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Engineering Report (REVISED)

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REMEDIAL INVESTIGATION REPORT BUFFALO COLOR AREA "D"

buffalo COLOR CORPORATION

Buffalo, New York

AlliedSignal

Morristown, New Jersey

AUGUST 1989

Recorded

BUFFALO COLOR CORPORATION

REMEDIAL INVESTIGATION REPORT
BUFFALO COLOR AREA "D"

REVISED ENGINEERING REPORT

AUGUST 1989

Prepared by
Allied Signal Corporation

and

Buffalo Color Corporation

Revision of The Engineering Report
Dated April 1989
Which was prepared by:

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TABLE OF CONTENTS (CONTINUED)

LIST OF TABLES (CONTINUED)

2.2.3. Structures

The Contact Process company had buildings along both sets of railroad tracks which form the borders of Area "D". With the possible exception of Buildings 403-410, no records of these buildings have been found int he plant archives. Building 432 was built in 1917. The building may have been used in conjunction with the Edgewood Arsenal to produce Phosgene gas. It was definitely used after the 1920s for the production of Picric Acid, an unstable chemical.

Most of the structures shown in the available records were built in the 1930's and 1940's for the manufacture of detergents. It is not clear at what date the tank parks were built, but it is known that they serviced the detergents units, so it is likely that they also were built in the 1930s or 1940s.

There is no record of when the "pit" structure on the south-west shore was built or to what use it was put in the past. The structure was idle during the late 1940's and a water intake line passed over (but not into) the pit area in the early 1950's. The ribbed-concrete design of the structure suggests that it may have been used as a settling basin for incoming river water.

The railroad tracks in Area "D" are at least as old as Building 432. A tabulation of structures found in the records is presented as Table 2-2.

2.2.4. Chemical Manufacturing Processes

A tabulation of what is known about the chemical processes which were carried out in Area "D" is presented as Table 2-3. Descriptions of the known processes are given as follows:

2.2.4.1. Sulfuric Acid

Sulfur is burned to form sulfur dioxide which is passed over a vanadium catalyst with air to form sulfur trioxide which is absorbed in a circulating stream of 98-99% sulfuric acid, where it unites with the small excess of water in the acid to form more sulfuric acid.

2.2.4.2. Phosgene

Phosgene is produced by the combination of carbon monoxide and chlorine gases using activated charcoal as a catalyst.

2.2.4.3. Picric Acid

Dinitrophenol is suspended in sulfuric and nitric acid and nitrated by adding sodium nitrate to form trinitrophenol.

2.2.4.4. <u>Detergents</u>

Kerosene (or Alkylate) is reacted with chlorine gas to form Keryl Chloride or (Alkylchloride) which is reacted with Benzene (or Toluene) and Metallic Aluminum to form Kerylbenzene (Keryltoluene, Alkylbenzene, or Alkyltoluene). This then reacted with Sulfuric Acid to form Kerylbenzene Sulfonate (Keryltoluene Sulfonate, Alkylbenzene Sulfonate, or Alkyltoluene Sulfonate) which is dried and sold. Aluminum Chloride and Hydrogen Chloride products are neutralized with Sodium Hydroxide.

2.2.5. <u>Solid Waste Handling Units</u>

2.2.5.1. <u>Weathering Area (1916-1976)</u>

Heavy metal sludges from a variety of processes were brought to the tip of the Area "D" peninsula and piled for "weathering". The dewartered sludges were then loaded onto trucks or railroad cars and shipped to metal recyclers. A summary of those sludge-producing processes which could be found in plant records is presented in Table 2-4.

2.2.5.2. <u>Iron Oxide Sludge Lagoons (1916-1976)</u>

Iron-bearing solid wastes were brought through the area reclaimed from the Buffalo River at the north-eastern corner of Area "D" and handled in a similar fashion to the Weathering Area operation. Iron sludge producing processes are also shown in Table 2-4.

2.2.5.3. <u>Incinerator Area (1922-1972)</u>

Burnable chemical wastes, solid and liquid, were brought to Area "D" to be burned along with wood and paper from other plant activities along the river bank between the weathering area and the iron sludge ponds. Open burning pits were operated until 1954 when an incinerator was constructed at Building 448. An estimate of the quantity of wastes handled at the incinerator based on previous reports to the NYSDEC is presented in Table 2-5. Metallic hardware such as brackets and hinges were recovered from the ashes of the open-burning and incinerator operations. Neither the ash, nor the chemical residuals of the materials listed in Table 2-5 were removed from the Area D site, but were left in the burning pits until the pits filled up. They were then covered over with dirt. It is, therefore, likely, that the wells and borings taken along the shore between the iron oxide ponds and the weathering area encountered this material in their A Zone samples.

Lake Warren, and Lake Whittlesey. At Buffalo, the surficial sediments were formed in glacial Lake Warren and Lake Whittlesey. These deposits are relatively thin and consist of laminated silt, fine-to-medium sand, and clay. Remnant beach strands are commonly associated with the borders of this unit.

Glacial Deposits

Sediments of glacial origin overlie bedrock in much of the Buffalo area. An extensive ground moraine comprised of a thin silty clay to sandy till occupies much of the area. The ground moraine is marked by end moraines composed of materials of similar texture as well as sand and gravel deposits formed in ice-marginal positions or as outwash. The Buffalo and Crystal Beach end moraines border the Buffalo area to the north and south, respectively. In general, the Glacial Deposits are thin and lie unconformable atop Paleozoic bedrock.

Bedrock

The bedrock stratigraphic succession beneath Buffalo consists of rock ranging in age from Middle Devonian to Upper Silurian. The Paleozoic strata dip toward the southeast at a slope of approximately 40 feet per mile. Bedrock exposure is controlled by glacial and lacustrine erosion.

4.2.2 Regional Hydrogeology

As will be discussed in Section 4.4, groundwater is not extensively utilized in the Buffalo area due to the readily available Lake Erie water source. It should be noted that the underlying Onondaga Limestone formation does contain significant openings and in the uppermost strata is of good quality, but deteriorates with depth. If Lake Erie were not available this layer could be productive. No information could be found on the flow direction of the bedrock aquifer.

Recharge to the overburden is principally through infiltration of precipitation, however, much of the overburden contains a high fine grain content and is, therefore, relatively impermeable. The regional direction of groundwater flow is to the west and northwest toward Lake Erie, with local variations in groundwater flow directions due to the influences of topography, land use, and drainage. On a regional scale, the Glacioacustrine Deposits and the Glacial Till are considered an aquitard, thus retarding the downward migration of groundwater.

material at the site. Typically, high values of electrical conductance imply the existence of conductive materials in the fill.

Figure 4-9 shows the computer-generated conductivity contours derived from the survey. Several highly conductive anomalies are observed at the site. The linear anomaly labelled "A" may be caused by a former underground trolley which was reported to have operated along the traverse. Another linear feature (B") could be due to railroad spurs. The high magnitude of readings along each of these features indicates buried metallic objects.

Another area of elevated conductivity values is in the vicinity of the lagoons ("C"), where magnetic ferrous wastes were deposited. Anomaly "D" was investigated with several test pits and was found to contain several "I" beams and other metallic objects. Additional isolated high-magnitude values primarily coincide with former rail spurs, for example, anomaly "E" occurs in an area where a rail spur is partially visible.

The "Pit Area" was also investigated with a test pit. The sides of the pit were found to be 3-4 feed deep and tocontain soils typical of the rest of Area "D".

4.3.2 <u>Alluvium</u>

The Waste/Fill material is underlain by Alluvium which was laid down by the Buffalo River. This unit generally consists of black to gray silty sand with trace of clay, however, grain-size textural variations to gravelly sand or sandy silt are recognized. In general, a coarsening downward sequence is present. Two sub-units of the alluvium are observed at the site: a black, brown, and red-brown clayey silt and very fine sand unit; and a lower, generally thicker and more permeable gray sand and gravel unit. Moisture conditions within the alluvium vary from moist to saturated.

Structural contours of the top of the alluvium are presented on Figure 4-10. The upper surface of the alluvium generally slopes in three directions. Sloping toward the northwest corner is due to trenching for the installation of underground utilities. Sloping toward the southwest and northeast corners is due to erosion by the Buffalo River. The alluvium ranges in thickness up to 22.0 (B-7-88) feet and averages 17.8 feet.

6.0 SITE CONTAMINATION CHARACTERIZATION

6.1 METHODOLOGY

The characterization of site contamination was accomplished by analysis of soil, groundwater, river water, stream sediments, and waste residuals. Samples were collected during the period of May-November, 1988. A summary of the sample collection and analysis methodology is presented below. A detailed discussion of the procedures that were used to collect and analyze all environmental samples is presented in Appendix A.2.

6.1.1 Soils

Soil samples were collected at the surface and at depth using split-spoon samplers. All surficial soil samples were collected to a depth of two (2) feet. Soil samples collected at depth were composited in accordance with the following protocol:

- For each deep boring, a Composite "A" sample was made of all of the apparently contaminated soil. The physical appearance of the soil (notably discoloration and odor) was used in conjunction with HNu total organic vapor readings to make this determination.

- At each boring,a Composite "B" sample was made of the first complete 2-foot split-spoon sample of apparently uncontaminated soil. This sample was collected within the next six (6) feet of boring sample below the Composite "A" sample.

- A "C" zone sample was made of the 2-foot split spoon sample starting six (6) feet below the top of the composite "B" sample.

If no apparently contaminated soil was encountered, no Composite "A" was collected. If the entire depth of the boring was through an apparently contaminated interval, such as the borings made to a specific depth for piezometer and monitoring well installation, then no Composite "B" and "C" was collected. For the same reason, no Composite "B" and/or "C" was collected at some of the soil borings that were terminated in the till which underlies the fill at the site. The decision to terminate all soil borings in the till was made in the field and is a deviation from the Work Plan that was approved by Buffalo Color/Allied Signal and the NYSDEC to prevent the down hole migration of contaminated fill material (see Appendix B.2). The field observations used as a basis for defining the Composite "A", "B" and "C" intervals are recorded in Appendix C.2, Boring Logs, and are summarized in Table 6-1.

A Total of six (6) Composite "C" samples and eleven (11) composite "B" samples were collected. Of these, three (3) of the "C" and (1) of the "B" samples were taken in the grey silty clay glacioacustrine layer. The rest were taken in the fill and alluvium layers.

None of the glacioacustrine layer samples showed contamination, but nearly all of the samples collected in the fill or the alluvium layers showed some contamination.

Surficial soil samples were collected at nine (9) locations as shown in Figure 6-1. Soil samples were collected at depth at twenty-four (24) locations including seven (7) soil boring, four (4) piezometer installations and ten (10) monitoring well (i.e., MW-1-88 through MW-10-88) installation locations. No soil samples were collected for chemical analysis at MW-11, MW-12, MW-13, W-6R, or the previously installed monitoring wells (i.e., W-7, W-8, W-12, W-13, W-14, W-15).

The surfical soil samples and deep soil composites were analyzed for the chemical parameters identified in Table 6-2. The analytical methods used for all analyses are summarized in Table 6-3.

