copper. The three samples which contained the highest concentrations of total copper were also analyzed for EP copper. The data were combined and are shown in Table 2-12 which indicates that copper concentrations exceeded background in surface soil.

2.2.6 Groundwater

H2M sampled eight monitoring wells (MW-1 to MW-8) and EA sampled five wells to characterize groundwater contamination. Water level elevations measured by H2M confirm that the site is located over a regional groundwater divide and that the groundwater flow direction varies seasonally. During H2M's August 1987 Phase

I investigation, groundwater samples from Wells MW-1, 2, 3, 4, and 5 were analyzed for TCL metals, volatile organic compounds and total dissolved solids. A sample from MW-3, which according to H2M was screened in perched water, was also analyzed for the same suite of constituents. During the Phase II investigation, groundwater samples from MW-1, 2 and 4-8 were analyzed for the full TCL, Total Organic Halides, (TOX), cyanide and leachate indicators. EA collected groundwater samples from wells MW-2, 5, 6 and 7, and a perched water sample from MW-3 which were analyzed for priority pollutant metals, semi-volatile and volatile organic compounds, pesticides and PCBs. Constituents detected in groundwater and in perched water (at MW-3) are summarized in Table 2-13.

2.3 QUALITY CONTROL

2.3.1 QA/QC Evaluation

All laboratory analyses done as part of AGI's investigation were reportedly performed according to NYSDEC CLP protocol. EA's investigation followed the firm's sampling QA/QC procedures including duplicate, spike, and rinsewater samples. CLP laboratory data qualifiers were provided for most of the raw data, and raw data was used based on the criteria in the Risk Assessment Guidance for Superfund (U.S. USEPA, 1989). The blank values were not always provided in the data set, however, when they were available, they were used in calculations if they met the previously mentioned criteria.

2.3.2 General Data Uncertainty

The various field investigations and project laboratories imply an uncertainty in the analytical database and, to compensate for this uncertainty, the more conservative or higher values were used in all calculations. For instance, when samples were duplicated or had higher detection limits, the higher concentration was used. When the calculated 95 percent upper limit was greater than the maximum value detected in the sample set, the maximum value was used as the 95 percent upper confidence limit in the risk assessment. If only one sample was collected, this value was used in the risk assessment as both the geometric mean and the 95 percent upper limit.

Sampling schemes also imply uncertainty. Groundwater samples were not collected on the same date and all wells were not sampled during each sampling program. Due to the variability in the groundwater quality data, the groundwater quality data from all sampling rounds were used in the calculations. When possible, the soil data for each constituent were combined at each depth and at each area of concern.

2.4 CHEMICAL CONSTITUENTS OF CONCERN

The chemicals of potential concern were selected according to the Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (USEPA 1989). For soil constituents, the detected constituents were selected if measured concentrations exceeded background. For groundwater, constituents were selected if their concentration exceeded USEPA Maximum Contaminant Levels (MCL) or NYSDEC's Groundwater Standards (6 NYCRR 703.5). A MCL is the maximum permissible level of a contaminant in water delivered to any user through a public water system. The following subsections describe the screening process for the chemicals of concern in groundwater and soil for each area of concern at the site.

2.4.1 Site-Wide Soil Surface

The metal concentrations found in the Phase I uniform grid soil samples (Table 2-3 and Table 2-4) were compared to background levels and, in all instances, concentrations of total metals were below background. Cyanide was detected in low concentrations and considered to be background. The site-wide soil surface was therefore eliminated from this risk assessment.

2.4.2 Vicinity of Clarifiers

The concentration of total copper in soil samples collected at the 25-foot depth in B109 was 2200 ppm. However, concentrations of total metals and cyanide found in soil samples in the vicinity of the clarifier during the Phase III sampling did not exceed background indicating that the copper detected at B109 was probably a local hot spot. Due to the localized nature of soil contamination in this area and the fact that contamination was limited to the 25 foot depth, there is virtually no possibility of inadvertent human exposure and risk is not evaluated separately for this area.

2.4.3 Wastewater Recharge Basins #1, #2 and #3

The total copper and total cyanide concentrations in soil samples taken three feet below the three basin floors (Tables 2-7, 2-8 and 2-9) are higher than the background levels of copper (1-70 ppm) or cyanide (undetected - 1.4 ppm, site background). Copper and cyanide in the wastewater recharge basins were selected as chemicals of concern.

2.4.4 Stormwater Drainage Area

The concentration of copper in surface soil samples (0-6 inch depth) were higher than background levels (Table 2-10). Semi-volatile organics detected included phenanthrene, di-n-butylphthalate, fluoranthene, pyrene, butylbenzylphthalate, bis(2-ethylhexyl)phthalate and di-n-octylphthalate. Since the relationship of these constituents to Cerro's operations is uncertain, and the phthalates are recognized as laboratory contaminants, these constituents were included in this risk assessment as a conservative measure to overstate the probable risk. Compounds where chronic reference dose values (RfDs) are available were selected to evaluate non-cancer risks. Compounds where cancer slope factors are published were selected for carcinogenic effects evaluation. As a result, fluoranthene, pyrene, butylbenzylphthalate, and bis(2-ethylhexyl)phthalate were selected for non-cancer effects evaluation, while bis(2-ethylhexyl)phthalate was evaluated for carcinogenic effect.

2.4.5 Former Sludge Area

Concentrations of total copper and cyanide in surface soil samples (Table 2-12) were higher than background for copper (1-70 ppm) and for cyanide (undetected-1.4 ppm, site background). Therefore, copper and cyanide were selected as chemicals of concern.

2.4.6 Groundwater

Data from MW-3 was not included in the risk assessment as this well was screened in perched water and is not representative of groundwater quality. This well was not sampled by H2M during Phase II investigation for this reason (H2M, 1989). Cyanide was detected in concentrations below New York State Groundwater Standards and it was not selected for evaluation as a chemical of concern. Lead was detected in groundwater samples from upgradient wells MW-1 and MW-2 at concentrations above the New York State Groundwater Standards. However, lead was not detected in site soil at concentrations above background. The elevated concentration of lead in groundwater was not considered to be related to the site conditions but it is included in the risk assessment to stress the conservative intent of the evaluation. Therefore, copper and lead were evaluated for the groundwater pathway.

2.4.7 Summary of Chemicals of Concern

The constituents selected as chemicals of concern for each area of concern were summarized in Table 2-14.

3.0 EXPOSURE ASSESSMENT

3.1 CHARACTERIZATION OF EXPOSURE SETTING

3.1.1 Climate

Syosset, Long Island is in a temperate - climate belt (Franke and McClymonds (1972). The mean annual temperature on the island is about 51°F (11°C). Area precipitation averages about 44 inches per year and is fairly evenly distributed throughout the year. The prevailing wind direction on Long Island is northwest during most of the year, except during the summer months when south and southwest winds prevail.

3.1.2 Geologic Setting

This discussion of the site geology and hydrogeology is derived from H2M's February 1989 Phase II Investigation.

Syosset is situated on a gently sloping glacial outwash plain, underlain by unconsolidated deposits. The Lloyd Aquifer lies directly on top of bedrock and is under artesian conditions. The Raritan clay, which is approximately 150 feet thick, is the overlying confining unit. The Magothy Aquifer, which consists of sand, gravel, silt and clay lies above the Raritan Clay. The saturated thickness of the Magothy Aquifer near the site is approximately 520 feet. (USGS Professional Paper 627-E, 1972). This formation currently supplies approximately 90 percent of Nassau County's public water supply. The Upper Pleistocene deposits are surficial deposits, which are up to 100 feet thick in some areas. These deposits consist of stratified sand and gravel and are the result of the most recent glaciation. Regional hydrogeologic studies indicate that there is a regional groundwater divide in the vicinity of the site and the horizontal direction of groundwater flow at the site is variable and probably seasonally dependent. The average flow direction is westerly, changing to north-westerly in the summer and to south- westerly in the winter. Depth to groundwater at the site is approximately 100 feet.

3.1.3 Demographics

The 3.14 square mile area encircled by a one mile radius from the site with an estimated population of 19,000 (Nassau-Suffolk Regional Planning Board, 1990) has 6 schools, 2 parks, and 1 hospital (Hagstrom, 1989) (see Figure 4). There are no residences adjacent to the site.

3.2 IDENTIFICATION OF EXPOSURE PATHWAYS

The fate of the constituents of concern in soil, water and air, as well as the potential for migration, are discussed in this section.

3.2.1 Areas of Concern

A number of areas of concern have been identified based on past activities and as a result of soil sampling. These include:

- Wastewater Recharge Basin #1
- Wastewater Recharge Basin #2
- Wastewater Recharge Basin #3
- Former Sludge Area
- Stormwater Drainage Area

AGI's site investigation found copper at 2,200 mg/kg approximately 25 feet below grade near the former in-ground wastewater holding tank (copper holding pond) and clarifier at Soil Boring B109. However, AGI reported that the elevated copper concentration was caused by a break in an underground wastewater pipe and the extent of soil contamination was very limited. Thus, soil in the vicinity of the clarifier was not considered as a source area.

3.2.2 Fate and Transport of Constituents of Concern in Release Media

To preserve the conservative nature of this risk assessment, the fate and transport of the constituents of concern in the various release media were always assumed as worst possible cases and the factors that tend to reduce the impact of the constituents such as:

- retardation
- natural attenuation/adsorption
- biodegradation
- volatilization

are not considered.

3.2.3 Contaminant Migration Pathways

Constituents detected at the site may migrate towards other environmental media within the Cerro site or towards downgradient receptor areas. Constituents in the soil may be transported via soil to groundwater and soil to air pathways. Once the constituents have been transported into other media, additional transport may occur. However, since there is no surface water in the vicinity of the site, there is no soil to surface water pathway. Moreover, copper and lead, the constituents of concern in the groundwater, are not volatile and are not expected to be transported from groundwater to air.

There is a theoretical pathway from soil to on-site groundwater, however, Cerro operated the site for approximately 30 years with an on-site groundwater discharge (approximately 600,000 gpd) and outdoor sludge storage. Given the possibility of groundwater impact, it would be reasonable to find residuals in the site groundwater. The various groundwater investigations have not found this impact except for lead which apparently has an off-site origin, because it was not found in the waste management area or in the site soil at any significant concentrations. In addition, virtually all of the sludge was removed from the site and the wastewater discharge (some 600,000 gpd) was terminated around 1982. In effect, whether or not the pathway exists, the source and driving force have been virtually eliminated.

3.2.4 Potential Routes of Exposure

Based on the areas of concern discussed in Section 3.2.1 and the environmental features and surroundings of the site, the following exposure pathways were initially considered to be of potential significance:

- Soil ingestion
- Direct Contact with Soil/Dust
- Soil inhalation
- Groundwater ingestion

These pathways were all screened and retained for quantitative evaluation. The following rationale was used to select these exposure routes.

3.2.4.1 Soil Ingestion

As discussed in Section 2, copper and cyanide were found above background in soil from Basin #1, 2, and 3, as well as in the stormwater drainage area and the former sludge area.

Workers on the site in its current condition, assuming no redevelopment and the continued existence of the areas of concern, could be exposed to contaminated soils. To preserve the conservative risk approach, the analysis admits the possibility that trespassers can access the site by climbing over or cutting through the security fence and they may inadvertently contact contaminated soil/dust and ingest a portion of the soil/dust while playing or eating. Since the possibility exists, this risk assessment evaluates this exposure pathway.

3.2.4.2 <u>Dermal Contact With Soil/Dust</u>

After constituents in the soil are deposited on the body surface, they can be absorbed through the skin and the dermal contact exposure route was evaluated in this risk assessment.

3.2.4.3 <u>Soil Inhalation</u>

Individuals in the vicinity of the site could be exposed to contaminants transported from surface soil as suspended particulates or dusts. Since soil particles are inhaled and copper and cyanide have been found in on-site surface soil, the health impact of this exposure pathway on workers at industrial facilities adjacent to the site boundary and nearby residents was evaluated.

3.2.4.4 <u>Groundwater Ingestion</u>

A well survey conducted in September, 1991 indicated that there are no private wells within a one mile radius of the site (see Figure 5). Cerro operated two on-site cooling water wells. Although Article IV, Section 4, Nassau County Health Ordinance, effectively precludes the installation of a private supply well where the area is served by a public supply, the potential public health risk associated with this hypothetical exposure route was evaluated to ensure a conservative approach.

3.3 QUANTIFICATION OF CHEMICAL INTAKES

Human exposure or chemical intake via the various pathways described in Section 3.2.4 must be determined to assess the real or potential health effects associated with the site. Estimated daily intakes of the selected contaminants of concern are calculated for each population associated with each exposure pathway. Two sets of contaminant concentrations were used to estimate human intakes: the geometric mean concentration as an estimate of the representative average exposure, and the 95% upper confidence limit of the geometric mean as an estimate of the reasonable maximum exposure. Geometric means for an area of concern were calculated by including all samples collected and assuming that the value of the non-detected samples were equal to half the detection value. This procedure yields a conservative geometric mean because it is likely that compounds were not present in the non-detects.

3.3.1 Soil Ingestion

The site is located in an industrial area with the closest residential homes about 1/4 mile away. The facility is closed and the buildings are vacant. Although the site is fenced and there is a security guard on duty, as with any other site the potential for illegal trespass always exists. Potential receptors would probably consist of older children and adults. However, to be conservative, the age of the exposed trespasser is assumed to be between 1-6 years because children in this age group have a high soil ingestion rate. Moreover, trespass episodes are assumed to occur with the same child 5 days per week, 50 weeks per year for a total of 250 exposure days per year.

A site-specific constituent intake rate for soil ingestion can be estimated from constituent concentrations in soil, the soil ingestion rate, the fraction of soil ingested from a contaminated source, exposure frequency and duration and body weight as shown in

Table 3-1. According to USEPA (1989), the soil ingestion rate for children between 1-6 years old is 0.2 g/day. Constituent concentrations in the surface soil (0-3 ft) were used in the calculation since young children are most likely to ingest surficial soils.

Assuming a future use exposure scenario, the basins, the drainage area and the sludge area are assumed to be filled in and graded for development. These basins are about 30-50 feet deep and after they are filled there would be virtually no potential for inadvertent exposure. However, since the site is zoned for industrial use, potential exposures to unprotected on-site workers is also evaluated as a conservative scenario.

3.3.2 Dermal Contact With Soil

After constituents in the soil are deposited on the body surface they can be absorbed through the skin. The site-specific absorbed dose of constituents from direct contact with site soil was estimated (see Table 3-2). The site-specific constituent absorbed dose from direct contact with soil was calculated from constituent concentrations in soil, skin surface area available for contact, the soil to skin adherence factor, dermal absorption factor for soil constituents, exposure frequency and duration and body weight.

The skin surface area available for contact is 3,120 cm^2 for adults (EPA, 1989), assuming arms and hands are exposed to soil/dust. For children under six, the skin surface area available for contact is estimated at 1,360 cm^2 (USEPA, 1989), also assuming that arms and hands are exposed to soil/dust deposit. Once covered with soil, a fraction of the constituents is assumed to penetrate through the skin. Dermal absorption for soil inorganic constituents was estimated at 1.8% for children and 0.9% for adults

(Hawley, 1985). For semi-volatile organics, the dermal absorption factor was assumed to be 0.1 (Ryan, 1987).

3.3.3 Inhalation of Soil Particulates

As discussed in Section 3.2.4.3, copper and cyanide in surface soil can be entrained in the air and inhaled. Thus, the site specific intake of these inorganic constituents was calculated using the equation in Table 3-3.

As a first step, the potential fugitive dust emission from site soil was derived by the following equation:

$$E = 1.7\ (S/1.5)[(365-p)/235]\ (f/15)$$ (USEPA, 1987)

Where:

E = Total suspended particulate emission factor (lb/acre/day)

S = Silt content of soil (percent)

p = Number of days per year with $\geq$ 0.01 inch of rain

f = Percentage of time that the unobstructed wind speed at the site exceeds 12 mph

The sandy pea gravel soil at the site is not expected to be as erodible as a soil with higher silt content. To be conservative, it was assumed that the contaminated soils have a silt content of 10 percent based on the average silt content of a sandy soil (USEPA, 1989b). The number of wet days per year is approximately 150 ($\geq$ 0.01 inch of precipitation) (USEPA, 1988). In addition, it was conservatively assumed that 50 percent of the wind speed at the site exceeds 12 mph (NOAA, 1989). Substituting these values into the equation gives a particulate matter emission rate of 34.6 lb/acre/day or 4.49×10^{-2} mg/m^2/sec.

The ambient impact of dust generated from the site on surrounding industrial facilities was then evaluated by applying this emission rate to a box model with no transverse dispersion (Hanna et al. 1982). The following conservative assumptions were made for individuals exposed at or near the source area:

- The receptor is at the downwind edge in the source area.

- The constituent is assumed to be uniformly mixed in a layer from the ground to the breathing zone and there is no dispersion higher than this zone.

- The wind speed (u) is assumed constant within the layer.