6.1.2 <u>Groundwater</u>

Seven (7) previously installed groundwater monitoring wells (i.e., W-7, W-8, and W-9 installed May 1982 and W-12, W-13, W-14, and W-15 installed April 1983) and ten (10) wells installed during May and June 1988 (i.e., MW-1 through MW-10) as a part of this RI program were sampled on two (2) occasions: 6/22-24/88 and 8/16-18/88. Subsequently, three (3) additional wells were installed (i.e., MW-11, MW-12, and MW-13) during November 1988. Samples were collected from these wells on one (1) occasion: 11/21/88. the location of each monitoring well is shown on Figure 6-1. The screened intervals of all the wells is discussed in Section 4.1.3.

All groundwater samples were collected using stainless steel or teflon bailers. None of the groundwater samples were filtered prior to analysis. The groundwater samples were analyzed for the chemical parameters identified in Table 6-2. The analytical methods used are summarized in Table 6-3. As Table 6-2 indicates, the groundwater

6.3 Ground Water

The groundwater monitoring results for those parameters having at least one detected value are summarized in Tables 6-7, 6-8, 6-9 and 6-10. Two (2) hydrogeologic units were monitored: the shallow unconfined water-bearing zone and the Glacioacustrine/Till Aquitard (see Section 4.4). A discussion of the character of contamination found in each of these units is presented below.

6.3.1 Shallow Unconfined Water-Bearing Zone

The screened interval of each well installed within this zone can be summarized as follows:

- Straddling the Water Table:

MW-2	MW-6
MW-3	MW-8
MW-4	MW-9
MW-5	MW-10

- Middle of Shallow Water-Bearing Zone:

W-7	W-13
W-8	W-14
W-9	W-15
W-12	

- Top of Uppermost Confining Layer:

MW-11
MW-12
MW-13

The elevation of each screened interval has been presented in Table 4-1. Field observations pertinent to visual and olfactory evidence of contamination at each well is presented in Table 4-2.

For the purpose of discussion of the character of contamination found in this zone, the Area "D" site is again divided into the areas identified in Section 6.2.

6.3.1.1 Iron Oxide Sludge Lagoons

Tow (2) wells (W-14 and W-15) were sampled on each of two (2) occasions in this area (see Figure 6-1). During the June sampling event, groundwater elevations were higher than during the August sampling

6.3.1.6 Remainder of Site

The two remaining wells at which groundwater samples were collected during the RI field activities are W-7, located near the northwest site boundary, and W-6R, located outside the northern site boundary adjacent to the site access road. Well W-7 is positioned at the most hydraulically upgradient location of all the wells monitored during this program.

Nine (9) volatile/semi-volatile compounds were detected in W-7, the most notable being benzene (16-210 ppb). Except for iron (42,000 - 47,000 ppb) and aluminum (2,400 ppb) metal concentrations were relatively low. The TOC (20-25 ppm), TOX (0.062-0.067 ppm) and specific conductivity (1400-1800 umhos) all reflect a relatively low level of groundwater contamination at this well.

Well W-7 is located inside Area "D" beside what were roadways and railroad sidings. The possibility of spillage from these sources was discussed in Section 2.2.6. The low levels of contamination found at this location are probably attributable to 70 or more years of chemical traffic in the immediate area.

The groundwater at W-6R contains numerous organic compounds in the low ppb concentration range. The groundwater collected from this well was observed to be black in color and to have a slight odor. Notable organic contaminants detected included:

benzene	480 - 500 ppb
toluene	88 - 110 ppb
benzidine	ND - 90 ppb
chlorobenzene	17 - 24 ppb
naphthalene	14 - 16 ppb
xylene	ND - 10 ppb
1-naphthylamine	6 - 9 ppb
1,4-dichlorobenzene	3 - 5 ppb
1,2-dichlorobenzene	3 - 4 ppb

Metals present include:

Iron	6,900 - 8,100 ppb
Aluminum	NR - 2,800 ppb
Zinc	390 - 430 ppb
Copper	80 - 160 ppb
Chromium	50 - 90 ppb
Lead	60 - 80 ppb

Well W-6R is located on idle DL&W Railroad property alongside the roadway leading into Area "D". Figures 4-15 and 4-16 and indicate that this well is immediately downgradient from the currently operational railroad property which form the north-western boundary of Area "D". Well W-6R could also be included in maps similar to Figures 2-3 or 2-4 which indicate potential spillage from past truck or railroad spillage.

6.3.2 Glacioacustrine/Till Aquitard

Two wells (MW-1-88 and MW-7-88) were installed in the glacial till to monitor the ground water quality of the lower portion of the aquitard that underlies the site. As previously discussed, a continuous glaciolacustrine/till aquitard is present beneath the site and groundwater in this zone exhibits a vertically upward hydraulic gradient (see Section 4.4). These factors would be expected to retard the downward migration of contaminants from the fill.

The analytical data for monitoring wells MW-1-88 and MW-7-88 summarized in Table 6-10 does not present clear evidence that the galciolacustrine till has been contaminated.

6.4 Surface Water

The surface water sampling results for those parameters having at least one detected value are summarized in Table 6-11. As indicated, most of the volatiles detected were also detected in the instrument blanks analyzed as a part of the quality control protocol. As discussed previously, acetone was present as a result of its use in field cleaning of sampling equipment.

These results are comparable to those of recent stream surveillance of the Buffalo River which were conducted by NYDEC and presented in the recently published Buffalo River Remedial Action Plan, and earlier by Buffalo Color corporation. These results have been incorporated into Table 8-1 (Alt.)

The surface water sampling locations are shown in Figure 6-2. The designated "upstream" (SW UP) and "downstream" (SW Down) sampling locations were named on the basis of normal flow direction in the Buffalo river. However, as has been discussed, flow reversals sometimes occur in the river (see Sections 4.4.2.2 and 5.0). During the 8/19/88 sampling event, such a flow reversal was occurring.

6.5 Stream Sediments

As discussed in Sections 4.4.2.1 and 5.1, flow direction reversals occur in the Buffalo River as a result of lake seiches. This situation might be expected to have some influence on sediment transport and distribution. However, since flow velocity is low during such flow reversals, the major sediment transport process is likely more a function of sediment scour that occurs during the spring melt/runoff and major storm events. The problem is complicated by the fact that the U.S. Army Corps of Engineers dredges the river bottoms, removing 100,000 - 200,000 tons of sediments per year. This may change the location and direction of subsequent deposition of sediments re-suspended during dredging. The discussion of the stream sediment sampling results is presented in this context.

The results of analysis of sediments collected from the bed of the Buffalo River just offshore of Area "D" for those parameters having at least one detected value are summarized in Table 6-12. As indicated in Table 6-12, the principal contaminants found in the sediments were eleven (11) PAH compounds, naphthalene, nitrobenzene, and metals, especially iron, copper, lead, chromium, and zinc.

These data are comparable to the results of river sediment sampling beside Area D which are presented in a recent study conducted by NYDEC and Erie County Department of Environment and Planning as part of the Niagara River Area Sediments (December 1987). These data have also been incorporated into Table 8-1 (Alt).

Several trends are apparent with respect to the spatial distribution of the semi volatile organics and metals found in the sediments. First is the occurrence of 1,2-dichlorobenzene, nitrobenzene, and naphthalene at sediment sampling stations 4 and 5. As shown in Figure 6-2, these two stations are located adjacent to the incineration area where the same semi volatile organics are present in high concentration in the soil (see Section 6.2.2).

Another trend was the steadily increasing concentrations of EOX and metals from Station No. 1 through Station No. 6 (see Figure 6-2). Finally, the highest concentration of PAH compounds and chromium was found at Station No. 8, located in the sediment depositional zone on the west side of the peninsula.

6.6 <u>Waste Residues</u>

Analysis of the two (2) tar-like waste residue samples collected from the shore on the east and west sides of Area "D" yielded inconsistent results. Thirteen (13) PAH compounds and two (2) phthalates were analytically detected in the west tar sample (see Table 6-13). A split sample of this material taken by NYDEC also showed total PAH levels of several hundred ppm. The discrepancies between the split samples of the tars is indicative of the difficulty encountered in trying to reproduce "soil" sampling results. The heterogeneity of the samples can result in highly different lab results on even intensively homogenized soil samples. Please note that if a 100 gram soil sample is split in half, a 1 mg chunk of a chemical slipping into one split sample instead of the other can make a 20 ppm difference in the reported results. In a tar-like sample, the probability of finding such chunks of chemicals is enhanced.

In contrast to the above, only bis (2-ethylhexyl)phthalate was reported to be present in the east tar sample. The iron content of this sample was determined to be 52 percent, indicating its probable identity as steel slag.

7.2.3 <u>Ground Water</u>

Contaminant loadings to the Buffalo River via the groundwater pathway were calculated for the Area "D" site using Darcy's Law and concentration data presented in Section 6.0. Considerations made in the performance of these calculations included:

- only groundwater in the uppermost saturated zone is contributing contaminants to the Buffalo River;

- the quantity of contaminants present in the uppermost saturated zone was not corrected for potential background sources (viz.hydraulically upgradient and bedrock sources); and

- loading calculations were made for the following groups of parameters:

    . total volatile organic compounds (VOCs), excluding acetone and methylene chloride,
    . polynuclear aromatic hydrocarbons (PAHs) and phthalates,
    . other semi-volatile organic compounds (SVOCs),
    . total iron
    . total metals (viz.Sb, As, Be, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Tl, Zn), excluding iron,
    . total organic carbon (TOC), and
    . total organic halogens (TOX).

- The elevation of the bottom of the uppermost saturated zones is a consistent, equal to the average elevation of clay shown in Table 4-5. The elevations of the tops of the uppermost saturated zones are measurements made shortly before the day of sampling. These data are presented in Table 4-3.

- The width of each section of the uppermost saturated zone was set equal to the length of corresponding shoreline.

- The river-front perimeter of Area "D" was subdivided into six sections, each measured by a group of monitoring wells in the uppermost saturated zone.

    . Iron Oxide Lagoon Area (Wells W-14, W-15)
    . Incinerator Area (MW-4-88, MW-9-88, MW-12-88, MW-13-88)
    . Between incinerator and weathering areas (MW-10-88)
    . Weathering Area (W-12, W-13)
    . West Shore (Southern End) (MW-2-88, MW-3-88, W-9)
    . West Shore (Northern End) (MW-5-88, MW-6-88)

All of the data collected during the present RI from these monitoring wells were utilized to calculate average concentrations of the above specified groups of contaminants in groundwater entering the Buffalo River from Area "D" as summarized in Table 7-1. A tabulation of all of the calculations is presented in Table 7-4 in Appendix E.3. No non-aqueous phase liquids were found in measurable quantities at any of the peripheral wells.

The overall estimates of this calculation are comparable to earlier ones.

Estimator	Date	Loadings (Pounds/Day) Organics	Metals
Buffalo Color (Phase 1)	Jun 1984	--	9.0
NYSDEC (Buffalo River RAP)	Mar 1989	3.9	0.5
Remedial Investigation	Aug 1989	12.8	1.3

7.2.4 Mechanical Erosion

The erosion potential of the river bank along the periphery of the Area "D" site was calculated using the Universal Soil Loss Equation (USLE) as developed by the United States Department of Agriculture (USDA) and summarized in USEPA (1982). Major assumptions used in the performance of these calculations included:

- that no vegetation exists on the river bank;
- that the fill material contains less than 0.5 percent organics; and
- that river scour increases the erosion potential by 25 percent along the eastern bank and by 10 percent along the southwestern bank.

The river bank along the periphery of the Area "D" site was segregated into six (6) areas to facilitate performance of the calculations and use of area-specific soil/waste fill characteristics. The six areas included: the iron oxide sludge pond area, the incineration area, the weathering area, the southwest bank, the area between the iron oxide sludge pond and the incineration area, and the area between the weathering area and the incineration area. No attempt was made to estimate the amount of waste fill which is eroding below the water surface. Erosion potential calculations are presented in Appendix E.1 along with a figure illustrating how the river bank was segregated into the above designated areas for calculation purposes.

Contaminant loadings to the Buffalo River via the mechanical erosion pathway were calculated using the erosion potential calculations and soil/fill contaminant concentration data presented in Section 6.0

Table 7-1

BUFFALO COLOR CORPORATION AREA "D"

GROUNDWATER
LOADINGS TO THE BUFFALO RIVER

Pounds/Day

	IRON OXIDE LAGOON AREA	INCIN-ERATOR AREA	INCIN./ WEATHER. AREA	WEATH-ERING AREA	WEST SHORE (SOUTH)	WEST SHORE (NORTH)	AREA D TOTAL
PAH/PHTHALATES	0.000	0.003	0.000	0.000	0.001	0.000	0.004
OTHER SEMI-VOLATILE ORGANICS	0.102	0.161	0.000	0.001	0.149	0.000	0.413
VOLATILE ORGANICS	0.005	0.016	0.000	0.000	0.013	0.000	0.034
TOTAL METALS LESS IRON	0.245	0.002	0.002	0.029	1.052	0.000	1.329
IRON	0.428	0.071	0.010	0.098	31.125	0.003	31.735
TOTAL ORGANIC CARBON	0.821	1.619	0.006	0.034	10.300	0.005	12.784
TOTAL ORGANIC HALOGEN	0.001	0.024	0.000	0.000	0.017	0.000	0.041
FLOW (Gallons/Day)	1284	11127	21	125	12283	15	24856

Detailed calculations presented in Appendix E.4 Table 7-4

The presence of an oily sheen, odor, HNu reading, or other visible sign of contamination was not observed at any of the underground utilities found. Approximate locations of observed underground utilities are presented on Figure 7-2.

7.3 Contaminant Loadings

7.3.1 Free-Product Migration

The 1982 finding of a 6-8 foot layer of kerosene-like material, floating on the water table at Well W-8 is confirmed.

Well W-8 is located in Area D about 15 feet south of the former Tank Park 910. That cluster of tanks had been surrounded by a concrete dike, but had an earthen floor. Table 2-3 indicates that kerosene is known to have been stored in tanks in Area D. It is therefore, probable that the material in W-8 is from a spill which occurred in Tank Park 910 sometime during its active life.

Table 2-2 indicates that Tank Park 910 was installed in 1953 and Table 2-3 shows that detergents manufacturing in Area D ended in 1974. Any spill in Tank Park 910 would, therefore, have occurred between these dates.

Free-product migration is generally governed by the viscosity and density of the product, relative permeability of the formation, and the rate at which ground water flows through the formation. Soluble constituents of the free-product are conservatively assumed to move at the same rate as groundwater flow. The organic contaminant plume is, expected to migrate in a southerly and southwesterly direction.

Figures 4-15 and 4-16 indicate that this would carry groundwater bearing dissolved constituents from W-8 toward monitoring well MW-5-89. In response to gradients of 0.00081 to 0.00194 ft/ft. Hydraulic conductivity measured at well MW-5-89 (Table 4-7) gives a value of 0.000137 cw/sec. Converting these data to migration rates gives values between 0.1 and 0.3 feet per year.

Applying the above rate of migration to the above dates of spill, we calculate that the distance travelled by groundwater from beneath Tank Park 910 lies between 2 and 11 feet. This is far short of the distance to MW-5-89 and further short of the distance to the river bank.

The movement of the floating organic phase itself is even slower than the groundwater, owing to the relative viscosities and densities of kerosene and water. The immobility of the organic phase is verified by the fact that the organic phase was not found in downgradient monitoring wells MW-3-88, MW-5-88, or MW-6-88 which are screened at the water table.

Analysis of the organic phase in W-8 shown in Table 6-9 indicated the presence of constituents which have some solubility in water. The table below shows that those constituents which were detected in both rounds of organic phase sampling were "non-detected" in the groundwater at MW-5-88 except for parameters probably related to the apparent laboratory contamination of glassware and equipment which also affected the blank samples.

<u>Comparison of W-8 Organic Phase with MW-5-88 Groundwater</u>

	W-8 Organic-Phase Concentration PPB		MW-5-88 Groundwater Concentration PPB	
Xylene	3,276	B	4.5	B
Fluoranthene	2,651		-	
Methylene Chloride	917	BB	4.0	BBJ
Acetone	550		-	
Benzene	394		-	
Chlorobenzene	363		-	
Pyrene	156		-	
Toluene	149	BBJ	< 0.1	BJ

<u>Comments:</u> B Contaminant present in laboratory blank
J Value of sample estimated by laboratory
\- Not detected in groundwater

The history of Area D described in Section 2 and the frequency of soil boring observations of stained or odorous soils indicate a reasonably high probability of finding evidence of non-aqueous phase liquids at many locations on the site. For this reason, we believe that it is unsound to infer that because "NAPL" is found at two locations, there is evidence of migration between the two points.

7.3.2 Groundwater

Calculated contaminant loadings to the Buffalo River from the Area "D" site via the groundwater pathway are summarized in Table 7-1. Examination of the data in Table 7-1 indicates that as much as 17.4 pounds of iron and 2.0 pounds of other metals are being discharged daily to the Buffalo River via groundwater. However, these numbers may be un-representatively high due to the high turbidity/suspended solids content of the groundwater quality samples collected during this investigation. Soluble metals data was not collected (see Section 6.0). Further examination of Table 7-1 indicates that halogenated organics are a minor amount (viz. less than 2 percent) of the total organic carbon being discharged to the Buffalo River. The data also indicate that PAHs and phthalates re a relatively minor amount (viz. less than 5 percent) of the total semi-volatile organic compounds being discharged to the Buffalo River via groundwater.

8.0 Public Health and Environmental Concerns

This section presents an assessment of public health and environmental concerns at the Buffalo Color Area "D" site. The objectives of this assessment are to evaluate potential human health and environmental impacts associated with exposure to contaminants associated with the site.

The three factors which govern the potential risk of hazardous wastes to human health and the environment are:

1) the presence of contaminants;
2) actual or potential paths of exposure to these contaminants; and
3) human and/or environmental receptors in the exposure paths.

A discussion of potential pathways of exposure and potential receptors of contaminants that may be migrating off-site from the Area "D" is presented in Section 8.1. An evaluation of specific site contaminants potentially affecting human health is presented in Section 8.2. Potential environmental impacts, including a review of the literature pertinent to environmental quality of the Buffalo River, is presented in Section 8.3.

8.1 Potential Receptors

Potential human exposure may result from contaminants present at the site or from contaminants emanating from the site (e.g., via groundwater, surface run-off, air, etc.). Potential human exposure points are addressed below on a media-specific basis.

Contaminated Soil - The Buffalo Color Area "D" site is located on a peninsula in the Buffalo River. A guarded security fence is located to the north and west of the site that limits entry onto the site to authorized personnel only. The site is not readily accessible to Buffalo Color employees or the general public from land. The steep banks of the south and east sides of Area "D" discourage entry from the Buffalo River. A

(Revised)

security fence blocks entry from the smooth-banked west side. Area "D" is patrolled eight (8) times per day by uniformed security. Under a trespass scenario, trespassers could be exposed to contaminated soil by dermal contact or ingestion (i.e., if contaminated soil is transferred to the hands, it could be ingested during activities such as eating or smoking).

<u>**Contaminated Groundwater**</u> - The Area "D" site is located in the City of Buffalo. Area residents are supplied with water by the City of Buffalo Department of Public Works, Water Division. There are no known potable water wells in the area, therefore, ingestion of contaminated groundwater is not a human exposure route of concern at the site.

<u>**Contaminated Surface Water**</u> - Any surface water contaminants from the site would flow east and empty into Lake Erie, approximately 4 miles downstream. There are no known surface water intakes on the Buffalo River downstream of the site. The closest downstream surface water intake used for potable supply is located near the confluence of Lake Erie and the Niagara river.

The impact of surface water contamination adjacent to the site would be lessened considerably by natural dilution within the stream system. This dilution results from a number of processes, including mechanical dispersion and physical/chemical/biological reductions (e.g., due to adsorption, settlement, volatilization, decay, etc.).

<u>**Air Contamination**</u> - Receptors considered potentially at risk from air contamination at the site are persons trespassing on the site. The greatest potential risk would result from volatilization of organics in surface soil. HNu readings taken during soil sampling indicated that there was some volatilization of organics in soil.

Summary - Based upon the foregoing discussions, the most likely human exposure pathways identified at the site are ingestion, dermal contact and inhalation of contaminants in surface soils by trespassers.

8.2 Public Health Impacts

8.2.1 Regulatory Standards and Guidelines

Potential impacts posed by surface water and groundwater contamination are identified on the basis of comparison of observed contaminant concentrations at the site with applicable federal and state standards and guidelines. These regulations and guidelines are the following:

- New York State Water Quality Regulations (Title 6, Parts 701 and 703).
- Secondary Drinking Water Regulation (40 CFR, Part 143)
- NYSDEC Ambient Water Quality Guidance Values (TOGS 1.1.1 4/1/87)
- Safe Drinking Water Act, Recommended Maximum Contaminant Levels
- Clean Water Act, Water Quality Criteria for Human Health
- NYSDOH Sanitary Code Drinking Water Supplies 10 NYCRR Subpart 5-1 (1989)

Since there are currently no applicable standards or guidelines relating to soil contamination, the potential impacts of soil contamination have not been addressed.

8.2.1.1 **Applicable Water Quality Standards and Criteria** - Surface water in the State of New York is classified by the New York State Department of Environmental Conservation (NYSDEC) according to the "Best Usage of Waters". The reach of the Buffalo River from the River's mouth to the City of Buffalo West Seneca border is designated as Class "D". New York State Water Quality Regulations (6NYCRR, Part 701) identify the best usage of Class "D" surface water as follows:

"The waters are suitable for fishing. The water quality shall be suitable for primary and secondary contact recreation even though other factors may limit the use for that purpose. Due to such natural conditions a intermittency of flow, water conditions not conducive to propagation of game fishery or stream bed conditions, the waters will not support fish propagation".

All groundwater in New York State are designated by NYSDEC as Class "GA". New York State Water Quality Regulations (6NYCRR, Part 703) identify the best usage of Class GA groundwater as follows:

> "The best usage of Class GA waters is as a source of potable water supply. Class GA waters are fresh groundwater found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock".