The particulate concentration inside the box can be calculated by the following equation:

$$PC_1 = \frac{E \times L}{H \times u}$$

Where:

PC_1 = Suspended Particulate Concentration (mg/m3)

E = Total Suspended Particulate Emission Rate (mg/m^2/sec)

u = Average Wind Speed (m/s)

L = Crosswind Width of the Source (m)

H = Breathing Height (m)
= 2 m or 6.5 feet

The total particulate concentrations for the various areas of concern are listed in Tables B-31 to B-35.

The off-site concentration was estimated assuming horizontal and vertical dispersion of the contaminants as they are transported to the downwind receptor point. The equation used to calculate the downwind air concentration is as follows:

$$PC_2 = \frac{j\,E\,A}{\pi \sigma_y \sigma_z u}$$

Where:

j = Frequency of wind toward the exposure point
E = Emission rate ($mg/m^2/sec$)
A = Area of source (m^2)
σy = Dispersion factor in crosswind direction (22 meter, assuming E stability) (from USEPA, 1988).
σ_z = Dispersion factor in vertical direction (12 meter, assuming E stability) (from USEPA, 1988).
u = Mean wind speed (5.5 m/s)
π = 3.14

The equation used to estimate site-specific constituent intake from the inhalation of soil/dust is shown in Table 3-3. The model assumes that exposure would occur 24 hours a day, 365 days per year for 30 years and that all suspended particulates in the air are respirable and can reach the lung for absorption. This is a very conservative assumption. For off-site worker exposures, it is assumed that exposure would occur 8 hours a day, 250 days per year for 30 years. In addition, since the closest off-site worker is assumed to be just outside the site boundary, the on-site particulate concentration was used to evaluate off-site worker exposure as a conservative approach.

3.3.4 Groundwater Ingestion

The equation for constituent intake via groundwater ingestion is shown in Table 3-4. The hypothetical receptor is an adult or child obtaining drinking water from a downgradient residential well. However, a September, 1991, well survey indicated that there are no private potable supply wells in the area of the Cerro site (Figure 4) and Nassau County Public Health Ordinance virtually precludes the installation of private potable supply wells in a developed area. Nevertheless, this potential exposure route was evaluated as a conservative measure. The groundwater ingestion rate was assumed to be two liters per day for adults and one liter per day for children. These exposure values are sufficiently conservative to allow for multiple water uses and related exposures because the average person consumes less than 0.5 l/day of tap water for drinking purposes (Adelman, 1984). The average adult body weight was assumed to be 70 kg. The potential risk associated with current measured concentrations of constituents in the groundwater database was used as a conservative proxy for off-site residential exposure.

4.0 TOXICITY ASSESSMENT

Toxicological evaluations of the constituents of concern are summarized in Appendix A. The health-related criteria used to evaluate the potential health risk are identified in this section.

4.1 CARCINOGENIC VERSUS NON-CARCINOGENIC HEALTH EFFECTS

A public health risk assessment typically divides the toxic effects of chemicals into two general classes. The first class of non-carcinogenic effects includes the adverse health effects not associated with an increased risk of cancer in the exposed population. Non-carcinogenic impacts can affect a number of body systems and have the general property that there is a range of doses above zero and below a "threshold" level where adverse effects are unlikely to occur in the exposed population. This threshold provides the basis for defining "acceptable" dose levels and exposures for this class of effects.

Carcinogenic effects relate to the increased risk of cancer in a population exposed to a particular chemical agent. It is generally assumed that the magnitude of the carcinogenic effect (the increased risk of cancer in an exposed population) is a linear function of the dose of carcinogenic exposures received by the population. In this case, there is no "threshold" or acceptable dose of carcinogens and the carcinogenic activity of a substance is generally characterized in terms of a potency value which defines the relationships between dose and the incremental risk to the exposed population.

4.2 REFERENCE DOSE (RfD)

The criteria used to evaluate the potential for non-carcinogenic effects are referred to as reference doses which are derived by USEPA based on the amount of a substance that is not expected to produce adverse non-carcinogenic health effects in the general population, including sensitive subgroups. Reference doses may be defined for subchronic exposures and for long-term chronic exposures. Most chronic acceptable exposure levels are based on long-term epidemiologic studies involving animals or, occasionally, humans. The highest chronic exposure level that is believed not to cause an adverse effect (NOAEL) is determined from all appropriate literature studies. The NOAEL is then adjusted by an uncertainty factor to derive the acceptable exposure level.

Reference doses (RfDs) are compared to route-specific intake rates of a chemical to assess the health impact of non-carcinogens. If the ratio of the average daily dose to the reference dose exceeds 1.0 for the duration of the exposure, the exposed population may experience adverse health effects. Because of the uncertainty in the definition of a reference dose, it is generally believed that they are low enough to protect health in most populations and exposure circumstances, and that a dose to reference dose ratio of approximately 1.0 should be considered more nearly an estimate of the maximum "safe" dose than an indication that there will be adverse effects in an exposed population.

Chronic reference doses used in this risk assessment have been developed by USEPA for the constituents subject to a quantitative risk assessment (Table 4-1). Reference doses for the oral route were used as a proxy to evaluate dermal exposure routes and inhalation exposure when inhalation route-specific RfDs were not available.

4.3 CARCINOGENIC POTENCY FACTORS

Carcinogenic risks are estimates of the increase in lifetim cancer risk that a population would experience given a specific exposure to one or more carcinogenic chemicals. The Carcinogenic Potency Factor (CPF) for a chemical is the upper 95 percent confidence limit on the slope of the chemical dose-response curve and mathematical extrapolation models (commonly a linearized multi-stage model) are used to estimate the maximum possible linear slope at low extrapolated doses consistent with the data. Carcinogenic potency factors are used to estimate potential cancer risk by multiplying the chronic daily intake (CDI) of a compound by the CPF. CPFs are expressed as the lifetime cancer risk per mg of the compound per kg body weight per day.

USEPA does not classify copper and cyanide, the main constituents of concern at the Cerro site, as carcinogenic. The CPF for bis(2-ethylhexyl) phthalate, the only carcinogenic constituent evaluated, is listed in Table 4-2. This compound is a generally accepted laboratory contaminant and its reported presence at low levels does not indicate that it relates to the site conditions.

5.0 RISK CHARACTERIZATION

In this section, the toxicity and exposure assessments are summarized and integrated into quantitative and qualitative expressions of risk and the nature and degree of risk to the potential receptor populations described in Section 3 is evaluated.

To characterize potential non-carcinogenic effects, comparisons are made between the projected intake of a substance and its reference dose to obtain a hazard quotient. A hazard index (HI) approach is used to assess the overall potential for non-carcinogenic effects posed by more than one chemical. This approach assumes that simultaneous subthreshold exposures to several chemicals could result in an adverse health effect and assumes that the magnitude of the adverse effect will be proportional to the sum of the ratios of subthreshold exposures to acceptable exposures. The hazard index is the sum of the hazard quotients, as described in the following equation.

$$\text{Hazard Index} = E_1/RfD_1 + E_2/RfD_2 + \ldots + E_i/RfD_i$$

Where:

E_i = Exposure level (or intake) for the i^{th} toxicant (mg/kg/day)

RfD_i = Reference dose for the i^{th} toxicant (mg/kg/day)

For carcinogens, risks are estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the potential carcinogen. Incremental individual lifetime cancer risk is calculated by multiplying exposure levels for each carcinogenic contaminant by its respective cancer potency factor (slope factor).

Risk = CDI x SF

Where:

Risk = A unitless probability of an individual developing cancer.

CDI = Chronic daily intake averaged over 70 years (mg/kg-day); and

SF = Slope factor, expressed in $(mg/kg\text{-}day)^{-1}$

The total combined cancer risk is then estimated by summing the risk estimates derived for each exposure pathway.

For each exposure scenario, risk was estimated for the reasonable maximum (MEI) and the representative average (AEI) exposure using the upper 95% confidence limit and the geometric mean concentration, respectively. The hazard indices are shown in exponential notation. Where exponentials (the E numbers) are negative, the hazard index is less than unity and there is no significant non-carcinogenic risk. The USEPA's generally acceptable carcinogenic risk level is one in a million or $1x10^{-6}$.

5.1 <u>RISK ASSOCIATED WITH CURRENT RESIDENTIAL EXPOSURE</u>

In keeping with the conservative nature of this risk assessment, it is assumed that off-site residents may be exposed to site constituents via ingestion, direct contact and soil inhalation.

Tables 5-1 to 5-5 summarize the total hazard index from the soil exposure pathways for each area of concern. For a reasonable maximum adult exposure, the total hazard indices for the various areas of concern are as follows: Wastewater Recharge Basin #1, 2E-02; Basin #2, 6E-02; Basin #3, 5E-02; Stormwater Recharge Basin, 2E-02 and Sludge Area, 3E-02. For the representative average exposure to an adult, the total hazard indices for these areas of concern are: Basin #1, 8E-03; Basin #2, 7E-02, Basin #3, 5E-03; Stormwater Discharge Basin, 8E-03; and Former Sludge Area, 1E-02.

The total hazard indices for the various areas of concern assuming the reasonable maximum exposure scenario for a child are as follows: Wastewater Recharge Basin #1, 2E-01; Basin #2, 4E-01; Basin #3, 4E-01; Stormwater Recharge Basin, 1E-01; and Former Sludge Area; 2E-01. For the representative average exposure to a child, the total hazard indices are also all below unity and indicate that there would be no significant non-carcinogenic effects.

These hazard indices are calculated using constituent concentrations in surface soil. Hazard indices calculated using constituent concentrations from deeper depths are lower (Appendix B). None of the total hazard indices for these areas of concern exceed unity. Therefore, exposure to soil constituents should have no significant non-carcinogenic effect.

The only carcinogenic constituent detected in site soil is bis(2-ethylhexyl)phthalate, a laboratory contaminant which was found in a sample from the stormwater drainage pipe outfall area. The total carcinogenic risk associated with the adult exposure to stormwater drainage basin soil is 4×10^{-8} and for children it is 2×10^{-8} (Table 5-6). These risks are less than the USEPA accepted risk level of one in one million or 1×10^{-6}.

The total hazard index for a child exposed to site groundwater is 3E+0 for the reasonable maximum estimate, and 4E-01 for the representative average estimate (Table 5-7). The total hazard index for an adult exposure to groundwater is 2E-01 and 2E-01 for reasonable maximum and representative average estimates, respectively. Therefore, exposure to groundwater constituents should have no significant non-carcinogenic effect under the representative average estimate. Lead contributes 79% of the total hazard index under the reasonable maximum child exposure and 78% under the representative average exposure. Lead was not detected in site soil and its presence in upgradient monitoring wells indicates an off-site source.

For the residential exposure of a child, the total hazard index for all exposure pathways , as shown in Table 5-8, is 4E+0 and 5E-01 for reasonable maximum and representative average estimates. For adult residential exposure, the total hazard index is 2E+0 and 2E-01 for reasonable maximum and representative average estimates, respectively. The hazard index for the representative average and reasonable maximum case is attributable to lead exposure and, as no validated reference dose has been established for lead, was based on an acceptable intake level derived by USEPA (USEPA, 1986). Potential health effects for lead can also be evaluated using the relationship between lead in water and blood lead levels established in USEPA (Fed. Register, 1991). For infants, a correlation coefficient of 0.04 ug/dL of blood lead per ug/l water lead was derived, assuming intake of 1 liter of water per day. The 95% upper limit of lead concentration from groundwater in on-site monitoring wells is 60 ug/l. Therefore, the ingestion of groundwater would result in an increase in blood lead level of 2.4 ug/dL. For adults, a slope of 0.06 ug/dL blood per ug/l water at water lead levels above 0.015 ug/l is established. Ingestion of groundwater at a concentration of 60 ug/l would result in an increse in blood lead level of 3.6 ug/dL. The present average blood lead level is about 6 ug/dL for the general population (USEPA, 1991b). Therefore, the total blood lead concentration is estimated to be 8.4 ug/dL for children and 9.6 ug/dL for adults. This estimated blood lead level is below USEPA's level of concern of 10-15 ug/dL of lead in blood. Therefore, reasonable maximum exposure to lead in groundwater should have no adverse health effects.

5.2 RISK ASSOCIATED WITH FUTURE RESIDENTIAL EXPOSURE

As discussed in Section 3.2.4, the Cerro facility is no longer in operation. The buildings will be demolished and the property redeveloped. Moreover, the site is located in an industrial area and is zoned for industrial use. It is extremely unlikely that there will be residential use on-site. In addition, in the event of future development, the various basins and former sludge area will be filled and graded. Since these basins are about 30 to 50 feet deep, there should be no potential inadvertent exposure in these areas under any reasonable future use scenario. Moreover, even if the various basins are not filled in, the risk associated with a future residential exposure scenario is expected to be the same as the current exposure scenario as a worst case approximation.

5.3 RISK ASSOCIATED WITH CURRENT OFF-SITE WORKER EXPOSURES

As discussed in the previous section, the former Cerro Conduit facility is no longer in operation. Therefore, current worker exposure is limited to workers in nearby industrial facilities and the most likely exposure pathway is via the inhalation of soil particulates.

Table 5-9 summarizes current non-carcinogenic risk associated with off-site worker exposure. Total hazard index for each area of concern under the reasonable maximum exposure scenario are as follows: Wastewater recharge Basin #1, 4E-04; Basin #2, 1E-03; Basin #3, 5E-04; Stormwater Drainage Basin 4E-04; and Former Sludge

Area; 3E-03. Total hazard index for the inhalation pathway is 5E-03 for the reasonable maximum estimate, and 1E-03 for the representative average estimate. Therefore, there should be no significant non-carcinogenic effect. As shown in Table 5-10, the total cancer risk associated with the inhalation of site soil for an off-site worker closest to the site is $2x10^{-10}$, which is less than the USEPA accepted risk level of one in a million or $1x10^{-6}$.

5.4 RISK ASSOCIATED WITH FUTURE WORKER EXPOSURE

Although it is not likely that the property will be used as an industrial facility without filling in the basins, this scenario was evaluated as a worst-case estimate of potential health risk. In this scenario, on-site workers, including those involved in site preparation and grading, may be exposed to soil constituents via ingestion, dermal contact, and inhalation pathways.

The total future non-carcinogenic risks associated with on-site worker exposure are summarized in Tables 5-11 to 5-15. Since the total hazard index for each area of concern ranged from 2E-02 to 6E-02 for the reasonable maximum estimate, and from 5E-03 to 1E-02 for representative average exposure, there should be no significant non-carcinogenic effect. Total carcinogenic risk for future on-site worker exposure is summarized in Table 5-16, and is estimated to be 4×10^{-8} for both reasonable maximum and representative average estimates. This risk is lower than the USEPA accepted one in a million ($1x10^{-6}$) risk level. The total hazard indices as shown in Table 5-17 are less than unity, therefore, there is no significant non-carcinogenic effect under the reasonable maximum and representative average estimates.

5.5 UNCERTAINTY ANALYSIS

The methods used to estimate the public health impact associated with an exposure to soil and groundwater at the Cerro

Conduit site involve many analytical assumptions, models and procedures which introduce uncertainty. This section addresses the principal sources of uncertainty in the risk estimates.

5.5.1 Uncertainty in Sampling and Analytical Results

All of the exposure, dose and risk estimates developed in this assessment ultimately depend on the chemical sampling and analytical results obtained during the RI and they reflect the limitations and inherent uncertainties in the database.

This risk assessment is based on an analytical database developed by three consulting firms over a period of four years. The major database concerns relate to whether the samples were collected in a consistent manner and at locations which truly represent the areas being characterized, and whether there are enough samples to adequately characterize the concentrations of various agents in the media of concern. In defense of the database, the samples were analyzed using either New York State DEC Contract Laboratory Program (CLP) protocols or USEPA methods.

During AGI's site investigation, extensive site wide soil sampling was conducted and the soil sampling locations, depth, and parameters to be analyzed were selected by the NYSDEC. In addition, the parameters selected for investigation were selected based on the plant's past operation. During EA's site investigations, soil samples were collected in areas and at depths formerly not studied (e.g., the stormwater drainage area) and groundwater samples were collected to verify data collected by H2M. Because of the large number of soil samples analyzed during the site investigations, the level of uncertainty in sampling and the database compiled from the analytical results is likely to be low.

5.5.2 Uncertainty in Exposure and Dose Assessment

In this risk assessment, estimates of human exposure were made using models and assumptions which describe the behavior of potential receptors and the biological interactions between contaminated media and receptors. Exposure point concentrations for the soil and groundwater pathway were estimated directly from the analytical data, and they depend on the quality and representativeness of that data and the methods used to summarize the data for the exposure assessment. The quality of these data have been discussed above. As for the methods used to summarize the data, all relevant data were used to obtain the upper 95% confidence limit concentrations and geometric mean concentrations of constituents in soil. The Phase I data was not used since it consisted of mainly metals analyses using EP toxicity methodology. In evaluating the groundwater pathway, the contaminant concentration in on-site monitoring wells were used to evaluate potential residential exposure. This exposure is hypothetical because the area is provided with public water and Nassau County Health Ordinance virtually eliminates the possibility that new private potable supply wells will be installed in the area.