According to these regulations, standards applicable to Class GA ground water shall be the most stringent of those from the following four sources:

1) New York State Water Quality Regulations (6NYCRR, Part 703)

2) Maximum Contaminant Levels (MCLs) for drinking water promulgated by the New York State Department of Health (10NYCRR, Subpart 5-1, Public Water Supplies).

3) Standards for raw water promulgated by the New York State Department of Health (10NYCRR, Part 170, Sources of Water Supply).

4) Maximum Contaminant Levels for drinking water promulgated as Primary Drinking Water Regulations by the U.S. Environmental Protection Agency (USEPA) pursuant to the Safe Drinking Water Act (40 CFR, Part 141).

In addition to the preceding enforceable standards for surface water and groundwater, the USEPA has issued water quality guidelines referred to as Secondary Drinking Water Regulations (40 CFR, Part 143). The NYSDEC also has Ambient Water Quality Guidance Values from their Division of Water Technical and Operational Guidance Series, referred to as TOGS 85-W-38. In addition, there are guidelines pursuant to the Clean Water and Safe Drinking Water Acts which are summarized in the USEPA's Guidance on Feasibility Studies Under CERCLA (USEPA, 1985b) which include the following:

1) Secondary Drinking Water Regulations (applicable to groundwater)

2) Ambient Water Quality Guidance Values (applicable to groundwater)

3) Safe Drinking Water Act, Recommended Maximum Contaminant Levels (applicable to groundwater).

4) Clean Water Act, Water Quality Criteria for Human Health -- Fish and Drinking Water (applicable to surface water)

5) Clean Water Act, Water Quality Criteria for Human Health - Adjusted for Drinking Water Only (applicable to groundwater)

8.2.1.2 **Comparison with Standards and Guidelines**

Table 8-1 summarizes observed versus allowable concentrations of hazardous surface water and groundwater contaminants at the site. For each of the chemical parameters included as part of the analytical program during the present RI, Table 8-1 lists its laboratory detection limit, its maximum observed concentration in surface water and groundwater samples, and the corresponding enforceable limits and non-enforceable guidelines applicable to these contaminants. For comparative purposes, the maximum observed oil and sediment concentrations for each contaminant are also presented.

Groundwater and surface water parameters detected in excess of the applicable standards and guidelines are summarized in Tables 8-2 through 8-4. As indicated, the most prevalent contaminants in groundwater at the site include volatile organics (viz., benzene, toluene, chlorobenzene, and xylene) and metals, (viz., arsenic, cadmium, chromium, lead and zinc). Most of the volatile organics are in violation of the recently revised 10 NYCRR Subpart 5-1, Public Water Supplies regulations, whereas most of the metals are in violation of the New York State Water Quality REgulations (6NYCRR, Part 703). As indicated in Table 8-3, the compounds that exceeded applicable guidelines most frequently include 2-chlorophenol, antimony and arsenic.

The data presented in Table 8-4 indicates a much lower incidence of contaminants in surface water than groundwater, based on a comparison with applicable standards and guidelines. However, it should be noted that it is impractical to access the water quality of the river adjacent to the site based on one round of sampling.

- Chromium concentrations of 0.1-0.2 mg/lg were reported in fish from the segment of the Buffalo River from the Cazenovia Creek confluence to Lake Erie.

- High concentrations of benzanthracene (up to 127.5mg/kg) and benzyprene (up to 2.46 mg/kg) were reported in a carp and goldfish composite sample collected near the mouth of the Buffalo River.

<u>**Data from 1980 indicated the following for macrophytes:**</u>

- The greatest number of metals (nine) found in Cladophora (analgal macrophyte) at concentrations above detection limits occurred at a site located near to the entrance to the Buffalo Ship Canal in the Buffalo river.

- Mercury was reported in only two Cladophora samples. One sample was collected at the Ship Canal location mentioned above.

- The highest concentrations of arsenic (35.0 ug/g), chromium (16 ug/g), cobalt (4.0 ug/g), copper (20.0 ug/g), and lead (41.0ug/g) were found in Cladophora from the Ship Canal location indicating metals pollution in this area.

A recent examination of the fish population of the Buffalo River (Adrian and Merckel,1989) demonstrated the presence of 29 species which were observed in a sampling of 3,510 fish. The species found were:

Gizzard Shad	Rock Bass
Pumpkinseed	Freshwater Drum
Golden Shiner	Northern Hog Sucker
Goldfish	Rainbow Trout
Emerald Shiner	Alewife
Carp	Common Shiner
Brown Bullhead	Quillback Carpsucker
White Perch	Muskellunge
Smallmouth Bass	Black Crapple
White Sucker	Creek Chub
Golden Redhorse	Northern Pike
Spottail Shiner	Coho Salmon
Largemouth Bass	White Crapple
White Bass	Brown Trout
Yellow Perch	

The study also reported evidence of spawning in the river. Larva from 9 separate taxa were identified.

8.3.1.3 **Sediments**

Although improved water quality has enhanced biota recovery, a continuing problem documented in the literature is contaminated sediments. Sediment transport to Lake Erie is very slow because of low water levels in the Buffalo River and high water levels in Lake Erie. The higher the lake, the lower the average amount of discharge from the river. This phenomena results in stagnant conditions, and during the summer months when precipitation is low and evaporation high, the River actually flows upstream (Oleszko 1975). This results in the possibility that a site may not only contribute to downstream contamination, but upstream contamination as well.

NYSDEC investigators have claimed (Litten, 1987) that if transport from the river occurs at all, it would happen during rare high-flow conditions. However, attempts to sample these events; viz. Longabucco and Carich (1982) and Meredith and Rumer (1986) were successful. These reports do concur, however, in demonstrating that the bottom of the river does have significant year to year rearrangement of sediments.

The only known measurement of natural fish bioaccumulation of contaminants from Buffalo River sediments is presented the Niagara River Area Sediments study by NYSDEC (Litten, December 1987). That study showed inconclusive results from four pesticides. The only compound family detected in the sediment was not detected in the fish and three pesticides detected in the fish were not detected in the sediment.

TABLE 8-1

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

		Ground Water				Surface Water			Sediment	Soil
Substance	Detection Limit (ug/l)	Max. Conc. (ug/l)[4]	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)[4]	Max. Conc. (ug/kg)
Volatiles										
Chloromethane	10	ND[4]	5	5-1	0	ND		0	NA[7]	NA
Bromomethane	10	ND	5	5-1	0	ND		0	NA	NA
Vinyl Chloride	10	6	2	MCL	0#	ND		0	NA	NA
Chloroethane	10	ND	5	5-1		ND			NA	NA
Methylene Chloride	5	15,000[8]	5	5-1	[50]	ND			NA	NA
Acetone	10	15,000[8]	50	5-1		22,000			NA	NA
Carbon Disulfide	5	43	50	5-1		ND			NA	NA
1,1-Dichloroethene	5	8	5	5-1	7.0	2			NA	NA
1,1-Dichloroethane	5	ND	5	5-1		ND			NA	NA
1,2-Dichloroethene (total)	5	19	5	5-1	[50]	5			NA	NA
Chloroform	5	24	50	5-1	0	ND		0	NA	NA
1,2-Dichloroethane	5	ND	5	5-1	0#	ND		0	NA	NA
2-Butanone (or MEK)	10	260	50	5-1		ND			NA	NA
1,1,1-Trichloroethane	5	ND	5	5-1	19,000	ND		18,400	NA	NA
Carbon Tetrachloride	5	ND	5	703.5	0	ND		0	NA	NA
Vinyl Acetate	10	ND	50	5-1		ND			NA	NA
Bromodichloromethane	5	7	50	5-1	0	ND		0	NA	NA
1,1,2,1-Tetrachloroethane	5	ND	5	5-1		ND			NA	NA
1,2-Dichloropropane	5	ND	5	5-1		ND			NA	NA

(Revised)

TABLE 8-1 - Cont.

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

		Ground Water				Surface Water			Sediment	Soil
Substance	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Volatiles (continued)										
Trichloroethene	5	3	5	5-1	0#	ND		[11]	NA	NA
Dibromochloromethane	5	ND	50	5-1	0	ND		0	NA	NA
1,1,2-Trichloroethane	5	ND	5	5-1	0	ND		0	NA	NA
Benzene	5	28,000	NT	703.5	0#	ND		[6]	NA	NA
cis,1,3-Dichloropropene	5	ND	5	5-1	87,000	ND		87,000	NA	NA
2-Chloroethyl Vinyl Ether	10	ND	50	5-1	0	ND		0	NA	NA
Bromoform	5	ND	50	5-1	0	ND		0	NA	NA
2-Hexanone	10	ND	50	5-1	[50]	ND			NA	NA
4-Methyl-2-pentanone	10	24	50	5-1		ND		[50]	NA	NA
Tetrachloroethene	5	ND	5	5-1	0#	ND		[1]	NA	NA
Toluene	5	4,700	5	5-1	[50]	ND		14,300	NA	NA
Chlorobenzene	5	48,000	5	5-1	[20]	ND	50	488	NA	NA
Ethyl Benzene	5	43,000	5	5-1	2,400	ND		1,400	NA	NA
Styrene	5	ND	5	5-1		ND			NA	NA
Total Xylenes	5	1,700	5	5-1		6			NA	NA
Acrolein	400	ND	50	5-1		ND			NA	NA
Acrolynitrile	400	ND	50	5-1		ND			NA	NA

(Revised)

TABLE 8-1 Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

Substance	Detection Limit (ug/l)	Ground Water: Max. Conc. (ug/l)	Ground Water: Enforceable Limit (ug/l)	Ground Water: (1) Source	Ground Water: Guideline Limit(2)	Surface Water: Max. Conc. (ug/l)	Surface Water: Enforceable Limit(3) (ug/l)	Surface Water: Guideline Limit(2) (ug/l)	Sediment: Max. Conc. (ug/kg)	Soil: Max. Conc. (ug/kg)
Semi-Volatiles										
Phenol	10	77	50	5-1	3,500	ND		3,500	ND	ND
Aniline	10	660	50	5-1		ND			NA	NA
bis(2-Chloroethyl)ether	10	ND	1	703.5	0	ND		0	ND	ND
2-Chlorophenol	10	1,800	50	5-1	0.1	ND		0.1	ND	ND
1,3-Dichlorobenzene	10	49	5	5-1	470	ND	50	400	ND	ND
1,4-Dichlorobenzene	10	4,900	5	5-1	470	ND	50	400	ND	13,000
Benzyl Alcohol	10	ND	50	5-1					ND	ND
1,2-Dichlorobenzene	10	21,000	5	5-1	470	ND	50	400	1,200	110,000
2-Methylphenol	10	47	50	5-1		ND			ND	ND
bis(2-Chloroisopropyl)ether	10	ND	50	5-1	34.7	ND		34.7	ND	ND
4-Methylphenol	10	ND	50	5-1		ND			ND	ND
N-Nitroso-dipropylamine	10	24	50	5-1		ND			ND	ND
Hexachloroethane	10	ND	50	5-1	0	ND		0	ND	ND
Nitrobenzene	10	15	50	5-1	[130]	ND		19,800	600	1,100,000
Isophorone	10	ND	50	5-1	5,200	ND		5,700	ND	ND
2-Nitrophenol	10	ND	50	5-1		ND			ND	ND
2,4-Dimethylphenol	10	130	50	5-1	400	ND		400	ND	ND
Benzoic Acid	50	18	50	5-1		ND			ND	ND

(Revised)

TABLE 8-1 Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

Substance	Ground Water					Surface Water			Sediment	Soil
	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Semi-Volatiles (Continued)										
Bis(2-Chloroethoxyl)methane	10	20	50	5-1	0	ND		0	ND	ND
2,4-Dichlorophenol	10	ND	50	5-1	[0.3]	ND			ND	ND
1,2,4-Trichlorobenzene	10	1,200	5	5-1		ND	50		ND	150,000
Naphthalene	10	4,900	50	5-1		ND			880	470,000
4-Chloroaniline	10	11,000	50	5-1		ND			ND	ND
Hexachlorobutadiene	10	ND	50	5-1	0	ND		0	ND	ND
4-Chloro-3-methylphenol	10	7	50	5-1	3,000	ND		3,000	ND	ND
2-Methylnaphthalene	10	16	50	5-1		ND			ND	ND
Hexachlorocyclopentadiene	10	ND	50	5-1	206	ND		206	ND	ND
2,4,6-Trichlorophenol	10	ND	50	5-1	0	ND		0	ND	ND
2,4,5-Trichlorophenol	50	ND	50	5-1	2,600	ND		2,600	ND	ND
2-Chloronaphthalene	10	ND	50	5-1	[10]	ND			ND	140,000
2-Nitroaniline	50	4	50	5-1		ND			ND	1,100
Dimethyl Phthalate	10	ND	50	5-1	350,000	ND		313,000	ND	ND
Acenaphthylene	10	15	50	5-1		ND			240	16,000
3-Nitroaniline	50	ND	50	5-1		ND			ND	ND
Acenaphthene	10	26	50	5-1	20	ND		20	ND	400
2,4-Dinitrophenol	50	ND	50	5-1	70	ND		70	ND	3,400
4-Nitrophenol	50	ND	50	5-1		ND			ND	ND
Dibenzofuran	10	13	50	5-1		ND			ND	ND

(Revised)

TABLE 8-1 - cont.

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

Substance	Detection Limit (ug/l)	Ground Water: Max. Conc. (ug/l)	Ground Water: Enforceable Limit (ug/l)	Ground Water: (1) Source	Ground Water: Guideline Limit(2)	Surface Water: Max. Conc. (ug/l)	Surface Water: Enforceable Limit(3) (ug/l)	Surface Water: Guideline Limit(2) (ug/l)	Sediment: Max. Conc. (ug/kg)	Soil: Max. Conc. (ug/kg)
Semi-Volatiles (continued)										
2,4-Dinitrotoluene	10	2,000	50	5-1		ND			ND	ND
2,6-Dinitrotoluene	10	1,700	50	5-1		ND			ND	ND
Diethylphthalate	10	4	50	5-1	434,000	ND		350,000	ND	ND
4-Chlorophenyl Phenyl Ether	10	ND	50	5-1		ND			ND	ND
Fluorene	10	24	50	5-1		ND			ND	25,000
4-Nitroaniline	50	ND	50	5-1		ND			ND	ND
4,6-Dinitro-2-methylphenol	50	ND	50	5-1		ND			ND	ND
N-nitrosodiphenylamine	10	15	50	5-1	0	ND		0	ND	ND
4-Bromophenyl Phenyl Ether	10	ND	50	5-1		ND			ND	ND
Hexachlorobenzene	10	ND	0.35	703.5	0	ND		0	ND	ND
Pentachlorophenol	50	2	50	5-1	1,010	ND		1,010	ND	ND
Phenanthrene	10	63	50	5-1		ND			940	270,000
Anthracene	10	14	50	5-1	[50]	ND			610	4,800
Di-n-butylphthalate	10	1	50	5-1	44,000	ND		34,000	ND	760
Fluoranthene	50	54	50	5-1		ND			1,700	330,000
Benzidine	50	360	50	5-1	0	ND	0.1	0	ND	ND
Pyrene	10	24	50	5-1		ND			1,200	310,000

(Revised)

TABLE 8-1 Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

	Ground Water					Surface Water			Sediment	Soil
Substance	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Semi-Volatiles - continued										
Butyl Benzyl Phthalate	10	ND	50	5-1	[50]	ND			ND	ND
3,3'-Dichlorobenzidine	20	ND	50	5-1	0	ND		0	ND	ND
Benzo(a)anthracene	10	12	50	5-1		ND			740	180,000
bis(2-ethyl hexyl)phthalate	10	52	50	5-1	21,000	12		15,000	ND	1,900
Chrysene	10	11	50	5-1		ND			580	180,000
Di-n-octyl Phthalate	10	ND	50	5-1		ND			ND	65
Benzo(b)fluoranthene	10	0.3	50	5-1	[0.002]	ND			590	150,000
Benzo(k)fluoranthene	10	0.6	50	5-1	[0.002]	ND			ND	140,000
Benzo(a)pyrene	10	7	NT	703.5	[0.002]	ND		[0.0012]	320	140,000
Indeno(1,2,3-cd)pyrene	10	ND	50	5-1		ND			240	77,000
Dibenz(a,h)anthracene	10	ND	50	5-1		ND			ND	830
Benzo(g,h,i)perylene	10	ND	50	5-1		ND			250	63,000
1-Naphthyamine	10	42,000	50	5-1		ND			NA	NA

(Revised)

TABLE 8-1 Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

Substance	Ground Water					Surface Water			Sediment	Soil
	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Metals, Cyanide, Hex. Chromium, TOC, TOX										
Aluminum	200	67,000				1,140			NA	NA
Antimony	50	124			[3]	ND		146	38,000	119,000
Arsenic	2	1,820	25	703.5	0	ND	60	0	138,000	2,860,000
Barium	100	1,020	1,000	703.5		76			NA	NA
Beryllium	3	7			0	ND	1,000[6]	1.1	1,300	NA
Cadmium	3	127	10	703.5	10	ND	2[6]	10	2,500	24,000
Chromium	9	2,140	50	5-1	50	28	279[6]	508	952,000	1,990,000
Copper	10	78,700	700	170.4	1,000	ND	16[6]	1,000	5,050,000	14,500,000
Iron	1,800	405,000	300	5-1		2,170	300		32,409,000	537,000,000
Lead	1	3,030	25	703.5	50	13	131[6]	50	497,000	83,200,000
Magnesium	2,000	59,700				12,800			NA	NA
Manganese	54	21,300	300	5-1		212			NA	NA
Mercury	0.13	50	2	703.5	10	ND		144	45,000	14,000
Nickel	15	830			15.4	ND	126[6]	13,400	100,000	467,000

TABLE 8-1 Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS

	Ground Water					Surface Water			Sediment	Soil
Substance	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
METALS, CYANIDE, HEX. CHROMIUM, TOX, TOX (Continued)										
Selenium	2	10	10	5-1	10	ND		10	ND	21,000
Silver	5	13	50	703.5	50	ND	7[6]	50	NA	NA
Thallium	2	94			17.8	10	20	13	3,600	66,000
Zinc	2	9,950	300	170.4	5,000	138	434[6]	5	1,100,000	3,320,000
Cyanide	10	56	100	170.4	200	19	20	200	NA	NA
Hexavalent Chromium	6	130	50	703.5	50	10	16		NA	NA
TOC	3,000	2,350,000				13,000			NA	NA
TOX (EOX)	5	27,200				53			63,000	2,780,000

NOTES:

(1) Sources for the Enforceable Limits are as follows:

703.5	6 NYCRR Water Quality Regulations, Part 703.5 Classes and Quality Standards for Ground Water
5-1	10 NYCRR Subpart 5 - Public Water Supplies
170.4	10 NYCRR, Part 170.4 Sources of Water Supply - Standards of Raw Water Quality
MCL	Maximum Contaminant Levels for drinking water promulgated under the Safe Drinking Water Act

(2) All Guideline Limits are from the Clean Water Act except as noted by an * which are from 40 CFR, Part 143.3 Environmental Protection Agency National Secondary Drinking Water Regulations - Secondary Maximum Contaminant Levels; or by a # which are from: 40 CFR Part 141 Recommended Maximum Contaminant Levels; or by [] which are from NYSDEC Division of Water Technical and Operational Series (85-W-38).

(3) All Surface Water Enforceable Limits are from: 6 NYCRR Water Quality Regulations Part 701.19 Classes and Standards for Fresh Surface Waters.

(4) ND = Not Detected ug/l (liquid) = ppb ug/kg (Solid) = ppb

(5) NT = Not detectable by tests as referenced in 703.4

(6) Calculated based on assumed hardness of 144 mg/l

(7) NA = Not Analyzed

(8) Methylene Chloride and Acetone were introduced as field and laboratory contaminants.

(Revised)

TABLE 8-1 (Alternate)

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)[9]

Substance	Detection Limit (ug/l)	Ground Water: Max. Conc. (ug/l)[4]	Ground Water: Enforceable Limit (ug/l)	Ground Water: (1) Source	Ground Water: Guideline Limit(2)	Surface Water: Max. Conc. (ug/l)	Surface Water: Enforceable Limit(3) (ug/l)	Surface Water: Guideline Limit(2) (ug/l)	Sediment: Max. Conc. (ug/kg)[4]	Soil: Max. Conc. (ug/kg)
Volatiles										
Chloromethane	10	NA[4]	5	5-1	0	ND		0	ND[7]	NA
Bromomethane	10	NA	5	5-1	0	ND		0	ND	NA
Vinyl Chloride	10	NA	2	MCL	0#	ND		0	ND	NA
Chloroethane	10	NA	5	5-1		ND			ND	NA
Methylene Chloride	5	NA	5	5-1	[50]	NA			NA	NA
Acetone	10	NA	50	5-1		NA			ND	NA
Carbon Disulfide	5	NA	50	5-1		NA			ND	NA
1,1-Dichloroethene	5	NA	5	5-1	7.0	ND			ND	NA
1,1-Dichloroethane	5	NA	5	5-1		ND			ND	NA
1,2-Dichloroethene (total)	5	NA	5	5-1	[50]	ND			ND	NA
Chloroform	5	NA	50	5-1	0	3		0	2,900	NA
1,2-Dichloroethane	5	NA	5	5-1	0#	ND		0	ND	NA
2-Butanone (or MEK)	10	NA	50	5-1		NA			NA	NA
1,1,1-Trichloroethane	5	NA	5	5-1	19,000	ND		18,400	ND	NA
Carbon Tetrachloride	5	NA	5	703.5	0	ND		0	ND	NA
Vinyl Acetate	10	NA	50	5-1		NA			NA	NA
Bromodichloromethane	5	NA	50	5-1	0	ND		0	ND	NA
1,1,2,1-Tetrachloroethane	5	NA	5	5-1		ND			ND	NA
1,2-Dichloropropane	5	NA	5	5-1		ND			ND	NA
trans-1,2-Dichloropropene	5	NA	50	5-1	87,000	ND		87,000	ND	NA

(Revised)

TABLE 8-1 (Alt) - Cont.