In the evaluation of the inhalation pathway, constituent concentrations in air were not measured and the use of conservative assumptions and models to estimate constituent concentrations in ambient air would tend to overestimate the actual exposure.

Other factors which introduce uncertainty into the exposure estimates include behavioral assumptions (days intruders spend on the site), exposure related factors (soil ingestion rate, skin surface area available for contact, etc.), and the intake factor (dermal and inhalation absorption factor, etc.). In many cases, it is difficult to judge the direction or magnitude of the bias introduced into the dose estimates by specific models and selected parameter values. However, it is probable that the analytical assumptions introduce a moderate to very conservative bias which overstates the actual risk.

5.5.3 Uncertainty in Toxicological Models and Parameters

The final source of uncertainty in the risk estimate relates to the models used to characterize the toxicologic properties of the indicator chemicals. The overriding uncertainties associated with the toxicological models and parameters are:

- The extrapolation of toxic or carcinogenic effects observed at the high doses typically used in animal studies to the effects that would occur at much lower, "real world" doses.

- The extrapolation of toxic effects in animals to toxic effects in man.

These extrapolations form the basis for the derivation of the factors used to estimate risks. The carcinogenic potency factors (CPFs) are derived using a weight-of-evidence approach to studies in the scientific literature. Due to the lack of human epidemiological data for most chemicals, the evidence results from animal studies in which experimental groups were exposed for most of their lifetime to doses many times those normally found in the environment. In some cases, only a single study may be used in this derivation process.

The USEPA uses a prescribed protocol (USEPA, 1986a) to evaluate animal data to estimate human cancer potency factors. The linearized multistage extrapolation model is utilized which provides a mathematical approximation of the dose-response slopes. Of the half-dozen equally feasible dose-response extrapolation models available, the one selected by USEPA is designed to define the highest upper bound risk condition. The results from this model most likely overestimate the actual risk rather than underestimate it. In addition, because the slope estimates are based on animal data, the ratio of cancer potency slopes between chemicals may reflect animal responses more than human responses. The models used in the risk analysis do not incorporate the effects of biologic protective mechanisms or human epidemiology and they are gross indicators specifically designed to overestimate potential risk in the general case.

5.5.4 Summary of Uncertainty

The quantitative estimates of risk are likely to be quite uncertain, since the derivation involves the interpretation of inherently uncertain analytical data and the use of generalized models to assess constituent exposures, doses, and health risks. To minimize the adverse effect of uncertainty in the risk evaluation, each step is biased toward an estimate that protects the public health. Since each step builds on the previous one, this biased approach is assumed to more than compensate for the uncertainty in the various risk assessment components.

5.6 ECOLOGICAL ASSESSMENT

The Cerro Conduit site is located in an industrial area with little if any wildlife. There is no surface water within a mile of the site. Also, much of the land in the vicinity of the site has been developed for commercial and residential uses. There are no unique ecosystem, critical habitats, food sources or nesting locations. No rare or endangered species of flora or fauna were noted, nor would they be expected to occur here. A detailed ecological assessment is not conducted because the site constituents are not expected to have significant ecological impact.

6.0 SUMMARY

This section presents the results of this risk assessment study and highlights the nature of the constituents evaluated, the toxicological assumptions, and the approach used to estimate exposure risk.

6.1 CHEMICALS OF CONCERN

The constituents of concern detected at the Cerro Conduit site are copper, cyanide and lead. In addition, semi-volatile organic compounds were detected in the stormwater drainage area at low concentrations. These constituents included: bis(2-ethylhexyl) phthalate, butylbenzylphthalate, di-n-octylphthalate, di-n-butylphthalate, fluoranthene and pyrene.

6.2 EXPOSURE ASSESSMENT

The exposure assessment characterized the exposure setting and population identified of exposure pathways and quantified the possible chemical intakes associated with the site.

The exposure pathways considered most applicable to the site are:

Off-Site Residential (Adult and Children)

Soil ingestion
Dermal contact with soil
Dust inhalation
Groundwater Ingestion

Off-Site Worker

Dust inhalation

On-Site Worker (future scenario only)

Soil ingestion
Dermal contact with soil
Dust inhalation

These exposure pathways were evaluated and quantified in the risk assessment.

6.3 TOXICITY ASSESSMENT

The toxicity assessment presented the available health effects criteria for each contaminant of concern and for each exposure pathway. For non-carcinogenic effects, available reference doses (RfDs) were presented. For carcinogenic effects, the available oral cancer potency factor (CPF) was identified for bis(2-ethylhexyl) phthalate which is likely a laboratory artifact. The USEPA does not classify copper and cyanide as carcinogenic.

6.4 RISK CHARACTERIZATION

The total carcinogenic and non-carcinogenic risks associated with each exposure pathway are shown in Table 6-1.

The total current and future carcinogenic risk associated with the adult and child residential exposure scenarios are both below the USEPA accepted one in a million (1×10^{-6}) risk and are insignificant. The total carcinogenic and non-carcinogenic risk to prospective on-site and current off-site workers, (including workers grading the site) are all below the level of concern. The total hazard index for the residential child and adult current and future scenarios is less than unity for the representative average estimate (AEI). Therefore, there should be no significant non-carcinogenic effects. The hazard index exceeds unity for the maximum estimate under the adult and child residential exposure scenario (2.0 and 4.0, respectively), however, the prospective groundwater residential use scenario is purely hypothetical and the exposure concentration used to calculate the groundwater ingestion pathway is abstracted from on-site monitoring wells. The health risk associated with the off-site ingestion of groundwater is speculative because the lead found in on-site groundwater has an apparent off-site origin and was not found in on-site soil. There are no private potable supply wells on the site or in the vicinity of the site and Nassau County Health Department Ordinance effectively precludes the installation of new private wells in developed areas where there is a public water supply. In effect, the theoretical groundwater pathway to off-site residents does not exist.

6.5 TARGET CLEANUP LEVEL

The concentrations of the constituents of concern that can remain in on-site soil without the possibility of a public health risk was calculated from the constituent concentrations used in calculating risk and the corresponding estimated total hazard index. The concentration of a contaminant that would not affect the health of an exposed population is the constituent concentration corresponding to a total hazard index of 1.0.

Table 6-2 shows the soil constituent concentrations that correspond to hazard index of 1.0. This concentration for copper is 5,200 mg/kg for the child residential exposure and 41,000 mg/kg for the adult residential exposure. For worker exposure, the concentration is 41,000 mg/kg. The soil concentration of cyanide that corresponds to a hazard index of 1.0 is 3,100 mg/kg for the child exposure and 29,000 mg/kg for the adult residential exposure. For worker exposure, the concentration is 28,200 mg/kg.

The concentration of copper in the vicinity of the clarifier (B109) is 2,200 mg/kg, and is below the target cleanup level derived in this risk assessment.

APPENDIX A

TOXICOLOGICAL PROFILES

BIS(2-ETHYLHEXYL)PHTHALATE

Introduction

Bis(2-ethylhexyl)phthalate (DEHP) is a colorless liquid, phthalate ester with a molecular weight of 390.54, a melting point of -50°C, and a boiling point of 385°C at 760 mm Hg (ACGIH, 1986; Verschureren, 1983; IARC, 1982b; Clayton and Clayton, 1981; CHRIS, 1978). DEHP has a water solubility of 0.285 mg/l and a log octanol-water partition coefficient (log Kow) of 4.88 (Verschueren, 1983; HSDB, 1987). The log octanol-water partition coefficient suggests that DEPH would be sorbed onto particles high in organic matter (Clement Associates, 1985a).

Human Health Effects

DEHP and its principle metabolite, MEHP, are readily absorbed from the gastrointestinal tract (U.S.PHS, 1987d). There is also evidence that DEHP can be absorbed through the skin. Although quantitative information is not available, animal studies indicate DEHP is absorbed by the lungs.

The target organs for DEHP appear to be the liver and testes (U.S.PHS, 1987d). DEHP has been found to induce morphological and biochemical changes in the liver of exposed rodents at relatively high dose levels (Gollamudi et al. 1985). Similar effects have been reported for a number of chemicals which induce hepatic xenobiotic metabolizing capabilities. A number of studies in laboratory animals have demonstrated that oral exposure to DEHP results in adverse hepatic effects. At high oral dose levels, DEHP causes functional hepatic damage characterized by morphological changes and alterations in the activity of hepatic enzyme systems (Mitchell et al., 1985; Lake et al. 1984; Carpenter et al. 1953).

The testicular effects of DEHP are characterized by a decrease in relative organ weight and damage to the seminiferous tubules (Gangolli, 1982). Similar effects have been reported in animals treated with MEHP, a major metabolite of DEHP.

A reference dose (RfD) has been calculated for DEHP (USEPA, 1987b). It is based on a one-year study in guinea pigs by Carpenter et al. (1953). In this study, groups of 23 to 24 animals of each sex were fed diets containing 0, 400, or 1300 mg/kg DEHP. This is equivalent to doses of approximately 19 and 64 mg/kg/day. Statistically significant increases in relative liver weights were observed in both groups of treated animals. An RfD was determined as follows:

$$RfD = \frac{(19\ mg/kg/day)}{1000} = 2 \times 10^{-2}\ mg/kg/day$$

19 mg/kg/day = NOAEL
1,000 = uncertainty factor

Studies by Milkov et al. (1973) have shown that workers exposed to 1.7 to 66 mg/m^3 DEHP complained of pain, numbness, and spasms of the upper and lower extremities. Extensive neurological studies revealed polyneuritis in 47 of 147 persons (32%) while 49.6 percent of the workers were classified as essentially healthy.

Eighty-one persons were evaluated for disturbance of the vestibular function and 78 percent showed depression of vestibular receptors. This was the first evidence of neurosomatic dysfunction as was a lowering of the level of the excitability threshold for the olfactory receptors (Milkov et al. 1973).

From this study, a TLV of 5 mg/m^3, as a time-weighted average, and a STEL of 10 mg/m^3 were recommended for DEHP, a substance of low toxicity by all routes of exposure (ACGIH, 1986).

Environmental Health Effects

In an acute oral toxicity study reported by Shaffer et al. (1945), single doses of DEHP were administered by gavage to male Wistar rats. The median lethal dose was estimated to be 30,600 mg/kg.

In other acute studies, Shaffer et al. (1945) reported an LD_{50} of 33,900 mg/kg for rabbits, Patty (1967) reported an LD_{50} of 26,000 mg/kg for mice, and Krauskopf (1973) reported an LD_{50} of 26,300 mg/kg for guinea pigs.

Lake et al. (1984) determined a marked difference in the parameter of liver toxicity in Sprague-Dawley rats and Syrian hamsters. NOAEL levels were 25 mg/kg for the rat and 250 mg/kg for the hamster with LOAEL values of 100 mg/kg for the rat and 1000 mg/kg for the hamster (Lake et al. 1984).

Agarwal et al. (1986) evaluated the reproductive (testicular) toxicity of DEHP in sexually mature male F344 rats. DEHP was administered in the diet at levels of 0, 320, 1,250, 5,000, or 20,000 mg/kg (equivalent to 0, 16, 62.4, 250, or 1,000 mg/kg/day) for 60 days. Reduced body weight, testicular weight, and epididymal weight were observed at doses of 250 mg/kg/day (NOAEL) and higher, but not at doses of 62.5 mg/kg/day (NOAEL) and lower. A decrease in various sex hormone levels was also observed at the two highest DEHP levels, with degenerative testicular alterations and reduced epididymal sperm count and motility noted at the highest DEHP level.

Acute median effect values ranged from 1,000 to 11,100 ug/l DEPH for the freshwater cladoceran Daphnia magna (USEPA, 1980d). The LC_{50} values for the midge, scud, and bluegill all exceeded the highest concentrations tested, which were 1'8,000 32,000, and 770,000 ug/liter, respectively (USEPA, 1980d). Since these values are greater than the water solubility of DEHP, it is unlikely that DEHP will be acutely toxic to organisms in natural waters. Chronic toxicity testing determined reproductive impairment for Daphnia magna at 3 ug/l and reported a chronic value of 8.4 ug/l for rainbow trout (USEPA, 1980d).

Carcinogenicity

Data from the NTP (1982) bioassay were used by USEPA (U.S. USEPA 1987c) to calculate upper-bound incremental unit carcinogenic risk to humans. Using the linearized multistage model, potency slope factors were estimated. Calculations were based on combined carcinomas and neoplastic nodules (or adenomas), with a potency slope factor of 1.4E-2 $(mg/kg/day)^{-1}$ for oral pathway.

DEHP has been classified by the USEPA as a Group B2--Probable Human Carcinogen (U.S. USEPA, 1986b).

COPPER

Introduction

Copper is a reddish metal that occurs naturally in rock, soil, water, sediment, and air. Its average concentration in the earth's crust is about 50 ppm. Copper also occurs naturally in plants and animals. It is an essential element for all known living organisms. Copper displays four oxidation states: Cu(o), Cu(I), Cu(II), and Cu(III). Cu(I) or the cuprous ion disproportionates rapidly in aqueous solution to form Cu(II) and Cu(o). Cuprous compounds are generally colorless. Cu(II) or the cupric ion is the most important oxidation state of copper and is the oxidation state generally encountered in water (Cotton and Wilkinson, 1980). Cupric compounds and complexes are blue or green in color. Cu(III) is strongly oxidizing and only occurs in a few compounds.

Copper is extensively mined and processed in the United States and is primarily used as the metal or alloy in the manufacture of wire, sheet metal, pipe, and other metal products. Copper compounds are most commonly used in agriculture to treat plant disease, like mildew, or for water treatment and as preservatives for wood, leather, and fabrics.

Environmental Fate and Transport

Copper is released to the atmosphere in the form of particulate matter or adsorbed to particulate matter. The chemical form of copper in the atmosphere is generally assumed to be oxides from the combustion sources. Metallic species are attacked by atmospheric oxidants in the atmosphere, resulting in the formation of oxides. As these oxides age, sulfatization may occur. Copper in the atmosphere can be removed by gravitational settling, dry deposition, washout by rain, and rainout (Schroeder et al. 1987).

Most copper deposited in soil will be strongly adsorbed and remain in the upper few centimeters of soil. Copper's movement in the soil is determined by physical and chemical interactions of copper and soil components. In most temperate soil, the pH, organic matter, and ionic strength of soil solutions are key factors affecting adsorption (Fuhrer, 1986). Copper can easily adsorb to organic matter, carbonate, clay minerals, or hydrous iron and manganese oxides. Sandy soil with low pH have the greatest potential for leaching. The ionic strength and pH of the soil solution affect the surface charge of soil and thereby influence ionic interaction.

The major species of soluble copper found in freshwater and seawater over a range of pH is Cu^{+2}, $Cu(HC03)^{+}$, and Cu(OH)2 (Long and Angino, 1977). The Cu(I) ion is unstable in water, tending to disproportionate to Cu+2 and copper metal unless a stabilizing ligand is present. In the Cu(II) state, copper form coordination compounds or complexes with both inorganic and organic ligands. The concentration of dissolved copper depends on factors such as pH, the oxidation-reduction potential of the water, and the presence of competing cations (Ca^{+2}, Fe^{+2}), anion of insoluble salts (S^{-2}, PO_4^{-2}, CO_3^{-2}), and organic and inorganic complexing agents. Precipitation will occur if the concentration of anion exceed the solubility of copper salt. The combined processes of complexation, adsorption, and precipitation control the level of free Cu(II) in water.

Health Effects

Copper is an essential nutrient that is incorporated into numerous enzymes. These enzymes are involved in functions such as hemoglobin formation, carbohydrate metabolism, catecholamine biosynthesis, and cross-linking of collagen, elastin, and hair keratin.

In humans, copper homeostasis plays an important role in the prevention of copper toxicity. Copper is readily absorbed from the stomach and small intestine. After copper requirements are met, there are several mechanisms that prevent copper overload. Excess copper absorbed into gastrointestinal mucosal cells is bound to the protein metallothionein. This bound copper is excreted when the cell is sloughed off. Copper that eludes the intestinal barrier can be stored in the liver or incorporated into bile and excreted in the feces. Because of the body's efficient means of blocking the absorption of excess copper, the most likely pathway for the entry of toxic amounts of copper would be long-term inhalation or possibly through the skin. Both of these pathways would allow copper to pass unimpeded into blood. Infants under one year old are at high risk of copper toxicity because they have not yet developed the copper homeostatic regulating mechanism. Individuals with Wilson's disease also do not have this copper regulating mechanism. The disease is characterized by excessive copper accumulation in the liver, brain, kidneys, and cornea and by low serum ceruloplasmin and high serum copper.