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

Substance	Ground Water					Surface Water			Sediment	Soil
	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Volatiles (continued)										
Trichloroethene	5	NA	5	5-1	0#	3		[11]	2,900	ND
Dibromochloromethane	5	NA	50	5-1	0	ND		0	11,333	NA
1,1,2-Trichloroethane	5	NA	5	5-1	0	ND		0	ND	NA
Benzene	5	NA	NT	703.5	0#	3		[6]	3,800	NA
cis,1,3-Dichloropropene	5	NA	5	5-1	87,000	ND		87,000	ND	NA
2-Chloroethyl Vinyl Ether	10	NA	50	5-1	0	ND		0	ND	NA
Bromoform	5	NA	50	5-1	0	ND		0	ND	NA
2-Hexanone	10	NA	50	5-1	[50]	NA			NA	NA
4-Methyl-2-pentanone	10	NA	50	5-1		NA		[50]	NA	NA
Tetrachloroethene	5	ND	5	5-1	0#	ND		[1]	ND	NA
Toluene	5	NA	5	5-1	[50]	ND		14,300	5,488	NA
Chlorobenzene	5	NA	5	5-1	[20]	ND	50	488	9,983	ND
Ethyl Benzene	5	NA	5	5-1	2,400	ND		1,400	238	NA
Styrene	5	NA	5	5-1		NA			ND	NA
Total Xylenes	5	NA	5	5-1		ND			1,648	NA
Acrolein	400	NA	50	5-1		NA			NA	NA
Acrolynitrile	400	NA	50	5-1		NA			NA	NA

(Revised)

TABLE 8-1 (Alt) - Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

Substance	Ground Water: Detection Limit (ug/l)	Ground Water: Max. Conc. (ug/l)	Ground Water: Enforceable Limit (ug/l)	Ground Water: (1) Source	Ground Water: Guideline Limit(2)	Surface Water: Max. Conc. (ug/l)	Surface Water: Enforceable Limit(3) (ug/l)	Surface Water: Guideline Limit(2) (ug/l)	Sediment: Max. Conc. (ug/kg)	Soil: Max. Conc. (ug/kg)
Semi-Volatiles										
Phenol	10	NA	50	5-1	3,500	ND		3,500	ND	NA
Aniline	10	651,000	50	5-1		NA			ND	NA
bis(2-Chloroethyl)ether	10	NA	1	703.5	0	ND		0	ND	NA
2-Chlorophenol	10	NA	50	5-1	0.1	ND		0.1	ND	ND
1,3-Dichlorobenzene	10	NA	5	5-1	470	ND	50	400	1,898	ND
1,4-Dichlorobenzene	10	NA	5	5-1	470	ND	50	400	3,448	ND
Benzyl Alcohol	10	NA	50	5-1		NA			ND	NA
1,2-Dichlorobenzene	10	NA	5	5-1	470	ND	50	400	3,925	ND
2-Methylphenol	10	NA	50	5-1		NA			ND	NA
bis(2-Chloroisopropyl)ether	10	NA	50	5-1	34.7	ND		34.7	ND	NA
4-Methylphenol	10	NA	50	5-1		NA			ND	NA
N-Nitroso-dipropylamine	10	NA	50	5-1		ND			ND	NA
Hexachloroethane	10	NA	50	5-1	0	ND		0	ND	NA
Nitrobenzene	10	NA	50	5-1	[130]	ND		19,800	ND	NA
Isophorone	10	NA	50	5-1	5,200	ND		5,700	ND	NA
2-Nitrophenol	10	NA	50	5-1		ND			ND	NA
2,4-Dimethylphenol	10	NA	50	5-1	400	ND		400	ND	NA
Benzoic Acid	50	NA	50	5-1		NA			ND	NA

(Revised)

TABLE 8-1 (Alt) - Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

Substance	Detection Limit (ug/l)	Ground Water: Max. Conc. (ug/l)	Ground Water: Enforceable Limit (ug/l)	Ground Water: (1) Source	Ground Water: Guideline Limit(2)	Surface Water: Max. Conc. (ug/l)	Surface Water: Enforceable Limit(3) (ug/l)	Surface Water: Guideline Limit(2) (ug/l)	Sediment: Max. Conc. (ug/kg)	Soil: Max. Conc. (ug/kg)
Semi-Volatiles (Continued)										
Bis(2-Chloroethoxyl)methane	10	NA	50	5-1	0	ND		0	ND	NA
2,4-Dichlorophenol	10	NA	50	5-1	[0.3]	ND			ND	ND
1,2,4-Trichlorobenzene	10	NA	5	5-1		ND	50		62,901	ND
Naphthalene	10	NA	50	5-1		ND			324,000	NA
4-Chloroaniline	10	NA	50	5-1		NA			ND	NA
Hexachlorobutadiene	10	NA	50	5-1	0	ND		0	ND	NA
4-Chloro-3-methylphenol	10	NA	50	5-1	3,000	ND		3,000	ND	NA
2-Methylnaphthalene	10	NA	50	5-1		NA			ND	NA
Hexachlorocyclopentadiene	10	NA	50	5-1	206	ND		206	ND	NA
2,4,6-Trichlorophenol	10	NA	50	5-1	0	ND		0	ND	NA
2,4,5-Trichlorophenol	50	NA	50	5-1	2,600	ND		2,600	ND	ND
2-Chloronaphthalene	10	NA	50	5-1	[10]	ND			4,000	NA
2-Nitroaniline	50	NA	50	5-1		NA			ND	NA
Dimethyl Phthalate	10	NA	50	5-1	350,000	ND		313,000	ND	NA
Acenaphthylene	10	NA	50	5-1		ND			26,245	NA
3-Nitroaniline	50	NA	50	5-1		NA			ND	NA
Acenaphthene	10	NA	50	5-1	20	ND		20	44,700	NA
2,4-Dinitrophenol	50	NA	50	5-1	70	ND		70	ND	ND
4-Nitrophenol	50	NA	50	5-1		ND			ND	NA
Dibenzofuran	10	NA	50	5-1		NA			ND	NA

(Revised)

TABLE 8-1 (Alt) - cont.

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

Substance	Ground Water					Surface Water			Sediment	Soil
	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Semi-Volatiles (continued)										
2,4-Dinitrotoluene	10	NA	50	5-1		ND			ND	ND
2,6-Dinitrotoluene	10	NA	50	5-1		ND			ND	NA
Diethylphthalate	10	NA	50	5-1	434,000	ND		350,000	533	NA
4-Chlorophenyl Phenyl Ether	10	NA	50	5-1		ND			ND	NA
Fluorene	10	NA	50	5-1		ND			42,300	NA
4-Nitroaniline	50	NA	50	5-1		NA			ND	ND
4,6-Dinitro-2-methylphenol	50	NA	50	5-1		NA			ND	NA
N-nitrosodiphenylamine	10	NA	50	5-1	0	ND		0	7,099	NA
4-Bromophenyl Phenyl Ether	10	NA	50	5-1		ND			ND	NA
Hexachlorobenzene	10	NA	0.35	703.5	0	ND		0	ND	NA
Pentachlorophenol	50	NA	50	5-1	1,010	ND		1,010	ND	NA
Phenanthrene	10	NA	50	5-1		ND			83,700	3,940
Anthracene	10	ND	50	5-1	[50]	4			119,000	9,590
Di-n-butylphthalate	10	NA	50	5-1	44,000	ND		34,000	6,496	NA
Fluoranthene	50	ND	50	5-1		4			102,000	10,210
Benzidine	50	240	50	5-1	0	ND	0.1	0	ND	4,520
Pyrene	10	ND	50	5-1		4			36,928	6,730

TABLE 8-1 (Alt) - Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

	Ground Water					Surface Water			Sediment	Soil
Substance	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
Semi-Volatiles - continued										
Butyl Benzyl Phthalate	10	NA	50	5-1	[50]	ND			192	NA
3,3'-Dichlorobenzidine	20	NA	50	5-1	0	ND		0	ND	NA
Benzo(a)anthracene	10	NA	50	5-1		ND			51,800	6,310
bis(2-ethyl hexyl)phthalate	10	NA	50	5-1	21,000	ND		15,000	18,216	NA
Chrysene	10	ND	50	5-1		6			39,500	4,630
Di-n-octyl Phthalate	10	NA	50	5-1		ND			ND	NA
Benzo(b)fluoranthene	10	NA	50	5-1	[0.002]	ND			96,896	NA
Benzo(k)fluoranthene	10	NA	50	5-1	[0.002]	ND			30,900	NA
Benzo(a)pyrene	10	ND	NT	703.5	[0.002]	ND		[0.0012]	72,496	7,740
Indeno(1,2,3-cd)pyrene	10	NA	50	5-1		ND			41,600	ND
Dibenz(a,h)anthracene	10	NA	50	5-1		ND			28,000	ND
Benzo(g,h,i)perylene	10	NA	50	5-1		ND			26,600	ND
1-Naphthyamine	10	49,600	50	5-1		43			NA	57,300

(Revised)

TABLE 8-1 (Alt) - Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

Substance	Ground Water: Detection Limit (ug/l)	Ground Water: Max. Conc. (ug/l)	Ground Water: Enforceable Limit (ug/l)	Ground Water: (1) Source	Ground Water: Guideline Limit(2)	Surface Water: Max. Conc. (ug/l)	Surface Water: Enforceable Limit(3) (ug/l)	Surface Water: Guideline Limit(2) (ug/l)	Sediment: Max. Conc. (ug/kg)	Soil: Max. Conc. (ug/kg)
Metals, Cyanide, Hex. Chromium, TOC, TOX										
Aluminum	2,000	67,000				NA			11,893	NA
Antimony	50	124			[3]	ND		146	ND	NA
Arsenic	2	1,820	25	703.5	0	68	360	0	17,075	1,870,000
Barium	100	1,020	1,000	703.5		NA			130,500	NA
Beryllium	3	7			0	3	1,100[6]	1.1	4,095	NA
Cadmium	3	127	10	703.5	10	3	2[6]	10	33,900	NA
Calcium	200	450,000				NA			36,000,000	NA
Chromium	9	2,140	50	5-1	50		279[6]	508	306,000	1,050,000
Cobalt	430	40				NA	5		14,750	NA
Copper	10	78,700	700	170.4	1,000	ND	16[6]	1,000	3,010,000	6,200,000
Iron	1,800	405,000	300	5-1			300		326,000,000	NA
Lead	1	3,030	25	703.5	50	145	131[6]	50	5,080,000	57,600,000
Magnesium	2,000	71,100				NA			12,000,000	NA
Manganese	54	21,300	300	5-1		NA	300		3,290,000	NA
Mercury	0.13	50	2	703.5	10	ND		144	72,700	138,000
Nickel	15	830			15.4	11	126[6]	13,400	375,000	187,000

(Revised)

TABLE 8-1 (Alt) - Con't

OBSERVED VERSUS ALLOWABLE CONTAMINANT CONCENTRATIONS
(From other studies)

Substance	Ground Water					Surface Water			Sediment	Soil
	Detection Limit (ug/l)	Max. Conc. (ug/l)	Enforceable Limit (ug/l)	(1) Source	Guideline Limit(2)	Max. Conc. (ug/l)	Enforceable Limit(3) (ug/l)	Guideline Limit(2) (ug/l)	Max. Conc. (ug/kg)	Max. Conc. (ug/kg)
METALS, CYANIDE, HEX. CHROMIUM, TOX, TOX (Continued)										
Selenium	2	10	10	5-1	10	ND		10	ND	NA
Silver	5	40	50	703.5	50	ND	7[6]	50	5,430	NA
Sodium	1,000	592,450				NA			800,000	NA
Thallium	2	94			17.8	ND	20	13	NA	NA
Vanadium	170	NA				ND			27,250	NA
Zinc	2	9,950	300	170.4	5,000	74	434[6]	5	4,290,000	4,400,000
Cyanide	10	56	100	170.4	200	NA	20	200	4,875	NA
Hexavalent Chromium	6	130	50	703.5	50	NA	16		NA	3,160
TOC	3,000	2,350,000				18,000			NA	NA
TOX (EOX)	5	27,200				50			NA	NA

(Revised)

NOTES:

(1) Sources for the Enforceable Limits are as follows:

703.5	6 NYCRR Water Quality Regulations, Part 703.5 Classes and Quality Standards for Ground Water
5-1	10 NYCRR Subpart 5 - Public Water Supplies
170.4	10 NYCRR, Part 170.4 Sources of Water Supply - Standards of Raw Water Quality
MCL	Maximum Contaminant Levels for drinking water promulgated under the Safe Drinking Water Act

(2) All Guideline Limits are from the Clean Water Act except as noted by an * which are from 40 CFR, Part 143.3 Environmental Protection Agency National Secondary Drinking Water Regulations - Secondary Maximum Contaminant Levels; or by a # which are from: 40 CFR Part 141 Recommended Maximum Contaminant Levels; or by [] which are from NYSDEC Division of Water Technical and Operational Series (85-W-38).

(3) All Surface Water Enforceable Limits are from: 6 NYCRR Water Quality Regulations Part 701.19 Classes and Standards for Fresh Surface Waters.

(4) ND = Not Detected ug/l (liquid) = ppb ug/kg (Solid) = ppb

(5) NT = Not detectable by tests as referenced in 703.4

(6) Calculated based on assumed hardness of 144 mg/l

(7) NA = Not Analyzed

(9) "Other studies" are:

Buffalo Color Corporation, Area D Groundwater Monitoring Data, (1979-1982)
Buffalo Color Corporation, Area D Engineering Reports, (1981-1984)
N.Y.S. Dept. of Environmental Conservation, Draft Buffalo River Remediation Plan, (March 1987), which cites:
- U.S. Army Corps of Engineers, Buffalo District Sediment Sampling, (1981)
- U.S. Environmental Protection Agency, Region V Sediment Sampling, (1981)
- N.Y.S. Dept. of Environmental Conservation, Sediment Sampling, (1983)
- Erie County Environmental Compliance Services, Sediment Sampling, (1985)
- N.Y.S. Dept. of Environmental Conservation, River Monitoring, (1982-1986)

N.Y.S. Dept. of Environmental Conservation, Niagara River Area Sediments, (December 1987)

(Revised)

Table 8-2

Groundwater Parameters Exceeding Enforceable Limits

	Max. GW. Conc. (µg/l)		Enforceable Limits Exceeded				Max Soil Conc. (µg/kg)	
	RI Study	Other[8] Studies	Conc. (µg/l)	Source (1)	No. of Samples RI	No. of Samples Other	RI Study	Other Studies
Benzene	28,000	NA	NT[5]	703.5	31/39	-/-	NA	NA
Chlorobenzene	48,000	NA	5	5-1	22/39	-/-	NA	ND
Ethylbenzene	43,000	NA	5	5-1	9/39	-/-	NA	NA
1,2-Dichlorobenzene	21,000	NA	5	5-1	6/39	-/-	110,000	ND
1,4-Dichlorobenzene	4,900	NA	5	5-1	8/39	-/-	13,000	ND
Toluene	4,700	NA	5	5-1	12/39	-/-	NA	NA
1-Naphthylamine	42,000	49,600	50	5-1	9/39	10/18	NA	57,300
Aniline	660	651,000	50	5-1	4/22	21/24	NA	NA
Xylene	1,700	NA	5	5-1	21/39	-/-	NA	NA
1,2,4-Trichlorobenzene	1,200	NA	5	5-1	4/39	-/-	150,000	ND
4-Chloroaniline	11,000	NA	50	5-1	2/39	-/-	ND	NA
Benzidine	360	240	50	5-1	2/39	3/18	ND	4,520
Naphthalene	4,900	NA	50	5-1	3/39	-/-	420,000	1,850
2,4-Dinitrotoluene	2,000	6,270	50	5-1	1/22	3/18	ND	ND
2-Chlorophenol	1,800	NA	50	5-1	2/39	-/-	ND	ND
2,6-Dinitrotoluene	1,700	NA	50	5-1	2/39	-/-	ND	NA
1,3-Dichlorobenzene	49	NA	5	5-1	1/39	-/-	ND	ND
2-Butanone	260	NA	50	5-1	1/39	-/-	NA	NA
1,2-Dichloroethene	19	NA	5	5-1	5/39	-/-	NA	NA
Vinyl Chloride	6	NA	2	MCL	1/39	-/-	NA	NA
Benzo(a) Pyrene	7	ND	NT[5]	703.5	1/39	0/18	140,000	7,740
1,1-Dichloroethene	8	NA	5	5-1	1/39	-/-	NA	NA
2,4-Dimethylphenol	130	NA	50	5-1	3/39	-/-	ND	NA
Phenol	77	NA	50	5-1	2/39	-/-	ND	NA
Phenanthrene	63	NA	50	5-1	2/39	0/18	270,000	9,590
Fluoranthene	54	NA	50	5-1	2/39	-/-	330,000	10,210
bis(2-Ethylhexylphthalate)	52	NA	50	5-1	1/39	-/-	1,900	NA
Iron	405,000	388,000	300	5-1	39/39	30/41	537,000,000	NA
Copper	78,700	110,000	700	170.4	8/39	5/24	14,500,000	6,200,000
Lead	3,030	2,650	25	703.5	24/39	15/24	83,800,000	57,600,000
Arsenic	1,820	801	25	703.5	22/39	20/24	2,860,000	1,870,000
Zinc	9,950	17,100	300	170.4	19/39	13/24	3,320,000	4,400,000
Manganese	21,300	5,560	300	5-1	17/22	10/10	NA	NA
Chromium	2,140	397	50	703.5	13/39	13/24	1,990,000	1,050,000
Mercury	50	5	2	703.5	9/39	3/18	14,000	138,000
Cadmium	127	20	10	703.5	12/39	4/24	24,800	NA
Hexavalent Chromium	130	319	50	703.5	4/39	10/18	NA	NA
Barium	1,020	NA	1,000	703.5	1/39	-/-	NA	NA

Footnotes refer to Table 8-2

APPENDIX C.1

EM TERRAIN CONDUCTIVITY SURVEY

(Revised)

Because the entire Buffalo Color Area "D" property contains sources of electromagnetic noise, no background readings could be obtained. Readings considered to be regionally background were taken near the northern boundary of South Park in Buffalo. The park is approximately three (3) miles from the Buffalo Color property. Ten readings, ranging from 22 to 26 mmhos/meter were taken at the park and are considered to be indicative of background values.

Readings on the peninsula property ranged from 22 to greater than 300 mmhos/meter. The values were computer contoured and are presented as Figure 4-9. Values greater than 300 mmhos/meter or stations where no reading could be found due to excess interference were given values of 300, indicating high-magnitude anomaly. Although Figure C.1.1 shows a high degree of irregularity over the entire peninsula, five noteworthy locations were further inspected. Comparison with plant records, visual inspection, and trenching with a back-hoe brought back no information inconsistant with the known history of the site.

APPENDIX E.3

CALCULATION OF CONTAMINANT LOADINGS TO THE BUFFALO RIVER
VIA GROUNDWATER MIGRATION

(Revised)

Table 7-4 a

IRON OXIDE LAGOON AREA

SAMPLE NUMBER	W-14	W-14	W-15	W-15
SAMPLE DATE (1988)	6-24	8-18	6-24	8-18
AQUIFER ELEVATION (Feet)	572.97	572.37	571.74	572.39
SHORELINE PERIMETER (Feet)	173	173	255	255
GRADIENT (Feet/Feet)	0.0007	0.0007	0.0007	0.0007
HYDR. CONDUCTIVITY (cm/sec)	0.0413	0.0413	0.0000	0.0000
FLOW RATE (Gal/Day)	1316.0	1252.4	0.6	0.6
SEMI-VOL. ORGANICS (ug/l)				
PHENOL				
2-CHLOROPHENOL				
1,3-DICHLOROBENZENE				
1,4-DICHLOROBENZENE				
1,2-DICHLOROBENZENE		3		
2-METHYLPHENOL		4		18
N-NITROSO-DI-n-PROPYLAMINE				
NITROBENZENE				69
2,4-DIMETHYLPHENOL				
BENZOIC ACID				
BIS(2-CHLOROETHYL)OXYMETHANE				
1,2,4-TRICHLOROBENZENE			1200	270
NAPHTHALENE	12	15	670	130
4-CHLOROANILINE				
4-CHLORO-3-METHYLPHENOL				
2-METHYLNAPHTHALENE				10
2-NITROANILINE				
ACENAPHTHYLENE				
ACENAPHTHENE			26	14
DIBENZOFURAN				13
2,4-NITROTOLUENE				
2,6-NITROTOLUENE				
DIETHYL PHTHALATE				
FLOURENE			24	17
N-NITROSODIPHENYLAMINE				6
PENTACHLOROPHENOL				
PHENANTHRENE			63	59
ANTHRACENE			14	13
DI-n-BUTYLPHTHALATE				
FLUORANTHENE			18	35
PYRENE			16	24
BENZO(A)ANTHRACENE			8	12
BIS(2-ETHYLHEXYL)PHTHALATE				6
CHRYSENE			5	11
BENZO(B)FLUORANTHENE				
BENZO(K)FLUORANTHENE				
BENZO(A)PYRENE				7
BENZIDINE				360
1-NAPHTHYLAMINE	16000	5600	42000	9100
ANILINE				660
PAH/PHTHALATES (ug/l)	12	15	844	328
PAH/PHTHALATES (Lbs/Year)	0.048	0.057	0.002	0.001
OTHER SEMI-VOLATILES (ug/l)	16000	5607	43200	10506
OTHER SEMI-VOL.(Lbs/Year)	64.14	21.39	0.08	0.02
VOLATILE ORGANICS (ug/l)				
VINYL CHLORIDE				
METHYLENE CHLORIDE	650	8	800	91
ACETONE		47	510	92
CARBON DISULFIDE				
1,1-DICHLOROETHENE				
1,2-DICHLOROETHENE				
CHLOROFORM		7		
2-BUTANONE				
BROMODICHLOROETHANE				
TRICHLOROETHENE				
BENZENE		250	1000	510
4-METHYL-2-PENTANONE				
TOLUENE			620	320
CHLOROBENZENE		2	190	400
ETHYLBENZENE		2		
XYLENE				23
VOLATILE ORGANICS (ug/l)	650	316	3120	1436
VOLATILE ORGANICS (lbs/Year)	2.61	1.21	0.01	0.00
TOTAL METALS (ug/l)				
ANTIMONY	124	58	21	
ARSENIC	1620	1820	35	
BERYLLIUM				
CADMIUM	127	37	16	
CHROMIUM	679	805	24	
COPPER	27800	3220	49	
LEAD	2480	3030	22	7
MERCURY	21	10		
NICKEL	630	760	90	
SELENIUM				
SILVER			5	
THALLIUM	57	15	36	
ZINC	3370	4390	72	37
HEXAVALENT CHROMIUM		10		
TOTAL METALS (ug/l)	36908	14155	370	44
TOTAL METALS (Lbs/Year)	147.95	54.00	0.00	0.00
IRON				
IRON (ug/l)	3940	405000	47500	22500
IRON (Lbs/Year)	15.79	1545	0.09	0.04
TOTAL ORGANIC CARBON				
TOC (mg/l)	53	110	650	500
TOC (Lbs/Year)	212.45	419.62	1.19	0.97
TOTAL ORGANIC HALOGEN				
TOX (ug/l)	27	180	160	5440
TOX (Lbs/Year)	0.11	0.69	0.00	0.01