The 1980 Recommended Dietary Allowances (NAS 1980) estimate that a daily dietary intake of 2-3 mg of copper (0.0286-0.0429 mg/kg/d) by adults is safe and adequate. However, health effects associated with exposure to high levels of copper can occur via inhalation, oral and dermal routes of exposure. The major route of copper exposure in humans involves the consumption of water contaminated with high levels of copper. The primary effects of oral exposure to copper is gastrointestinal irritation, manifested as vomiting, nausea, diarrhea, abdominal pain, anorexia and a metallic taste in the mouth. Exposure levels that produced these gastrointestinal effects were 0.07-1421 mg Cu/kg/d as Cu (II). Individuals with high intake of copper can develop centrilobular necrosis in the liver and tubular cell sloughing in the kidney. Centrilobular necrosis in the liver and necrosis of renal tubular cells were observed after copper intakes of 5.7-637 mg/kg/d as copper sulfate (Chuttani et al., 1965). The inhalation exposure route is mainly an important exposure route for factory workers. Respiratory, gastrointestinal, hepatic and dermal effects were observed in workers exposed to airborne copper dust. Dermal exposure to copper in humans is less significant than oral or inhalation exposure. In some individuals, dermal exposure to copper metal can result in contact pruritic dermatitis. (Barranco 1972; Saltzer and Wilson 1968).

The New York State groundwater standard for copper is 0.2 mg/l. USEPA has established a chronic oral reference dose (RfD or acceptable intake) at 1.3 mg/l, based on gastrointestinal irritation. Recently, USEPA has promulgated an action level of 1.3 mg/L for copper which will be triggered if more than 10 percent of targeted tap water samples are above 1.3 mg/L (USEPA, 1991).

Acute Toxicity to Aquatic Animals

In hard water, the acute values of copper range from 6.5 ug/l for Daphnia magna to 10,200 ug/l for the bluegill, Leopomis macrochirus. For saltwater species, embryo of the blue mussel, Mytilus edulis and Pacific oyster, Crassostrea gigas are the most sensitive saltwater species tested with acute values of 5.8 and 7.8 ug/l, respectively. Acute value for saltwater fishes ranged from 13.93 ug/l for Summer flounder.

CYANIDE

Introduction

Of the cyanide compounds, those most likely to be encountered by humans are hydrogen cyanide, sodium cyanide, and potassium cyanide. Hydrogen cyanide is a colorless gas or liquid with a faint, bitter almond odor. Sodium cyanide and potassium cyanide are both colorless solids that possess a slight odor of bitter almond in damp air.

Environmental Fate

Most cyanide in the atmosphere exists as hydrogen cyanide gas. Metal cyanides may be present as particulate matter in air. Hydrogen cyanide has the potential to be transported over long distances before reacting with potochemically generated hydroxyl radicals (half-life of 334 days) (Fritz et al. 1982). Since hydrogen cyanide is miscible in water , wet deposition may be an important fate process. Metal cyanide particles can be removed from air by both wet and dry deposition.

In water, cyanide occurs most commonly in the form of hydrogen cyanide, although it can also occur as the cyanide ion (CN^-), alkali metal cyanides (ie., KCN, NaCN), stable metallocyanide complexs (i.e., $[Fe(CN)_6]^{-3}$), moderately stable metallocyanide complexs (i.e., copper cyanide), or easily decomposable metallocyanide complexs (i.e., zinc cyanide). Volatilization is expected to be an important removing process for hydrogen cyanide in water. At pH <9.2, most of the free cyanide should exist as hydrogen cyanide, a volatile form of cyanide. Biodegradation is also expected to be an important fate process in natural water systems. A number of microorganisms have been shown to degrade low concentrations of cyanide under both aerobic and anaerobic conditions (Towill et al. 1978; Callahan et al. 1979). Hydrogen cyanide is not expected to undergo direct photolysis, to hydrolyze, to adsorb significantly to suspended solids and sediments, or to bioaccumulate significantly in aquatic organisms (Callahan et al. 1979).

The fate of cyanide in soil is pH dependent. Cyanide may exist in the form of hydrogen cyanide, alkali metal salts, or immobile metallocyanide complexes. At soil surface with pH <9.2, it is expected that volatilization of hydrogen cyanide is an important loss mechanism for cyanide. In subsurface soil, cyanide present at low concentrations would probably biodegrade. In soil with pH <9.2, hydrogen cyanide is expected to be highly mobile, and in cases where levels of cyanide are toxic to microorganisms (i.e., landfills, spills), hydrogen cyanide may leach into groundwater (EPA, 1984).

Human Health Effects

Cyanides are readily absorbed following inhalation, oral and dermal routes of exposure. Inhalation exposure to hydrogen cyanides provides the most rapid route of entry, resulting in the most rapid onset of toxic effects. Once absorbed, cyanide is distributed by the blood throughout the body.

Cyanide exerts toxic effects by reacting with iron in cytochrome oxidase, the enzyme that catalyzes the terminal step in the electron transport chain, thereby preventing utilization of oxygen by cells. Cyanide also has inhibitory effects on Schiff base intermediates and can bind to other bimolecules. These reactions may contiribute to cyanide toxicity.

The nervous system is the most sensitive end point of cyanide toxicity. Acute exposure to HCN at high concentrations results in hyperventilation followed by unconsciousness and often death. These effects are secondary to effects on the central nervous system. Exposure to 90 ppm HCN (100 mg/m^3) or more will cause death in humans, whereas 5 to 44 ppm (6 to 49 mg/m^3) will cause a variety of nonlethal effects. Among fumigators who had received small acute intoxications from HCN, symptoms found include tachycardia, accompanied by palpitation, vertigo, buzzing in the ears, headache, epigastric burning, vomiting, general weakness, tremor, sensory obtusion, dyspnea, precordial pain, and loss of consciousness. There is a high incidence of nervous disorders including vertigo, equilibrium disturbances, and nystogmers. Human oral LD_{50} of 2.86 mg/kg NaCN (1.52 mg/kg CN^-) was estimated (EPA, 1989). Dermal LD_{50} for HCN was estimated at 100 mg/kg. Cardiovascular and respiratory effects have been observed in humans and animals following exposure to cyanides. Thyrotoxicity has been reported in humans and animals following inhalation and oral exposure to cyanides. Animal studies indicated that cyanide and cyanide compounds can result in concentration-related increases in maternal mortality fetal resorptions, and fetal malformations. The most common malformations observed were exencephely, encephelocide, and rib anomalies. Thiocyanate administration during gestation has been reported to result in thyroid effects in the offspring.

CARCINOGENICITY

Cyanide have not been associated with carcinogenic effects in animals or humans.

Acute Toxicity to Aquatic Animals

Free cyanide concentration from about 50 to 200 ug/l were fatal to juveniles of most of the more sensitive fish species. Most of the invertebrate species tested were more resistant than fish. The acute value for freshwater species range from 2490 ug/l for Midge ,*Tanytarsus dissimilis* to 44.73 ug/l for Rainbow trout, Salmo gairdneri. For saltwater species, the chronic values for invertebrates ranged from 4.893 ug/l for rock crab, Cancer irroratus, to over 10,000 ug/l for Alantic slippershell, Crepidula fornicata. The acute values for saltwater fish range from 59 ug/l to 372 ug/l.

Chronic Toxicity to Aquatic Animals

For chronic toxicity, long-term survival and growth of various freshwater fish species were observed to be substantially reduced at free cyanide concentration of about 20 to 50 ug/l. The chronic values for brook trout, Salvelinus fontinalis, and fathead minnow, Pimephales promelas were 13.57 and 7.849 ug/l, respectively.

Toxicity to Aquatic Plants

Both freshwater and saltwater plants show a wide range of sensitivities to cyanide. Growth and reproductive effects occurring at 11 to 25 ug/l for saltwater red macroalgae, Champia parvula. At 30 ug/l, the growth of green algae, Scenedesmus quadricauda, was inhibited.

Existing Guidelines

The World Health Organization (WHO) has established an ADI for cyanide in food of 3.5 mg/person/day for a 70 kg human. For occupational exposures, NIOSH (1990) has established a TWA 5 mg/m^3 for cyanide. Hydrogen cyanide at 50 ppm is considered immediately dangerous to life or health (IDLH). USEPA (1980) established 3.77 mg/l CN^- for ambient water quality criteria to protect human health; 3.5 ug/l CN^- as 24 hours average to protect aquatic life. According to New York State ambient water quality standard, 100 ug/l was established to protect human health and 5.2 ug/l CN- for protecting aquatic life.

Reference Doses (RfDs)

Oral RfDs for hydrogen cyanide, sodium cyanide, potassium cyanide were 0.02, 0.04, 0.05 mg/kg/day, respectively (EPA 1986). The RfDs are based on the study by Howard and Hanzal (1955), in which no effects were observed in rats fed HCN in the diet for 2 years at a level that provided females a dose of 10.8 mg/kg/day CN^- (highest NOAEL).

The uncertainity factor and modifying factor used in the calculation were 100 and 5, respectively.

LEAD

Physical/Chemical Properties

Lead is a naturally occurring element in the earth's crust. It exists in three oxidation states: the metallic (0) state, and the +2 and +4 states. Lad occurs naturally mainly as Pb^{+2}. Lead also occurs as PB^{+4}. $Pb0_2$ is one of the few stable Pb^{+4} compounds (Eisler, 1988).

Lead and its compounds can be detected everywhere in the environment. In soil, the lead content from crustal rock typically ranges between 10 and 230 mg/kg (ASTDR, 1988). Levels of lead in surface water throughout the United States typically range between 5 and 30 mg/l (USEPA, 1986b). The average lead content of river sediment is estimated to be about 20 mg/kg (Perwak et al., 1982).

The major source of lead in the environment is atmospheric emissions of organolead (tetraethyl lead and tetramethyl lead) vapors from the manufacture, transport, and handling of leaded gasoline.

Environmental Fate and Transport

In natural waters, lead exists mainly as the stable divalent cation or as part of an inorganic complex of low solubility with the major anions in neutral environments. These inorganic complexing agents (hydroxide, carbonate, sulfide, and more rarely sulfate) may act as a solubility control in precipitating lead from water (Callahan, 1979). In addition, a significant portion of lead in polluted water is sorbed to organic complexing agent, such as humic acid, which can maintain lead ions in a bound form at a pH as low as 3 (Guy and Chakrabarti, 1976).

Sorption processes exert important effects on the distribution of lead in the environment. Most lead is retained strongly in soil, and very little is transported into surface water or ground water (EPA, 1986). In an aquatic system, lead is removed by adsorbing to the sediment. Almost all of the lead in the sediment is in the clay fraction (Pita and Hyne, 1975).

Under most conditions, adsorption to clay and other mineral surfaces, coprecipitation/sorption by hydrous iron oxides, and incorporation into cationic lattice sites in crystalline sediments are the main sorption processes (Callahan et al., 1979). These processes are dependent on such factors as the presence of inorganic colloids and iron oxides, ion-exchange characteristics, and the amount of lead in soil/sediment. When the pH is above 7, almost all of the lead is in the solid phase. But at lower pH, lead may be desorbed (Huang et al., 1977). In addition, release of lead from the sediment increases as the redox conditions become more oxidizing (Lu and Chen, 1977).

Biomethylation of lead by microorganisms can also release lead from the sediment. The resulting volatile compound from biomethylation, tetramethyl lead, can be either oxidized in the water column or released to the atmosphere.

Toxicity to Aquatic Biota

Freshwater vertebrates and invertebrates are more sensitive to lead in soft water than in hard water (USEPA, 1980, 1983). At a hardness of about 50 mg/l $CaCO_3$ the median effect concentration for nine families range from 140 ug/liter to 236,000 ug/l. Chronic values for Daphnia magna and the rainbow trout are 12.26 and 83.08 ug/l, respectively, at a hardness of about 50 mg/l. Acute-chronic ratios calculated for three freshwater species ranged from 18 to 62. Freshwater algae show an inhibition of growth at concentrations above 500 ug/l.

Acute values for twelve saltwater species range from 476 ug/l for common mussel to 27,000 ug/l for the soft shell clam. Chronic exposure to lead causes adverse effects in mysid shrimp at 37 ug/l, but not at 17 ug/l. The acute-chronic ratio for this species is 118.

Human Effects

Humans are usually exposed to lead by the inhalation and oral routes. Dermal exposure to lead is much less significant than exposure by inhalation or the oral route. For children, the primary site of lead absorption is the gastro-intestinal tract (Hammond, 1982). For dietary lead, absorption in children is about 50 percent. In adults, gastrointestinal lead absorption is reported to be 8 percent (Hammond, 1982) or 15 percent (Chamberlain et al., 1978). Absorption of airborne lead by inhalation first involves deposition of particulate lead in the respiratory tract. The rate of deposition of particulate airborne lead in adult humans is about 30 to 50 percent and is modified by factors such as particulate size and ventilation rate (EPA, 1986). Once lead is deposited in the respiratory tract, its absorption is virtually complete. Dermal absorption of inorganic lead compounds is much less significant and absorption of lead acetate in cosmetic preparation applied to the skin was measured to be 0 to 0.3 percent in humans, and was expected to be 0.06 percent during normal use of such preparation (Moore, et al. 1980).

Once absorbed, lead is dispersed to three compartments in the body: blood, soft tissue, and bone. In human adults, about 95 percent of the total body burden of lead is found in the bones. Of the lead distributed into blood, 99 percent is associated with the erythrocytes (Everson and Patterson, 1980) and over 50 percent of the erythrocyte lead pool is bound to hemoglobin. Lead accumulated in bones can be metabolized and redistributed in the body. During physiological stress such as pregnancy and lactation, lead from maternal bone is readily distributed to the fetus (ATSDR, 1987).

The effects of exposure to lead do not depend on the routes of entry, but rather are correlated with internal exposure, usually measured as blood lead levels. At high exposure levels (blood lead levels in excess of 120 ug/dL in adults (Kehoe, 1961), lead produces encephalopathy. The condition can worsen to delirium, convulsions, paralysis, coma and death. High exposure levels of lead also produces gastrointestinal effects, anemia, nephropathy, electrocardiographic-abnormalities, spontaneous abortion in women and decreased fertility in men. Lower blood level (40-60 ug/dL) in adults significantly increased central and peripheral nervous system and gastrointestinal symptoms. Lower-level exposure to lead also affects the synthesis of heme, which is a constituent of hemoglobin. Lead interferes with heme biosynthesis by altering the activity of three enzymes: delta-amino-levulinic acid synthetase (ALA-S), delta-amino-levulinic acid dehydrase (ALA-D), and ferochelatase, resulting in decreased hemoglobin production. This, coupled with an increase in erythrocycte destruction, results in a hypochromic, normocytic anemia. The blood lead threshold for decreased hemoglobin levels in children is determined to be about 40 ug/dL (WHO, 1977, USEPA, 1986). In children, exposure to lead has been shown to inhibit formation of the heme-containing protein cytochrome P-450 and electron-transfer cytochromes (Saenger et al., 1984; Alvares et al., 1975). Hence, lead exposure can have pronounced effects in fundamental metabolic and energy-transfer processes. In addition, lower-level exposure to lead (blood level of 33 to 120 ug/dL) decreases the circulating level of an active form of vitamin D, 1,25-dihydroxyvitamin D, in children (Rosen, 1985). This form of vitamin D is responsible for the maintenance of calcium homeostasis in the body. Blood lead levels of 22 to 89 ug/dL have also been associated with suppression of immune responses (Ewers et al., 1982).

Effects of most concern from low-level exposure to lead are neurobehavioral impairment, IQ deficits, elevated hearing thresholds, growth retardation in infants exposed prenatally and children exposed postnatally, and the elevation of blood pressure in middle-aged men. Dose effect relationships for these effects show no indications of a threshold down to the lowest levels of internal exposure (blood lead level 10 ug/dL).

Data regarding the genotoxicity of lead compounds are not conclusive. Results of mutation tests in microorganisms were negative, but these tests may not be appropriate to demonstrate the mutagenicity of carcinogenic metals (EPA, 1986).

Results in mammalian test systems and in vivo studies in occupationally exposed humans were conflicting, but the data do suggest clastogenic effects (Al-Hakkak et al., 1986; Nordenson et al., 1978). USEPA has classified lead as a B2 (probable human) carcinogen on the basis of animal bioassays which have shown statistically significant increases in renal tumors with dietary and subcutaneous exposure to several soluble lead salts. However, available human evidence is considered to be inadequate to refute or demonstrate potential human carcinogenicity from lead exposure. EPA's Carcinogen Assessment Group recommends that a numerical estimate of carcinogenic risk from lead exposure not be used.

APPENDIX B

RISK CALCULATIONS

CERRO CONDUIT COM[illegible]NY, SYOSSET, NEW YORK

TABL[illegible]-1

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(WASTEWATER RECHARGE BASIN # 1)

ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Estimated * Daily Intake (EDI) (mg/kg-day) (95U)	Estimated * Daily Intake (EDI) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD) (95U)	Hazard Index (EDI/RfD) (GM)
3 Feet	Copper	1040.00	392.76	5.09E-04	1.92E-04	3.70E-02	9.42E-03	3.56E-03
	Cyanide	47.00	16.65	2.30E-05	8.15E-06	2.00E-02	7.87E-04	2.79E-04
	Total						1.02E-02	3.84E-03
6 Feet	Copper	500.00	251.15	2.45E-04	1.23E-04	3.70E-02	4.53E-03	2.27E-03
	Cyanide	21.00	11.95	1.03E-05	5.85E-06	2.00E-02	3.52E-04	2.00E-04
	Total						4.88E-03	2.47E-03
10-12 Feet	Copper	140.00	134.91	6.85E-05	6.60E-05	3.70E-02	1.27E-03	1.22E-03
	Cyanide	46.00	25.38	2.25E-05	1.24E-05	2.00E-02	7.71E-04	4.25E-04
	Total						2.04E-03	1.65E-03
15-17 Feet	Copper	240.00	162.48	1.17E-04	7.95E-05	3.70E-02	2.17E-03	1.47E-03
	Cyanide	24.00	19.60	1.17E-05	9.59E-06	2.00E-02	4.02E-04	3.28E-04
	Total						2.58E-03	1.80E-03
20-22 Feet	Copper	110.00	110.00	5.38E-05	5.38E-05	3.70E-02	9.96E-04	9.96E-04
	Cyanide	28.00	14.97	1.37E-05	7.32E-06	2.00E-02	4.69E-04	2.51E-04
	Total						1.47E-03	1.25E-03

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration

IR = ingestion rate = 200 mg/day (chidren)

= 100 mg/day (adult)

CF = conversion factor = 1.0E-6 kg/mg

FI = fraction ingested from contaminated source = 0.5

EF = exposure frequency = 250 dyas

ED = exposure duration = 30 years (national upper-bound time at one residence) for adult

= 6 years for children (age 1-6)

BW = body weight = 16 kg (children) (age 1- 6)

= 70 kg (adult)

AT = average time (period over which exposure is averaged)

= ED x 365 days/year for noncarcinogenic effects

= 70 x 365 days/year for carcinogenic effects

CERRO CONDUIT CO NY, SYOSSET, NEW YORK

TABLE B-2

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(WASTEWATER RECHARGE BASIN # 1)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Estimated * Daily Intake (EDI) (mg/kg-day) (95U)	Estimated * Daily Intake (EDI) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD) (95U)	Hazard Index (EDI/RfD) (GM)
3 Feet	Copper	1040.00	392.76	4.45E-03	1.68E-03	3.70E-02	1.20E-01	4.54E-02
	Cyanide	47.00	16.65	2.01E-04	7.13E-05	2.00E-02	1.01E-02	3.56E-03
	Total						1.30E-01	4.90E-02
6 Feet	Copper	500.00	251.15	2.14E-03	1.08E-03	3.70E-02	5.78E-02	2.91E-02
	Cyanide	21.00	11.95	8.99E-05	5.12E-05	2.00E-02	4.49E-03	2.56E-03
	Total						6.23E-02	3.16E-02
10-12 Feet	Copper	140.00	134.91	5.99E-04	5.78E-04	3.70E-02	1.62E-02	1.56E-02
	Cyanide	46.00	25.38	1.97E-04	1.09E-04	2.00E-02	9.85E-03	5.43E-03
	Total						2.60E-02	2.13E-02
15-17 Feet	Copper	240.00	162.48	1.03E-03	6.96E-04	3.70E-02	2.78E-02	1.88E-02
	Cyanide	24.00	19.60	1.03E-04	8.39E-05	2.00E-02	5.14E-03	4.20E-03
	Total						3.29E-02	2.30E-02
20-22 Feet	Copper	110.00	110.00	6.87E-04	6.87E-04	3.70E-02	1.86E-02	1.86E-02
	Cyanide	28.00	14.97	1.75E-04	9.36E-05	2.00E-02	8.75E-03	4.68E-03
	Total						2.73E-02	2.33E-02

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration

IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)

CF = conversion factor = 1.0E-6 kg/mg

FI = fraction ingested from contaminated source = 0.5

EF = exposure frequency = 250 days

ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)

BW = body weight = 16 kg (children age 1 - 6)
= 70 kg (adult)

AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO CONDUIT COM Y, SYOSSET, NEW YORK

TABLE B-3

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(WASTEWATER RECHARGE BASIN # 2)

ADULT

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface	Copper	13000.00	13000.00	6.36E-03	6.36E-03	3.70E-02	1.72E-01	1.72E-01
	Cyanide	21.00	21.00	1.03E-05	1.03E-05	2.00E-02	5.14E-04	5.14E-04
	Total						1.72E-01	1.72E-01
3 Feet	Copper	2228.65	303.318	1.09E-03	1.48E-04	3.70E-02	2.95E-02	4.01E-03
	Cyanide	96.00	5.521	4.70E-05	2.70E-06	2.00E-02	2.35E-03	1.35E-04
	Total						3.18E-02	4.15E-03
6 Feet	Copper	320.53	199.22	1.57E-04	9.75E-05	3.70E-02	4.24E-03	2.63E-03
	Cyanide	8.90	3.38	4.35E-06	1.65E-06	2.00E-02	2.18E-04	8.27E-05
	Total						4.46E-03	2.72E-03
10-12 Feet	Copper	190.00	127.85	9.30E-05	6.25E-05	3.70E-02	2.51E-03	1.69E-03
	Cyanide	18.00	7.05	8.81E-06	3.45E-06	2.00E-02	4.40E-04	1.72E-04
	Total						2.95E-03	1.86E-03
15-17 Feet	Copper	100.00	54.91	4.89E-05	2.69E-05	3.70E-02	1.32E-03	7.26E-04
	Cyanide	58.00	7.74	2.84E-05	3.79E-06	2.00E-02	1.42E-03	1.89E-04
	Total						2.74E-03	9.15E-04
20-22 Feet	Cyanide	24.00	24.00	1.17E-05	1.17E-05	2.00E-02	5.87E-04	5.87E-04
	Total						5.87E-04	5.87E-04

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children) (age 1-6)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-4

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(WASTEWATER RECHARGE BASIN # 2)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface	Copper	13000.00	13000.00	5.57E-02	5.57E-02	3.70E-02	1.50E+00	1.50E+00
	Cyanide	21.00	21.00	8.99E-05	8.99E-05	2.00E-02	4.49E-03	4.49E-03
	Total						1.51E+00	1.51E+00
3 Feet	Copper	2228.65	303.318	9.54E-03	1.30E-03	3.70E-02	2.58E-01	3.51E-02
	Cyanide	96.00	5.521	4.11E-04	2.36E-05	2.00E-02	2.05E-02	1.18E-03
	Total						2.78E-01	3.63E-02
6 Feet	Copper	320.53	199.22	1.37E-03	8.53E-04	3.70E-02	3.71E-02	2.30E-02
	Cyanide	8.90	3.38	3.81E-05	1.45E-05	2.00E-02	1.90E-03	7.23E-04
	Total						3.90E-02	2.38E-02
10-12 Feet	Copper	190.00	127.85	8.13E-04	5.47E-04	3.70E-02	2.20E-02	1.48E-02
	Cyanide	18.00	7.05	7.71E-05	3.02E-05	2.00E-02	3.85E-03	1.51E-03
	Total						2.58E-02	1.63E-02
15-17 Feet	Copper	100.00	54.91	4.28E-04	2.35E-04	3.70E-02	1.16E-02	6.35E-03
	Cyanide	58.00	7.74	2.48E-04	3.31E-05	2.00E-02	1.24E-02	1.66E-03
	Total						2.40E-02	8.01E-03
20-22 Feet	Cyanide	24.00	24.00	1.03E-04	1.03E-04	2.00E-02	5.14E-03	5.14E-03
	Total						5.14E-03	5.14E-03

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children) (age 1 - 6)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO CONDUIT CO[illegible]Y, SYOSSET, NEW YORK

TABLE B-5

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(WASTEWATER RECHARGE BASIN # 3)

ADULT

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
3 Feet	Copper	2070.00	195.65	1.01E-03	9.57E-05	3.70E-02	2.74E-02	2.59E-03
	Cyanide	44.00	2.64	2.15E-05	1.29E-06	2.00E-02	1.08E-03	6.46E-05
	Total						2.84E-02	2.65E-03
6 Feet	Copper	1900.00	100.89	9.30E-04	4.94E-05	3.70E-02	2.51E-02	1.33E-03
	Cyanide	15.00	1.40	7.34E-06	6.85E-07	2.00E-02	3.67E-04	3.42E-05
	Total						2.55E-02	1.37E-03
10-12 Feet	Copper	240.00	96.16	1.17E-04	4.70E-05	3.70E-02	3.17E-03	1.27E-03
	Cyanide	6.50	3.39	3.18E-06	1.66E-06	2.00E-02	1.59E-04	8.29E-05
	Total						3.33E-03	1.35E-03
15-17 Feet	Copper	60.00	40.26	2.94E-05	1.97E-05	3.70E-02	7.93E-04	5.32E-04
	Total						7.93E-04	5.32E-04

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration

IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)

CF = conversion factor = 1.0E-6 kg/mg

FI = fraction ingested from contaminated source = 0.5

EF = exposure frequency = 250 dyas

ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years (age 1 - 6)

BW = body weight = 16 kg (children)
= 70 kg (adult)

AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-6

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(WASTEWATER RECHARGE BASIN # 3)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
3 Feet	Copper	2070.00	195.65	8.98E-03	8.49E-04	3.70E-02	2.39E-01	2.26E-02
	Cyanide	44.00	2.64	1.91E-04	1.15E-05	2.00E-02	9.42E-03	5.65E-04
	Total						2.49E-01	2.32E-02
6 Feet	Copper	1900.00	100.89	8.25E-03	4.38E-04	3.70E-02	2.20E-01	1.17E-02
	Cyanide	15.00	1.40	6.51E-05	6.08E-06	2.00E-02	3.21E-03	3.00E-04
	Total						2.23E-01	1.20E-02
10-12 Feet	Copper	240.00	96.16	1.04E-03	4.17E-04	3.70E-02	2.78E-02	1.11E-02
	Cyanide	6.50	3.39	2.82E-05	1.47E-05	2.00E-02	1.39E-03	7.26E-04
	Total						2.92E-02	1.19E-02
15-17 Feet	Copper	60.00	40.26	2.60E-04	1.75E-04	3.70E-02	6.94E-03	4.66E-03
	Total						6.94E-03	4.66E-03

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration

IR = ingestion rate = 200 mg/day (chidren)

= 100 mg/day (adult)

CF = conversion factor = 1.0E-6 kg/mg

FI = fraction ingested from contaminated source = 0.5

EF = exposure frequency = 365 days

ED = exposure duration = 30 years (national upper-bound time at one residence) for adult

= 6 years for children (age 1-6)

BW = body weight = 16 kg (children) (age 1-6)

= 70 kg (adult)

AT = average time (period over which exposure is averaged)

= ED x 365 days/year for noncarcinogenic effects

= 70 x 365 days/year for carcinogenic effects

CERRO CONDU[illegible]MPANY, SYOSSET, NEW YORK
[illegible]BLE B-7
EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION
(STORMWATER DRAINAGE BASIN)
ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Estimated * Daily Intake (EDI) (mg/kg-day) (95U)	Estimated * Daily Intake (EDI) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD) (95U)	Hazard Index (EDI/RfD) (GM)
Surface	Copper	682.78	267.89	3.34E-04	1.31E-04	3.70E-02	9.03E-03	3.54E-03
	Fluoranthene	0.20	0.20	9.78E-08	9.78E-08	4.00E-02	2.45E-06	2.45E-06
	Di-n-butylphthalate	1.40	1.40	6.85E-07	6.85E-07	1.00E-01	6.85E-06	6.85E-06
	Pyrene	0.14	0.14	6.85E-08	6.85E-08	3.00E-02	2.28E-06	2.28E-06
	Butylbenzylphthalate	2.20	2.20	1.08E-06	1.08E-06	2.00E-01	5.38E-06	5.38E-06
	bis(2-ethylhexyl) phthalate	1.20	1.20	5.87E-07	5.87E-07	2.00E-02	2.94E-05	2.94E-05
	Di-n-octylphthalate	3.80	3.80	1.86E-06	1.86E-06	2.00E-02	9.30E-05	9.30E-05
	Total						9.17E-03	3.68E-03
5-7 Feet	Copper	6.00	4.23	2.94E-06	2.07E-06	3.70E-02	7.93E-05	5.59E-05
	Cyanide	6.50	1.60	3.18E-06	7.83E-07	2.00E-02	1.59E-04	3.91E-05
	Total						2.38E-04	9.51E-05
10-12 Feet	Copper	4.00	1.91	1.96E-06	9.34E-07	3.70E-02	5.29E-05	2.53E-05
	Total						5.29E-05	2.53E-05
15-17 Feet	Copper	16.00	5.73	7.83E-06	2.80E-06	3.70E-02	2.12E-04	7.58E-05
	Total						2.12E-04	7.58E-05

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children) (age 1-6)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-8

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR SOIL INGESTION

(STORMWATER DRAINAGE BASIN)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Estimated * Daily Intake (EDI) (mg/kg-day) (95U)	Estimated * Daily Intake (EDI) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD) (95U)		Hazard Index (EDI/RfD) (GM)
Surface	Copper	682.78	267.89	2.92E-03	1.15E-03	3.70E-02	7.90E-02		3.10E-02
	Fluoranthene	0.20	0.20	8.56E-07	8.56E-07	4.00E-02	2.14E-05		2.14E-05
	Di-n-butylphthalate	1.40	1.40	5.99E-06	5.99E-06	1.00E-01	5.99E-05		5.99E-05
	Pyrene	0.14	0.14	5.99E-07	5.99E-07	3.00E-02	2.00E-05		2.00E-05
	Butylbenzylphthalate	2.20	2.20	9.42E-06	9.42E-06	2.00E-01	4.71E-05		4.71E-05
	bis(2-ethylhexyl) phthalate	1.20	1.20	5.14E-06	5.14E-06	2.00E-02	2.57E-04		2.57E-04
	Di-n-octylphthalate	3.80	3.80	1.63E-05	1.63E-05	2.00E-02	8.13E-04		8.13E-04
	Total						8.02E-02		3.22E-02
5-7 Feet	Copper	6.00	4.23	2.57E-05	1.81E-05	3.70E-02	6.94E-04		4.89E-04
	Cyanide	6.50	1.60	2.78E-05	6.85E-06	2.00E-02	1.39E-03		3.42E-04
	Total						2.09E-03		8.32E-04
10-12 Feet	Copper	4.00	1.91	1.71E-05	8.18E-06	3.70E-02	4.63E-04		2.21E-04
	Total						4.63E-04		2.21E-04
15-17 Feet	Copper	16.00	5.73	6.85E-05	2.45E-05	3.70E-02	1.85E-03	***	6.63E-04
	Total						1.85E-03	***	6.63E-04

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration

IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)

CF = conversion factor = 1.0E-6 kg/mg

FI = fraction ingested from contaminated source = 0.5

EF = exposure frequency = 250 days

ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)

BW = body weight = 16 kg (children) (age 1-6)
= 70 kg (adult)

AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO CONDUIT CO[illegible]NY, SYOSSET, NEW YORK

TABLE B-9

EXPOSURE CALCULATIONS FOR SOIL INGESTION
(FORMER SLUDGE AREA)
ADULT

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface-6 Inches	Copper	1035.47	380.34	5.07E-04	1.86E-04	3.70E-02	1.37E-02	5.03E-03
	Cyanide	27.00	10.07	1.32E-05	4.93E-06	2.00E-02	6.60E-04	2.46E-04
	Total						1.44E-02	5.28E-03

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children) (age 1- 6)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-10

EXPOSURE CALCULATIONS FOR SOIL INGESTION (FORMER SLUDGE AREA) CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface-6 Inches	Copper	1035.47	380.34	4.43E-03	1.63E-03	3.70E-02	1.20E-01	4.40E-02
	Cyanide	27.00	10.07	1.16E-04	4.31E-05	2.00E-02	5.78E-03	2.16E-03
	Total						1.26E-01	4.62E-02

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children) (age 1-6)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-11

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL

(WASTEWATER RECHARGE BASIN #1)

ADULTS

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Estimated * Absorbed Dose (EAD) (mg/kg-day) (95U)	Estimated * Absorbed Dose (EAD) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD) (95U)	Hazard Index (EAD/RfD) (GM)
3 Feet	Copper	1040.00	392.76	4.14E-04	1.56E-04	3.70E-02	1.12E-02	4.23E-03
	Cyanide	47.00	16.65	1.87E-05	6.63E-06	2.00E-02	9.36E-04	3.32E-04
	Total						1.21E-02	4.56E-03
6 Feet	Copper	500.00	251.15	1.99E-04	1.00E-04	3.70E-02	5.38E-03	2.70E-03
	Cyanide	21.00	11.95	8.37E-06	4.76E-06	2.00E-02	4.18E-04	2.38E-04
	Total						5.80E-03	2.94E-03
10-12 Feet	Copper	140.00	134.91	5.58E-05	5.37E-05	3.70E-02	1.51E-03	1.45E-03
	Cyanide	46.00	25.38	1.83E-05	1.01E-05	2.00E-02	9.16E-04	5.06E-04
	Total						2.42E-03	1.96E-03
15-17 Feet	Copper	240	162.48	9.56E-05	6.47E-05	3.70E-02	2.58E-03	1.75E-03
	Cyanide	24	19.60	9.56E-06	7.81E-06	2.00E-02	4.78E-04	3.90E-04
	Total						3.06E-03	2.14E-03
20-22 Feet	Copper	110	110.00	4.38E-05	4.38E-05	3.70E-02	1.18E-03	1.18E-03
	Cyanide	28.00	14.97	1.12E-05	5.96E-06	2.00E-02	5.58E-04	2.98E-04
	Total						1.74E-03	1.48E-03

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration

CF = conversion factor = 1.0E-6 kg/mg

SA = skin surface area available for contact (cm^2/event)

= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult

= 0.096(arms) + 0.040(hands) = 0.136 m^2 = 1360 cm^2 for children

AF = Soil to skin adherence factor (mg/cm^2)

= 1.45 mg/cm^2 for commercial potting soil

ABS = absorption factor

for inorganics = 0.018 for children ; = 0.009 for adults

(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)

for semivolatile organics = 0.1

(Ryan, E. A. et al. 1987, "Assessing Risk From Dermal Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)

EF = exposure frequency = 250 days

ED = exposure duration = 30 years (national upper-bound time at one residence) for adult

= 6 years for children (age 1-6)

BW = body weight = 16 kg (children) (age 1-6)

= 70 kg (adult)

AT = average time (period over which exposure is averaged)

= ED x 365 days/year for noncarcinogenic effects

= 70 x 365 days/year for carcinogenic effects

CERRO CONE COMPANY, SYOSSET, NEW YORK

TABLE B-12

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL

(WASTEWATER RECHARGE BASIN #1)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
3 Feet	Copper	1040.00	392.76	2.17E-03	8.21E-04	3.70E-02	5.87E-02	2.22E-02
	Cyanide	47.00	16.65	9.82E-05	3.48E-05	2.00E-02	4.91E-03	1.74E-03
	Total						6.36E-02	2.39E-02
6 Feet	Copper	500.00	251.15	1.04E-03	5.25E-04	3.70E-02	2.82E-02	1.42E-02
	Cyanide	21.00	11.95	4.39E-05	2.50E-05	2.00E-02	2.19E-03	1.25E-03
	Total						3.04E-02	1.54E-02
10-12 Feet	Copper	140.00	134.91	2.93E-04	2.82E-04	3.70E-02	7.91E-03	7.62E-03
	Cyanide	46.00	25.38	9.61E-05	5.30E-05	2.00E-02	4.81E-03	2.65E-03
	Total						1.27E-02	1.03E-02
15-17 Feet	Copper	240.00	162.48	5.01E-04	3.39E-04	3.70E-02	1.36E-02	9.18E-03
	Cyanide	24.00	19.60	5.01E-05	4.10E-05	2.00E-02	2.51E-03	2.05E-03
	Total						1.61E-02	1.12E-02
20-22 Feet	Copper	110.00	110.00	2.30E-04	2.30E-04	3.70E-02	6.21E-03	6.21E-03
	Cyanide	28.00	14.97	5.85E-05	3.13E-05	2.00E-02	2.93E-03	1.56E-03
	Total						9.14E-03	7.78E-03

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO CONI COMPANY, SYOSSET, NEW YORK

TABLE B-13

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL

(WASTEWATER RECHARGE BASIN # 2)

ADULTS

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface	Copper	13000	13000	5.18E-03	5.18E-03	3.70E-02	1.40E-01	1.40E-01
	Cyanide	21.00	21.00	8.37E-06	8.37E-06	2.00E-02	4.18E-04	4.18E-04
	Total						1.40E-01	1.40E-01
3 Feet	Copper	2228.65	303.318	8.88E-04	1.21E-04	3.70E-02	2.40E-02	3.27E-03
	Cyanide	96.00	5.521	3.82E-05	2.20E-06	4.00E-02	9.56E-04	5.50E-05
	Total						2.50E-02	3.32E-03
6 Feet	Copper	320.53	199.22	1.28E-04	7.94E-05	3.70E-02	3.45E-03	2.15E-03
	Cyanide	8.90	3.38	3.55E-06	1.35E-06	2.00E-02	1.77E-04	6.73E-05
	Total						3.63E-03	2.21E-03
10-12 Feet	Copper	190.00	127.85	7.57E-05	5.09E-05	3.70E-02	2.05E-03	1.38E-03
	Cyanide	18.00	7.05	7.17E-06	2.81E-06	2.00E-02	3.59E-04	1.40E-04
	Total						2.40E-03	1.52E-03
15-17 Feet	Copper	100.00	54.91	3.98E-05	2.19E-05	3.70E-02	1.08E-03	5.91E-04
	Cyanide	58.00	7.74	2.31E-05	3.08E-06	2.00E-02	1.16E-03	1.54E-04
	Total						2.23E-03	7.45E-04
20-22 Feet	Copper	24.00	24.00	9.56E-06	9.56E-06	3.70E-02	2.58E-04	2.58E-04
	Total						2.58E-04	2.58E-04

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration

CF = conversion factor = 1.0E-6 kg/mg

SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children

AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil

ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)

EF = exposure frequency = 250 days

ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)

BW = body weight = 16 kg (children)
= 70 kg (adult)

AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO COND'⁻⁻ COMPANY, SYOSSET, NEW YORK
.BLE B-14
EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL
(WASTEWATER RECHARGE BASIN # 2)
CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface	Copper	13000	13000	2.72E-02	2.72E-02	3.70E-02	7.34E-01	7.34E-01
	Cyanide	21.00	21.00	4.39E-05	4.39E-05	2.00E-02	2.19E-03	2.19E-03
	Total						7.56E-01	7.56E-01
3 Feet	Copper	2228.65	303.318	4.66E-03	6.34E-04	3.70E-02	1.26E-01	1.71E-02
	Cyanide	96.00	5.521	2.01E-04	1.15E-05	4.00E-02	5.01E-03	2.88E-04
	Total						1.31E-01	1.74E-02
6 Feet	Copper	320.53	199.22	6.70E-04	4.16E-04	3.70E-02	1.81E-02	1.12E-02
	Cyanide	8.90	3.38	1.86E-05	7.06E-06	2.00E-02	9.30E-04	3.53E-04
	Total						1.90E-02	1.16E-02
10-12 Feet	Copper	190.00	127.85	3.97E-04	2.67E-04	3.70E-02	1.07E-02	7.22E-03
	Cyanide	18.00	7.05	3.76E-05	1.47E-05	2.00E-02	1.88E-03	7.36E-04
	Total						1.26E-02	7.96E-03
15-17 Feet	Copper	100.00	54.91	2.09E-04	1.15E-04	3.70E-02	5.65E-03	3.10E-03
	Cyanide	58.00	7.74	1.21E-04	1.62E-05	2.00E-02	6.06E-03	8.09E-04
	Total						1.17E-02	3.91E-03
20-22 Feet	Copper	24.00	24.00	5.01E-05	5.01E-05	3.70E-02	1.36E-03	1.36E-03
	Total						1.36E-03	1.36E-03

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO COND' COMPANY, SYOSSET, NEW YORK
.BLE B-15
EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL
(WASTEWATER RECHARGE BASIN #3)
ADULTS

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Estimated * Absorbed Dose (EAD) (mg/kg-day) (95U)	Estimated * Absorbed Dose (EAD) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD) (95U)	Hazard Index (EAD/RfD) (GM)
3 Feet	Copper	2070.00	195.65	8.25E-04	7.79E-05	3.70E-02	2.23E-02	2.11E-03
	Cyanide	44.00	2.64	1.75E-05	1.05E-06	2.00E-02	8.77E-04	5.30E-05
	Total						2.32E-02	2.16E-03
6 Feet	Copper	1900.00	100.89	7.57E-04	4.02E-05	3.70E-02	2.05E-02	1.09E-03
	Cyanide	15.00	1.40	5.98E-06	5.58E-07	2.00E-02	2.99E-04	2.79E-05
	Total						2.08E-02	1.11E-03
10-12 Feet	Copper	240.00	96.16	9.56E-05	3.83E-05	3.70E-02	2.58E-03	1.04E-03
	Cyanide	6.50	3.39	2.59E-06	1.35E-06	2.00E-02	1.29E-04	6.75E-05
	Total						2.71E-03	1.10E-03
15-17 Feet	Copper	60.00	40.26	2.39E-05	1.60E-05	3.70E-02	6.46E-04	4.33E-04
	Total						6.46E-04	4.33E-04

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)
CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-16

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL

(WASTEWATER RECHARGE BASIN # 3)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Geometric Mean (GM)	Estimated * Absorbed Dose (EAD) (mg/kg-day) (95U)	(GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD) (95U)	(GM)
3 Feet	Copper	2070.00	195.65	4.32E-03	4.09E-04	3.70E-02	1.17E-01	1.10E-02
	Cyanide	44.00	2.64	9.19E-05	5.52E-06	2.00E-02	4.60E-03	2.76E-04
	Total						1.21E-01	1.13E-02
6 Feet	Copper	1900.00	100.89	3.97E-03	2.11E-04	3.70E-02	1.07E-01	5.70E-03
	Cyanide	15.00	1.40	3.13E-05	2.93E-06	2.00E-02	1.57E-03	1.46E-04
	Total						1.09E-01	5.84E-03
10-12 Feet	Copper	240.00	96.16	5.01E-04	2.01E-04	3.70E-02	1.36E-02	5.43E-03
	Cyanide	6.50	3.39	1.36E-05	7.08E-06	2.00E-02	6.79E-04	3.54E-04
	Total						1.42E-02	5.78E-03
15-17 Feet	Copper	60.00	40.26	1.25E-04	8.41E-05	3.70E-02	3.39E-03	2.27E-03
	Total						3.39E-03	2.27E-03

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-17
EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL
(STORMWATER DRAINAGE BASIN)
ADULTS

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Geometric Mean (GM)	Estimated * Absorbed Dose (EAD) (mg/kg-day) (95U)	(GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD) (95U)	(GM)
Surface	Copper	682.78	267.89	2.72E-04	1.07E-04	3.70E-02	7.35E-03	2.88E-03
	Fluoranthene	0.20	0.20	8.85E-07	8.85E-07	4.00E-02	2.21E-05	2.21E-05
	Di-n-butylphthalate	1.40	1.40	6.19E-06	6.19E-06	1.00E-01	6.19E-05	6.19E-05
	Pyrene	0.14	0.14	6.20E-07	6.20E-07	3.00E-02	2.07E-05	2.07E-05
	Butylbenzylphthalate	2.20	2.20	9.74E-06	9.74E-06	2.00E-01	4.87E-05	4.87E-05
	bis(2-ethylhexyl) phthalate	1.20	1.20	5.31E-06	5.31E-06	2.00E-02	2.66E-04	2.66E-04
	Di-n-octylphthalate	3.80	3.80	1.55E-05	1.55E-05	2.00E-02	7.76E-04	7.76E-04
	Total						8.55E-03	4.08E-03
5-7 Feet	Copper	6.00	4.23	2.39E-06	1.69E-06	3.70E-02	6.46E-05	4.55E-05
	Cyanide	6.50	1.60	2.59E-06	6.37E-07	2.00E-02	1.29E-04	3.19E-05
	Total						1.94E-04	7.74E-05
10-12 Feet	Copper	4.00	1.91	1.59E-06	7.61E-07	3.70E-02	4.31E-05	2.06E-05
	Total						4.31E-05	2.06E-05
15-17 Feet	Copper	16.00	5.73	6.37E-06	2.28E-06	3.70E-02	1.72E-04	6.17E-05
	Total						1.72E-04	6.17E-05

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO COI COMPANY, SYOSSET, NEW YORK

.ABLE B-18

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL
(STORMWATER DRAINAGE BASIN)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EAD/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Surface	Copper	682.78	267.89	1.43E-03	5.60E-04	3.70E-02	3.86E-02	1.51E-02
	Fluoranthene	0.20	0.20	2.32E-06	2.32E-06	4.00E-02	5.80E-05	5.80E-05
	Di-n-butylphthalate	1.40	1.40	1.63E-05	1.63E-05	1.00E-01	1.63E-04	1.63E-04
	Pyrene	0.14	0.14	1.63E-06	1.63E-06	3.00E-02	5.42E-05	5.42E-05
	Butylbenzylphthalate	2.20	2.20	2.55E-05	2.55E-05	2.00E-01	1.28E-04	1.28E-04
	bis(2-ethylhexyl) phthalate	1.20	1.20	1.39E-05	1.39E-05	2.00E-02	6.96E-04	6.96E-04
	Di-n-octylphthalate	3.80	3.80	4.41E-05	4.41E-05	2.00E-02	2.21E-03	2.21E-03
	Total						4.19E-02	1.84E-02
5-7 Feet	Copper	6.00	4.23	1.25E-05	8.84E-06	3.70E-02	3.39E-04	2.39E-04
	Cyanide	6.50	1.60	1.36E-05	3.34E-06	2.00E-02	6.79E-04	1.67E-04
	Total						1.02E-03	4.06E-04
10-12 Feet	Copper	4.00	1.91	8.36E-06	3.99E-06	3.70E-02	2.26E-04	1.08E-04
	Total						2.26E-04	1.08E-04
15-17 Feet	Copper	16.00	5.73	3.34E-05	1.20E-05	3.70E-02	9.03E-04	3.24E-04
	Total						9.03E-04	3.24E-04

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-19

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL

(FORMER SLUDGE AREA)

ADULT

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Reference Doses (RfD)	Hazard Index (EAD/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)	(mg/kg-day)	(95U)	(GM)
Surface- 6 Inches	Copper	1035.47	380.34	4.12E-04	1.52E-04	3.70E-02	1.12E-02	4.09E-03
	Cyanide	27.00	10.07	1.07E-05	4.01E-06	2.00E-02	5.38E-04	2.00E-04
	Total						1.17E-02	4.30E-03

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

CERRO CONI[illegible] COMPANY, SYOSSET, NEW YORK

TABLE B-20

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR DERMAL CONTACT WITH SOIL

(FORMER SLUDGE AREA)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Reference Doses (RfD)	Hazard Index (EAD/RfD)	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)	(mg/kg-day)	(95U)	(GM)
Surface- 6 Inches	Copper	1035.47	380.34	2.16E-03	7.95E-04	3.70E-02	5.85E-02	2.15E-02
	Cyanide	27.00	10.07	5.64E-05	2.10E-05	2.00E-02	2.82E-03	1.05E-03
	Total						6.13E-02	2.25E-02

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

EXPOSURE CALCULATION OF NONCA[illegible]ER EFFECT FOR INHALATION OF SOIL PARTICULATES

*:E= 1.7 x (S/1.5) x [(365-k)/235] x (f/15)

E = total suspended particulate emission rate (lb/acre/day)
S = silt content of soil (percent) = 10
k = number of days with greater than 0.01 inches of rain = 150
f = percentage of time that unobstructed wind speed exceeds 12 mph at the site (50 %)

E = 1.7 x (10/1.5)x(215/235)x(50/15) = 34.6 lb/acre/day
= 4.48 E-5 g/m2/sec = 4.48 E-2 mg/m2/sec

for offsite residental exposure

*** : EID = (Sc x TSP x BR x 10E-6 x EF X ED)/(BW X AT)

Sc = contaminant concentration in soil
TSP = suspended particulates concentration due to emission from site soil (mg/m3)
BR = breathing rate = 20 (m3/day) for adult; = 10 (m3/day) for children
EF = 365 days/year
ED = 30 years for adult; = 6 years for children
BW = body weight = 70 kg for adult; = 16 kg for children

for closest worker exposure

*** : EID = (Sc x Cb x BR x 10E-6 x EF x ED x 1/3)/(BW X AT)
Sc = contaminant concentration in soil
Cb = suspended particles concentration breathing (mg/m3)
BR = breathing rate = 20 (m3/day)
ED = 30 years
EF = 250 days
BW = body weight = 70 kg for adult
AT = average time (over which exposure is average)
= ED x 365 days/yr for noncarcinogenic effect; = 70 x 365 for carcinogenic effects

for offsite residence:

** :TSP = j x E x A/(3.14159 x Vy x Vz x U)

j = frequency of wind toward the exposure point (0.1)
E = emission rate of dust (mg/m2/sec) = 4.48 E-2
A = surface area of concern
Vy = dispersion factor in crosswind direction = 22 m
Vz = dispersion factor in vertical direction = 12 m
U = mean wind speed = 5.5 m/sec

TSP = 0.09 x 4.48 E-2 x A/(3.14159 x 22 x 12 x 5.5)

for closest workers exposure:

** : Cb = Mb / Vb

Mb = contaminants mass entering the box per unit time (mg/sec)
= E x 1m x source length
Vb = volume of air entering the box per unit time (m^3/sec)
= windspeed x breathing height (2 m) x unit width
= 5.5 m/sec x 2 m x 1 m = 11 m^3/sec

surface area for area of concern :

wastewater recharge basin # 1 = 1838.13 m^2 length = 52.8 m

wastewater recharge basin # 2 = 3177.216 m^2 length = 67.2 m

wastewater recharge basin # 3 = 530.8416 m^2 length = 30.72 m

formal sludge disposal area = 4652.237 m^2 length = 75.84 m

stormwater drainage area = 5065.574 m^2 length = 87.36 m

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TABLE B-21

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 1)
OFF-SITE RESIDENCE - ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
3 Feet	Copper	1.04E+03	3.93E+02	4.48E-05	1.82E-03	5.41E-07	2.04E-07	3.70E-02	1.46E-05	5.52E-06
	Cyanide	4.70E+01	1.66E+01	4.48E-05	1.82E-03	2.44E-08	8.66E-09	2.00E-02	1.22E-06	4.33E-07
	Total								1.58E-05	5.95E-06
6 Feet	Copper	5.00E+02	2.51E+02	4.48E-05	1.82E-03	2.60E-07	1.31E-07	3.70E-02	7.03E-06	3.53E-06
	Cyanide	2.10E+01	1.19E+01	4.48E-05	1.82E-03	1.09E-08	6.21E-09	2.00E-02	5.46E-07	3.11E-07
	Total								7.57E-06	3.84E-06
10-12 Feet	Copper	1.40E+02	1.35E+02	4.48E-05	1.82E-03	7.28E-08	7.02E-08	3.70E-02	1.97E-06	1.90E-06
	Cyanide	4.60E+01	2.54E+01	4.48E-05	1.82E-03	2.39E-08	1.32E-08	2.00E-02	1.20E-06	6.60E-07
	Total								3.16E-06	2.56E-06
15-17 Feet	Copper	2.40E+02	1.62E+02	4.48E-05	1.82E-03	1.25E-07	8.45E-08	3.70E-02	3.37E-06	2.28E-06
	Cyanide	2.40E+01	1.96E+01	4.48E-05	1.82E-03	1.25E-08	1.02E-08	2.00E-02	6.24E-07	5.10E-07
	Total								4.00E-06	2.79E-06
20-22 Feet	Copper	1.10E+02	1.10E+02	4.48E-05	1.82E-03	5.72E-08	5.72E-08	3.70E-02	1.55E-06	1.55E-06
	Cyanide	2.80E+01	1.50E+01	4.48E-05	1.82E-03	1.46E-08	7.78E-09	2.00E-02	7.28E-07	3.89E-07
	Total								2.27E-06	1.94E-06

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-22

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 1)

OFF-SITE RESIDENCE - CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
3 Feet	Copper	1.04E+03	3.93E+02	4.48E-05	1.82E-03	1.18E-06	4.47E-07	3.70E-02	3.20E-05	1.21E-05
	Cyanide	4.70E+01	1.66E+01	4.48E-05	1.82E-03	5.35E-08	1.89E-08	2.00E-02	2.67E-06	9.47E-07
	Total								3.46E-05	1.30E-05
6 Feet	Copper	5.00E+02	2.51E+02	4.48E-05	1.82E-03	5.69E-07	2.86E-07	3.70E-02	1.54E-05	7.72E-06
	Cyanide	2.10E+01	1.19E+01	4.48E-05	1.82E-03	2.39E-08	1.36E-08	2.00E-02	1.19E-06	6.80E-07
	Total								1.66E-05	8.40E-06
10-12 Feet	Copper	1.40E+02	1.35E+02	4.48E-05	1.82E-03	1.59E-07	1.53E-07	3.70E-02	4.30E-06	4.15E-06
	Cyanide	4.60E+01	2.54E+01	4.48E-05	1.82E-03	5.23E-08	2.89E-08	2.00E-02	2.62E-06	1.44E-06
	Total								6.92E-06	5.59E-06
15-17 Feet	Copper	2.40E+02	1.62E+02	4.48E-05	1.82E-03	2.73E-07	1.85E-07	3.70E-02	7.38E-06	5.00E-06
	Cyanide	2.40E+01	1.96E+01	4.48E-05	1.82E-03	2.73E-08	2.23E-08	2.00E-02	1.36E-06	1.11E-06
	Total								8.74E-06	6.11E-06
20-22 Feet	Copper	1.10E+02	1.10E+02	4.48E-05	1.82E-03	1.25E-07	1.25E-07	3.70E-02	3.38E-06	3.38E-06
	Cyanide	2.80E+01	1.50E+01	4.48E-05	1.82E-03	3.18E-08	1.70E-08	2.00E-02	1.59E-06	8.51E-07
	Total								4.97E-06	4.23E-06

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-23

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 2)

OFF-SITE RESIDENCE - ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface	Copper	1.30E+03	1.30E+03	4.48E-05	8.69E-05	3.23E-08	3.23E-08	3.70E-02	8.72E-07	8.72E-07
	Cyanide	2.10E+01	1.01E+01	4.48E-05	8.69E-05	5.21E-10	2.50E-10	2.00E-02	2.61E-08	1.25E-08
	Total								8.98E-07	8.85E-07
3 Feet	Copper	2.23E+03	3.03E+02	4.48E-05	3.12E-03	1.99E-06	2.70E-07	3.70E-02	5.37E-05	7.31E-06
	Cyanide	9.60E+01	5.52E+00	4.48E-05	3.12E-03	8.56E-08	4.92E-09	2.00E-02	4.28E-06	2.46E-07
	Total								5.80E-05	7.55E-06
6 Feet	Copper	3.21E+02	1.99E+02	4.48E-05	3.12E-03	2.86E-07	1.78E-07	3.70E-02	7.72E-06	4.80E-06
	Cyanide	8.90E+00	3.38E+00	4.48E-05	3.12E-03	7.93E-09	3.01E-09	2.00E-02	3.97E-07	1.51E-07
	Total								8.12E-06	4.95E-06
10-12 Feet	Copper	1.90E+02	1.28E+02	4.48E-05	3.12E-03	1.69E-07	1.14E-07	3.70E-02	4.58E-06	3.08E-06
	Cyanide	1.80E+01	7.05E+00	4.48E-05	3.12E-03	1.60E-08	6.28E-09	2.00E-02	8.02E-07	3.14E-07
	Total								5.38E-06	3.39E-06
15-17 Feet	Copper	1.00E+02	5.49E+01	4.48E-05	3.12E-03	8.91E-08	4.89E-08	3.70E-02	2.41E-06	1.32E-06
	Cyanide	5.80E+01	7.74E+00	4.48E-05	3.12E-03	5.17E-08	6.90E-09	2.00E-02	2.59E-06	3.45E-07
	Total								4.99E-06	1.67E-06
20-22 Feet	Copper	2.40E+01	2.40E+01	4.48E-05	3.12E-03	2.14E-08	2.14E-08	3.70E-02	5.78E-07	5.78E-07
	Total								5.78E-07	5.78E-07

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CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-24

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 2)

OFF-SITE RESIDENCE - CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface	Copper	1.30E+04	1.30E+04	4.48E-05	8.69E-05	7.06E-07	7.06E-07	3.70E-02	1.91E-05	1.91E-05
	Cyanide	2.10E+01	1.01E+01	4.48E-05	8.69E-05	1.14E-09	5.47E-10	2.00E-02	5.70E-08	2.73E-08
	Total								1.91E-05	1.91E-05
3 Feet	Copper	2.23E+03	3.03E+02	4.48E-05	3.12E-03	4.35E-06	5.92E-07	3.70E-02	1.18E-04	1.60E-05
	Cyanide	9.60E+01	5.52E+00	4.48E-05	3.12E-03	1.87E-07	1.08E-08	2.00E-02	9.36E-06	5.39E-07
	Total								1.27E-04	1.65E-05
6 Feet	Copper	3.21E+02	1.99E+02	4.48E-05	3.12E-03	6.25E-07	3.89E-07	3.70E-02	1.69E-05	1.05E-05
	Cyanide	8.90E+00	3.38E+00	4.48E-05	3.12E-03	1.74E-08	6.59E-09	2.00E-02	8.68E-07	3.30E-07
	Total								1.78E-05	1.08E-05
10-12 Feet	Copper	1.90E+02	1.28E+02	4.48E-05	3.12E-03	3.71E-07	2.49E-07	3.70E-02	1.00E-05	6.74E-06
	Cyanide	1.80E+01	7.05E+00	4.48E-05	3.12E-03	3.51E-08	1.38E-08	2.00E-02	1.76E-06	6.88E-07
	Total								1.18E-05	7.43E-06
15-17 Feet	Copper	1.00E+02	5.49E+01	4.48E-05	3.12E-03	1.95E-07	1.07E-07	3.70E-02	5.27E-06	2.90E-06
	Cyanide	5.80E+01	7.74E+00	4.48E-05	3.12E-03	1.13E-07	1.51E-08	2.00E-02	5.66E-06	7.55E-07
	Total								1.09E-05	3.65E-06
20-22 Feet	Copper	2.40E+01	2.40E+01	4.48E-05	3.12E-03	4.68E-08	4.68E-08	3.70E-02	1.27E-06	1.27E-06
	Total								1.27E-06	1.27E-06

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-25

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 3)

OFF-SITE RESIDENCE - ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
3 Feet	Copper	2.23E+03	1.96E+02	4.48E-05	5.22E-04	3.33E-07	2.92E-08	3.70E-02	8.99E-06	7.89E-07
	Cyanide	9.60E+01	2.64E+00	4.48E-05	5.22E-04	1.43E-08	3.94E-10	2.00E-02	7.16E-07	1.97E-08
	Total								9.71E-06	8.09E-07
6 Feet	Copper	1.90E+03	1.01E+02	4.48E-05	5.22E-04	2.84E-07	1.51E-08	3.70E-02	7.66E-06	4.07E-07
	Cyanide	1.50E+01	1.40E+00	4.48E-05	5.22E-04	2.24E-09	2.09E-10	2.00E-02	1.12E-07	1.04E-08
	Total								7.78E-06	4.17E-07
10-12 Feet	Copper	2.40E+02	9.62E+01	4.48E-05	5.22E-04	3.58E-08	1.44E-08	3.70E-02	9.68E-07	3.88E-07
	Cyanide	6.50E+00	3.39E+00	4.48E-05	5.22E-04	9.70E-10	5.06E-10	2.00E-02	4.85E-08	2.53E-08
	Total								1.02E-06	4.13E-07
15-17 Feet	Copper	6.00E+01	4.03E+01	4.48E-05	5.22E-04	8.95E-09	6.01E-09	3.70E-02	2.42E-07	1.62E-07
	Total								2.42E-07	1.62E-07

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-26

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 3)

OFF-SITE RESIDENCE - CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
3 Feet	Copper	2.23E+03	1.96E+02	4.48E-05	5.22E-04	7.28E-07	6.39E-08	3.70E-02	1.97E-05	1.73E-06
	Cyanide	9.60E+01	2.64E+00	4.48E-05	5.22E-04	3.13E-08	8.62E-10	2.00E-02	1.57E-06	4.31E-08
	Total								2.12E-05	1.77E-06
6 Feet	Copper	1.90E+03	1.01E+02	4.48E-05	5.22E-04	6.20E-07	3.29E-08	3.70E-02	1.68E-05	8.90E-07
	Cyanide	1.50E+01	1.40E+00	4.48E-05	5.22E-04	4.90E-09	4.57E-10	2.00E-02	2.45E-07	2.29E-08
	Total								1.70E-05	9.13E-07
10-12 Feet	Copper	2.40E+02	9.62E+01	4.48E-05	5.22E-04	7.84E-08	3.14E-08	3.70E-02	2.12E-06	8.48E-07
	Cyanide	6.50E+00	3.39E+00	4.48E-05	5.22E-04	2.12E-09	1.11E-09	2.00E-02	1.06E-07	5.53E-08
	Total								2.22E-06	9.04E-07
15-17 Feet	Copper	6.00E+01	4.03E+01	4.48E-05	5.22E-04	1.96E-08	1.31E-08	3.70E-02	5.29E-07	3.55E-07
	Total								5.29E-07	3.55E-07

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TABLE B-27

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(STORMWATER DRAINAGE BASIN)

OFF-SITE RESIDENCE - ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	(GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	(GM)
Surface	Copper	6.83E+02	2.68E+02	4.48E-05	4.98E-03	9.72E-07	3.82E-07	3.70E-02	2.63E-05	1.03E-05
	Fluoranthene	2.00E-01	2.00E-01	4.48E-05	4.98E-03	2.85E-10	2.85E-10	4.00E-02	7.12E-09	7.12E-09
	Di-n-butylphthalate	1.40E+00	1.40E+00	4.48E-05	4.98E-03	1.99E-09	1.99E-09	1.00E-01	1.99E-08	1.99E-08
	Pyrene	1.40E-01	1.40E-01	4.48E-05	4.98E-03	1.99E-10	1.99E-10	3.00E-02	6.65E-09	6.65E-09
	Butylbenzylphthalate	2.20E+00	2.20E+00	4.48E-05	4.98E-03	3.13E-09	3.13E-09	2.00E-01	1.57E-08	1.57E-08
	bis(2-ethylhexyl) phthalate	1.20E+00	1.20E+00	4.48E-05	4.98E-03	1.71E-09	1.71E-09	2.00E-02	8.55E-08	8.55E-08
	Di-n-octylphthalate	3.80E+00	3.80E+00	4.48E-05	4.98E-03	5.41E-09	5.41E-09	2.00E-02	2.71E-07	2.71E-07
	Total								2.67E-05	1.07E-05
5 - 7 Feet	Copper	6.00E+00	4.23E+00	4.48E-05	4.98E-03	8.55E-09	6.02E-09	3.70E-02	2.31E-07	1.63E-07
	Cyanide	6.50E+00	1.60E+00	4.48E-05	4.98E-03	9.26E-09	2.28E-09	2.00E-02	4.63E-07	1.14E-07
	Total								6.94E-07	2.77E-07
10-12 Fee	Copper	4.00E+00	1.91E+00	4.48E-05	4.98E-03	5.70E-09	2.72E-09	3.70E-02	1.54E-07	7.35E-08
	Total								1.54E-07	7.35E-08
15-17 Fee	Copper	1.60E+01	5.73E+00	4.48E-05	4.98E-03	2.28E-08	8.16E-09	3.70E-02	6.16E-07	2.21E-07
	Total								6.16E-07	2.21E-07

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-28
EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES
(STORMWATER DRAINAGE BASIN)
OFF-SITE RESIDENCE - CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface	Copper	6.83E+02	2.68E+02	4.48E-05	4.98E-03	2.13E-06	8.35E-07	3.70E-02	5.75E-05	2.26E-05
	Fluoranthene	2.00E-01	2.00E-01	4.48E-05	4.98E-03	6.23E-10	6.23E-10	4.00E-02	1.56E-08	1.56E-08
	Di-n-butylphthalate	1.40E+00	1.40E+00	4.48E-05	4.98E-03	4.36E-09	4.36E-09	1.00E-01	4.36E-08	4.36E-08
	Pyrene	1.40E-01	1.40E-01	4.48E-05	4.98E-03	4.36E-10	4.36E-10	3.00E-02	1.45E-08	1.45E-08
	Butylbenzylphthalate	2.20E+00	2.20E+00	4.48E-05	4.98E-03	6.85E-09	6.85E-09	2.00E-01	3.43E-08	3.43E-08
	bis(2-ethylhexyl) phthalate	1.20E+00	1.20E+00	4.48E-05	4.98E-03	3.74E-09	3.74E-09	2.00E-02	1.87E-07	1.87E-07
	Di-n-octylphthalate	3.80E+00	3.80E+00	4.48E-05	4.98E-03	1.18E-08	1.18E-08	2.00E-02	5.92E-07	5.92E-07
	Total								5.84E-05	2.34E-05
5 - 7 Feet	Copper	6.00E+00	4.23E+00	4.48E-05	4.98E-03	1.87E-08	1.32E-08	3.70E-02	5.05E-07	3.56E-07
	Cyanide	6.50E+00	1.60E+00	4.48E-05	4.98E-03	2.03E-08	4.98E-09	2.00E-02	1.01E-06	2.49E-07
	Total								1.52E-06	6.05E-07
10-12 Feet	Copper	4.00E+00	1.91E+00	4.48E-05	4.98E-03	1.25E-08	5.95E-09	3.70E-02	3.37E-07	1.61E-07
	Total								3.37E-07	1.61E-07
15-17 Feet	Copper	1.60E+01	5.73E+00	4.48E-05	4.98E-03	4.98E-08	1.79E-08	3.70E-02	1.35E-06	4.82E-07
	Total								1.35E-06	4.82E-07

eder associates consulting engineers, p.c.

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-29

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(FORMER SLUDGE AREA)

OFF-SITE RESIDENCE - ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhalated Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhalated Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface - 6 Inches	Copper	1.04E+03	3.80E+02	4.48E-05	4.57E-03	1.35E-06	4.97E-07	3.70E-02	3.65E-05	1.34E-05
	Cyanide	2.70E+01	1.01E+01	4.48E-05	4.57E-03	3.53E-08	1.32E-08	2.00E-02	1.76E-06	6.58E-07
	Total								3.83E-05	1.41E-05

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-30

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(FORMER SLUDGE AREA)

OFF-SITE RESIDENCE - CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface - 6 Inches	Copper	1.04E+03	3.80E+02	4.48E-05	4.57E-03	2.96E-06	1.09E-06	3.70E-02	7.99E-05	2.94E-05
	Cyanide	2.70E+01	1.01E+01	4.48E-05	4.57E-03	7.71E-08	2.88E-08	2.00E-02	3.86E-06	1.44E-06
	Total								8.38E-05	3.08E-05

CERRO CONDUIT COMPAN[illegible] YOSSET, NEW YORK

TABLE B-31

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 1)

CLOSEST WORKER EXPOSURE

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Particle** Concentration Breathing (Cb) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
3 Feet	Copper	1.04E+03	3.93E+02	4.48E-05	2.15E-01	1.46E-05	5.51E-06	3.70E-02	3.94E-04	1.49E-04
	Cyanide	4.70E+01	1.66E+01	4.48E-05	2.15E-01	6.59E-07	2.34E-07	2.00E-02	3.30E-05	1.17E-05
	Total								4.27E-04	1.61E-04
6 Feet	Copper	5.00E+02	2.51E+02	4.48E-05	2.15E-01	7.01E-06	3.52E-06	3.70E-02	1.90E-04	9.52E-05
	Cyanide	2.10E+01	1.19E+01	4.48E-05	2.15E-01	2.95E-07	1.68E-07	2.00E-02	1.47E-05	8.38E-06
	Total								2.04E-04	1.04E-04
10-12 Feet	Copper	1.40E+02	1.35E+02	4.48E-05	2.15E-01	1.96E-06	1.89E-06	3.70E-02	5.31E-05	5.11E-05
	Cyanide	4.60E+01	2.54E+01	4.48E-05	2.15E-01	6.45E-07	3.56E-07	2.00E-02	3.23E-05	1.78E-05
	Total								8.53E-05	6.89E-05
15-17 Feet	Copper	2.40E+02	1.62E+02	4.48E-05	2.15E-01	3.37E-06	2.28E-06	3.70E-02	9.10E-05	6.16E-05
	Cyanide	2.40E+01	1.96E+01	4.48E-05	2.15E-01	3.37E-07	2.75E-07	2.00E-02	1.68E-05	1.37E-05
	Total								1.08E-04	7.53E-05
20-22 Feet	Copper	1.10E+02	1.10E+02	4.48E-05	2.15E-01	1.54E-06	1.54E-06	3.70E-02	4.17E-05	4.17E-05
	Cyanide	2.80E+01	1.50E+01	4.48E-05	2.15E-01	3.93E-07	2.10E-07	2.00E-02	1.96E-05	1.05E-05
	Total								6.13E-05	5.22E-05

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-32

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 2)

CLOSEST WORKER EXPOSURE

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Particle** Concentration Breathing (Cb) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface	Copper	1.30E+04	1.30E+04	4.48E-05	3.13E-02	2.65E-05	2.65E-05	3.70E-02	7.17E-04	7.17E-04
	Cyanide	2.10E+01	1.01E+01	4.48E-05	3.13E-02	4.29E-08	2.06E-08	2.00E-02	2.14E-06	1.03E-06
	Total								7.20E-04	7.18E-04
3 Feet	Copper	2.23E+03	3.03E+02	4.48E-05	2.74E-01	3.98E-05	5.42E-06	3.70E-02	1.08E-03	1.47E-04
	Cyanide	9.60E+01	5.52E+00	4.48E-05	2.74E-01	1.72E-06	9.87E-08	2.00E-02	8.58E-05	4.93E-06
	Total								1.16E-03	1.51E-04
6 Feet	Copper	3.21E+02	1.99E+02	4.48E-05	2.74E-01	5.73E-06	3.56E-06	3.70E-02	1.55E-04	9.62E-05
	Cyanide	8.90E+00	3.38E+00	4.48E-05	2.74E-01	1.59E-07	6.04E-08	2.00E-02	7.95E-06	3.02E-06
	Total								1.63E-04	9.93E-05
10-12 Feet	Copper	1.90E+02	1.28E+02	4.48E-05	2.74E-01	3.40E-06	2.29E-06	3.70E-02	9.18E-05	6.18E-05
	Cyanide	1.80E+01	7.05E+00	4.48E-05	2.74E-01	3.22E-07	1.26E-07	2.00E-02	1.61E-05	6.30E-06
	Total								1.08E-04	6.81E-05
15-17 Feet	Copper	1.00E+02	5.49E+01	4.48E-05	2.74E-01	1.79E-06	9.81E-07	3.70E-02	4.83E-05	2.65E-05
	Cyanide	5.80E+01	7.74E+00	4.48E-05	2.74E-01	1.04E-06	1.38E-07	2.00E-02	5.18E-05	6.92E-06
	Total								1.00E-04	3.34E-05
20-22 Feet	Copper	2.40E+01	2.40E+01	4.48E-05	2.74E-01	4.29E-07	4.29E-07	3.70E-02	1.16E-05	1.16E-05
	Total								1.16E-05	1.16E-05

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-33

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(WASTEWATER RECHARGE BASIN # 3)
CLOSEST WORKER EXPOSURE

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Particle** Concentration Breathing (Cb) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
3 Feet	Copper	2.23E+03	1.96E+02	4.48E-05	1.25E-01	1.82E-05	1.60E-06	3.70E-02	4.92E-04	4.32E-05
	Cyanide	9.60E+01	2.64E+00	4.48E-05	1.25E-01	7.84E-07	2.16E-08	2.00E-02	3.92E-05	1.08E-06
	Total								5.31E-04	4.43E-05
6 Feet	Copper	1.90E+03	1.01E+02	4.48E-05	1.25E-01	1.55E-05	8.24E-07	3.70E-02	4.20E-04	2.23E-05
	Cyanide	1.50E+01	1.40E+00	4.48E-05	1.25E-01	1.23E-07	1.14E-08	2.00E-02	6.13E-06	5.72E-07
	Total								4.26E-04	2.29E-05
10-12 Feet	Copper	2.40E+02	9.62E+01	4.48E-05	1.25E-01	1.96E-06	7.86E-07	3.70E-02	5.30E-05	2.12E-05
	Cyanide	6.50E+00	3.39E+00	4.48E-05	1.25E-01	5.31E-08	2.77E-08	2.00E-02	2.66E-06	1.39E-06
	Total								5.57E-05	2.26E-05
15-17 Feet	Copper	6.00E+01	4.03E+01	4.48E-05	1.25E-01	4.90E-07	3.29E-07	3.70E-02	1.33E-05	8.89E-06
	Total								1.33E-05	8.89E-06

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-34

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(STORMWATER DRAINAGE BASIN)
CLOSEST WORKER EXPOSURE

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Particle** Concentratio Breathing (Cb) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface	Copper	6.83E+02	2.68E+02	4.48E-05	3.56E-01	1.59E-05	6.22E-06	3.70E-02	4.29E-04	1.68E-04
	Fluoranthene	2.00E-01	2.00E-01	4.48E-05	3.56E-01	4.64E-09	4.64E-09	4.00E-02	1.16E-07	1.16E-07
	Di-n-butylphthalate	1.40E+00	1.40E+00	4.48E-05	3.56E-01	3.25E-08	3.25E-08	1.00E-01	3.25E-07	3.25E-07
	Pyrene	1.40E-01	1.40E-01	4.48E-05	3.56E-01	3.25E-09	3.25E-09	3.00E-02	1.08E-07	1.08E-07
	Butylbenzylphthalate	2.20E+00	2.20E+00	4.48E-05	3.56E-01	5.11E-08	5.11E-08	2.00E-01	2.55E-07	2.55E-07
	bis(2-ethylhexyl) phthalat	1.20E+00	1.20E+00	4.48E-05	3.56E-01	2.79E-08	2.79E-08	2.00E-02	1.39E-06	1.39E-06
	Di-n-octylphthalate	3.80E+00	3.80E+00	4.48E-05	3.56E-01	8.82E-08	8.82E-08	2.00E-02	4.41E-06	4.41E-06
	Total								4.35E-04	1.75E-04
5 - 7 Feet	Copper	6.00E+00	4.23E+00	4.48E-05	3.56E-01	1.39E-07	9.82E-08	3.70E-02	3.77E-06	2.65E-06
	Cyanide	6.50E+00	1.60E+00	4.48E-05	3.56E-01	1.51E-07	3.72E-08	2.00E-02	7.55E-06	1.86E-06
	Total								1.13E-05	4.51E-06
10-12 Feet	Copper	4.00E+00	1.91E+00	4.48E-05	3.56E-01	9.29E-08	4.44E-08	3.70E-02	2.51E-06	1.20E-06
	Total								2.51E-06	1.20E-06
15-17 Feet	Copper	1.60E+01	5.73E+00	4.48E-05	3.56E-01	3.72E-07	1.33E-07	3.70E-02	1.00E-05	3.60E-06
	Total								1.00E-05	3.60E-06

CERRO CONDUIT COMPANY, SYOSSET, NEW YORK

TABLE B-35

EXPOSURE CALCULATION OF NONCANCER EFFECTS FOR INHALATION OF SOIL PARTICULATES

(FORMER SLUDGE AREA)

CLOSEST WORKER EXPOSURE

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Particle** Concentrati Breathing (Cb) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Reference Doses (RfD) (mg/kg-day)	Hazard Index (EID/RfD) (95U)	Hazard Index (EID/RfD) (GM)
Surface - 6 Inches	Copper	1.04E+03	3.80E+02	4.48E-05	3.09E-01	9.14E-05	3.36E-05	3.70E-02	2.47E-03	9.08E-04
	Cyanide	2.70E+01	1.01E+01	4.48E-05	3.09E-01	2.38E-06	8.89E-07	2.00E-02	1.19E-04	4.45E-05
	Total								2.59E-03	9.52E-04

CERRO CONDUIT COM[illegible]NY, SYOSSET, NEW YORK

TA[illegible] B-36

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR GROUNDWATER INGESTION

(GROUNDWATER)

ADULT

Compounds Compounds	Groundwater Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
	95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Copper	3.46E-01	6.96E-02	9.89E-03	1.99E-03	3.70E-02	2.67E-01	5.37E-02
Cyanide	5.20E-02	1.08E-02	1.49E-03	3.09E-04	2.00E-02	7.43E-02	1.54E-02
Lead	6.00E-02	6.00E-03	1.71E-03	1.71E-04	1.40E-03	1.22E+00	1.22E-01
Total						1.57E+00	1.92E-01

*: EDI = (CW x IR x EF x ED)/(BW x AT)

CW = chemical concentration in water
IR = ingestion rate = 1 liters/day (chidren)
= 2 liters/day (adult)
EF = exposure frequency = 365 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 6 years for children (age 1- 6)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects

CERRO CONDUIT COM[illegible]NY, SYOSSET, NEW YORK

TA[illegible] B-37

EXPOSURE CALCULATIONS OF NONCANCER EFFECTS FOR GROUNDWATER INGESTION

(GROUNDWATER)

CHILDREN

Compounds Compounds	Groundwater Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Reference Doses (RfD) (mg/kg-day)	Hazard Index (EDI/RfD)	
	95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)		(95U)	(GM)
Copper	3.46E-01	6.96E-02	2.16E-02	4.35E-03	3.70E-02	5.84E-01	1.18E-01
Cyanide	5.20E-02	1.08E-02	3.25E-03	6.75E-04	2.00E-02	1.62E-01	3.38E-02
Lead	6.00E-02	6.00E-03	3.75E-03	3.75E-04	1.40E-03	2.68E+00	2.68E-01
Total						3.43E+00	4.19E-01

*: EDI = (CW x IR x EF x ED)/(BW x AT)

CW = chemical concentration in water
IR = ingestion rate = 1 liters/day (chidren)
= 2 liters/day (adult)
EF = exposure frequency = 365 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 6 years for children (age 1- 6)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects

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ABLE B-38

EXPOSURE CALCULATIONS OF CANCER RISK FOR SOIL INGESTION
(STORMWATER DRAINAGE BASIN)
ADULT

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Slope Factor	Cancer Risk	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)	(mg/kg-day)-1	(95U)	(GM)
Surface	bis(2-ethylhexyl) phthalate	1.20	1.20	2.52E-07	2.52E-07	1.40E-02	3.52E-09	3.52E-09
	Total						3.52E-09	3.52E-09

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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ABLE B-39

EXPOSURE CALCULATIONS OF CANCER RISK FOR SOIL INGESTION
(STORMWATER DRAINAGE BASIN)
CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Daily Intake (EDI) (mg/kg-day)		Slope Factor	Cancer Risk	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)	(mg/kg-day)-1	(95U)	(GM)
Surface	bis(2-ethylhexyl) phthalate	1.20	1.20	4.40E-07	4.40E-07	1.40E-02	6.16E-09	6.16E-09
	Total						6.16E-09	6.16E-09

*: EDI = (CS x IR x CF x FI x EF x ED)/(BW x AT)

CS = soil concentration
IR = ingestion rate = 200 mg/day (chidren)
= 100 mg/day (adult)
CF = conversion factor = 1.0E-6 kg/mg
FI = fraction ingested from contaminated source = 0.5
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence) for adult
= 6 years for children (age 1-6)
BW = body weight = 16 kg (children) (age 1 - 6)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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[illegible]ABLE B-40

EXPOSURE CALCULATIONS OF CANCER RISK FOR DERMAL CONTACT WITH SOIL

(STORMWATER DRAINAGE BASIN)

ADULT

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Slope Factor	Cancer Rsisk	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)	(mg/kg-day)^-1	(95U)	(GM)
Surface	bis(2-ethylhexyl) phthalate	1.20	1.20	2.28E-06	2.28E-06	1.40E-02	3.19E-08	3.19E-08
	Total						3.19E-08	3.19E-08

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children

AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil

ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1

(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)

EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-41

EXPOSURE CALCULATIONS OF CANCER RISK FOR DERMAL CONTACT WITH SOIL

(STORMWATER DRAINAGE BASIN)

CHILDREN

Depth	Compounds	Soil Concentration (mg/kg)		Estimated * Absorbed Dose (EAD) (mg/kg-day)		Slope Factor	Cancer Rsisk	
		95 % Upper Limit (95U)	Geometric Mean (GM)	(95U)	(GM)	(mg/kg-day)^-1	(95U)	(GM)
Surface	bis(2-ethylhexyl) phthalate	1.20	1.20	8.68E-07	8.68E-07	1.40E-02	1.22E-08	1.22E-08
	Total						1.22E-08	1.22E-08

*: EAD = (CS x CF x SA x AF x ABS x EF x ED)/(BW x AT)

CS = soil concentration
CF = conversion factor = 1.0E-6 kg/mg
SA = skin surface area available for contact (cm^2/event)
= 0.23(arms) + 0.082(hands) = 0.312 m^2 = 3120 cm^2 for adult
= 0.13(arms) + 0.057(hands) = 0.187 m^2 = 1870 cm^2 for children
AF = Soil to skin adherence factor (mg/cm^2)
= 1.45 mg/cm^2 for commercial potting soil
ABS = absorption factor
for inorganics = 0.018 for children; = 0.009 for adult
(Hawley, J.K. 1985. Assessment of Health Risk from Exposure to Contaminated Soil, Risk Analysis 5(4): 289 - 302)
for semivolatile organics = 0.1
(Ryan, E.A. et al. "Assessing Risk From Exposure at Hazardous Waste Sites", Superfund '87 Proceedings of the 8th National Conference, Nov. 16-18, 1987, Washington D.C.)
EF = exposure frequency = 250 days
ED = exposure duration = 30 years (national upper-bound time at one residence)
= 70 years (lifetime)
BW = body weight = 16 kg (children)
= 70 kg (adult)
AT = average time (period over which exposure is averaged)
= ED x 365 days/year for noncarcinogenic effects
= 70 x 365 days/year for carcinogenic effects

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TABLE B-42

EXPOSURE CALCULATION OF CANCER RISK FOR INHALATION OF SOIL PARTICULATES

(STORMWATER DRAINAGE BASIN)

OFF-SITE RESIDENCE - ADULT

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Slope Factor (mg/kg-day)^-1	Cancer Risk (EID x Slope Factor) (95U)	Cancer Risk (EID x Slope Factor) (GM)
Surface	bis(2-ethylhexyl) phthalate	1.20E+00	1.20E+00	4.48E-05	4.98E-03	7.32E-10	7.32E-10	1.40E-02	1.03E-11	1.03E-11
	Total								1.03E-11	1.03E-11

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TABLE B-43

EXPOSURE CALCULATION OF CANCER RISK FOR INHALATION OF SOIL PARTICULATES

(STORMWATER DRAINAGE BASIN)

OFF-SITE RESIDENCE - CHILDREN

Depth	Compounds	Soil Concentration (mg/kg) 95 % Upper Limit (95U)	Soil Concentration (mg/kg) Geometric Mean (GM)	Emission Rate* of Dust Particulates (g/m2/sec) (E)	Total** Suspended Particulates (TSP) (mg/m^3)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (95U)	Estimated *** Inhaled Dose (EID) (mg/kg-day) (GM)	Slope Factor (mg/kg-day)^-1	Cancer Risk (EID x Slope Factor) (95U)	Cancer Risk (EID x Slope Factor) (GM)
Surface	bis(2-ethylhexyl) phthalate	1.20E+00	1.20E+00	4.48E-05	4.98E-03	3.20E-10	3.20E-10	1.40E-02	4.49E-12	4.49E-12
	Total								4.49E-12	4.49E-12

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