Table 7-4 b LOADING TO RIVER DUE TO GW MIGRATION

WEATHERING AREA

SAMPLE NUMBER	W-12	W-12	W-13	W-13
SAMPLE DATE (1988)	6-23	8-17	6-23	8-17
AQUIFER DEPTH (Feet)	572.9	572.7	572.83	572.68
SHORELINE PERIMETER (Feet)	200	200	204	204
GRADIENT (Feet/Feet)	0.0004	0.0004	0.0004	0.0004
HYDR. CONDUCTIVITY (cm/sec)	0.0031	0.0031	0.0029	0.0029
FLOW RATE (Gal/Day)	65.1	64.0	60.9	60.2
SEMI-VOL. ORGANICS (ug/l)				
PHENOL				
2-CHLOROPHENOL				
1,3-DICHLOROBENZENE				
1,4-DICHLOROBENZENE				
1,2-DICHLOROBENZENE				
2-METHYLPHENOL				
N-NITROSO-DI-n-PROPYLAMINE				
NITROBENZENE			10	15
2,4-DIMETHYLPHENOL				
BENZOIC ACID				
BIS(2-CHLOROETHYL)OXYMETHANE				
1,2,4-TRICHLOROBENZENE				
NAPHTHALENE				
4-CHLOROANILINE				
4-CHLORO-3-METHYLPHENOL				
2-METHYLNAPHTHALENE				
2-NITROANILINE			4	
ACENAPHTHYLENE				
ACENAPHTHENE				
DIBENZOFURAN				
2,4-NITROTOLUENE			2000	
2,6-NITROTOLUENE			1500	1700
DIETHYL PHTHALATE				
FLOURENE				
N-NITROSODIPHENYLAMINE				
PENTACHLOROPHENOL				
PHENANTHRENE				
ANTHRACENE				
DI-n-BUTYLPHTHALATE				
FLUORANTHENE				
PYRENE				
BENZO(A)ANTHRACENE				
BIS(2-ETHYLHEXYL)PHTHALATE		52		
CHRYSENE				
BENZO(B)FLUORANTHENE				
BENZO(K)FLUORANTHENE				
BENZO(A)PYRENE				
BENZIDINE				
1-NAPHTHYLAMINE				
ANILINE				
PAH/PHTHALATES (ug/l)	0	52	0	0
PAH/PHTHALATES (Lbs/Year)	0.000	0.010	0.000	0.000
OTHER SEMI-VOLATILES (ug/l)	0	0	3514	1715
OTHER SEMI-VOL.(Lbs/Year)	0.00	0.00	0.65	0.31
VOLATILE ORGANICS (ug/l)				
VINYL CHLORIDE				
METHYLENE CHLORIDE	1	7	6	7
ACETONE	54	110	24	16
CARBON DISULFIDE				
1,1-DICHLOROETHENE		1		1
1,2-DICHLOROETHENE		4		3
CHLOROFORM				
2-BUTANONE				
BROMODICHLOROETHANE				
TRICHLOROETHENE				
BENZENE	0.1		0.4	2
4-METHYL-2-PENTANONE				
TOLUENE	0.09		1	2
CHLOROBENZENE			1	
ETHYLBENZENE				
XYLENE		7		6
VOLATILE ORGANICS (ug/l)	55.19	129	32.4	37
VOLATILE ORGANICS (lbs/Year)	0.01	0.03	0.01	0.01
TOTAL METALS (ug/l)				
ANTIMONY		5		7
ARSENIC	18	25	460	933
BERYLLIUM			6	
CADMIUM	6		21	24
CHROMIUM	203	197	62	201
COPPER	330	306	28600	78700
LEAD	2390	1390	312	573
MERCURY	50	3	2.1	5.2
NICKEL	60	60	460	830
SELENIUM				
SILVER	9		8	
THALLIUM				
ZINC	1220	1390	2460	5610
HEXAVALENT CHROMIUM		130	6	82
TOTAL METALS (ug/l)	4286	3506	32397	86965
TOTAL METALS (Lbs/Year)	0.85	0.68	6.01	15.94
IRON				
IRON (ug/l)	45000	72200	75000	233000
IRON (Lbs/Year)	8.92	14.08	13.92	42.71
TOTAL ORGANIC CARBON (mg/l)				
TOC (mg/l)	27	33	31	39
TOC (Lbs/Year)	5.35	6.44	5.75	7.15
T. ORGANIC HALOGEN (ug/l)				
TOX (ug/l)	29	15	36	21
TOX (Lbs/Year)	0.01	0.00	0.01	0.00

Table 7-4 c LOADING TO RIVER DUE TO GW MIGRATION

WEATHERING AREA/INCINERATOR AREA

SAMPLE NUMBER	MW-10	MW-10
SAMPLE DATE (1988)	6-23	8-17
AQUIFER DEPTH (Feet)	573.13	572.83
SHORELINE PERIMETER (Feet)	240	240
GRADIENT (Feet/Feet)	0.0011	0.0011
HYDR. CONDUCTIVITY (cm/sec)	0.0003	0.0003
FLOW RATE (Gal/Day)	20.9	20.4
SEMI-VOL. ORGANICS (ug/l)		
PHENOL		
2-CHLOROPHENOL		
1,3-DICHLOROBENZENE		
1,4-DICHLOROBENZENE		
1,2-DICHLOROBENZENE		
2-METHYLPHENOL		
N-NITROSO-DI-n-PROPYLAMINE		
NITROBENZENE		
2,4-DIMETHYLPHENOL		
BENZOIC ACID		
BIS(2-CHLOROETHYL)OXYMETHANE		
1,2,4-TRICHLOROBENZENE		
NAPHTHALENE		
4-CHLOROANILINE		
4-CHLORO-3-METHYLPHENOL		
2-METHYLNAPHTHALENE		
2-NITROANILINE		
ACENAPHTHYLENE		
ACENAPHTHENE		
DIBENZOFURAN		
2,4-NITROTOLUENE		
2,6-NITROTOLUENE		
DIETHYL PHTHALATE		
FLOURENE		
N-NITROSODIPHENYLAMINE		
PENTACHLOROPHENOL		
PHENANTHRENE		
ANTHRACENE		
DI-n-BUTYLPHTHALATE		
FLUORANTHENE		
PYRENE		
BENZO(A)ANTHRACENE		
BIS(2-ETHYLHEXYL)PHTHALATE		7
CHRYSENE		
BENZO(B)FLUORANTHENE		
BENZO(K)FLUORANTHENE		
BENZO(A)PYRENE		
BENZIDINE		
1-NAPHTHYLAMINE		
ANILINE		
PAH/PHTHALATES (ug/l)	0	7
PAH/PHTHALATES (Lbs/Year)	0.000	0.000
OTHER SEMI-VOLATILES (ug/l)	0	0
OTHER SEMI-VOL.(Lbs/Year)	0.00	0.00
VOLATILE ORGANICS (ug/l)		
VINYL CHLORIDE	2	10
METHYLENE CHLORIDE	19	55
ACETONE		
CARBON DISULFIDE		
1,1-DICHLOROETHENE		1
1,2-DICHLOROETHENE		4
CHLOROFORM		
2-BUTANONE		
BROMODICHLOROETHANE		
TRICHLOROETHENE		
BENZENE	0.7	
4-METHYL-2-PENTANONE		
TOLUENE	0.4	
CHLOROBENZENE		
ETHYLBENZENE		
XYLENE		6
VOLATILE ORGANICS (ug/l)	22.1	76
VOLATILE ORGANICS (lbs/Year)	0.00	0.00
TOTAL METALS (ug/l)		
ANTIMONY		5
ARSENIC	1560	440
BERYLLIUM		
CADMIUM	49	14
CHROMIUM	44	30
COPPER	1800	3710
LEAD	77	
MERCURY		
NICKEL	370	430
SELENIUM		
SILVER	8	
THALLIUM		
ZINC	4180	5290
HEXAVALENT CHROMIUM		23
TOTAL METALS (ug/l)	8088	9942
TOTAL METALS (Lbs/Year)	0.51	0.62
IRON		
IRON (ug/l)	80500	44800
IRON (Lbs/Year)	5.12	2.78
TOTAL ORGANIC CARBON		
TOC (mg/l)	35	32
TOC (Lbs/Year)	2.23	1.99
TOTAL ORGANIC HALOGEN		
TOX (ug/l)	220	290
TOX (Lbs/Year)	0.01	0.02

Table 7-4 d LOADING TO RIVER DUE TO GW MIGRATION

INCINERATOR AREA

SAMPLE NUMBER	MW-4	MW-4	MW-9	MW-9	MW-12	MW-13
SAMPLE DATE (1988)	6-23	8-18	6-23	8-17	11-21	11-21
AQUIFER DEPTH (Feet)	572.95	572.85	573.31	573.01	572.4	572.04
SHORELINE PERIMETER (Feet)	211	211	116	116	116	222
GRADIENT (Feet/Feet)	0.0018	0.0018	0.0018	0.0018	0.0018	0.0018
HYDR. CONDUCTIVITY (cm/sec)	0.0005	0.0005	0.0024	0.0024	0.0029	0.0007
FLOW RATE (Gal/Day)	52.3	51.9	135.5	132.3	152.0	72.0
SEMI-VOL. ORGANICS (ug/l)						
PHENOL						
2-CHLOROPHENOL	1800	1200				
1,3-DICHLOROBENZENE		49	1			
1,4-DICHLOROBENZENE	4900	510	5	6		
1,2-DICHLOROBENZENE	21000	920	5			
2-METHYLPHENOL		47				
N-NITROSO-DI-n-PROPYLAMINE						
NITROBENZENE						
2,4-DIMETHYLPHENOL	94	130	4			
BENZOIC ACID						
BIS(2-CHLOROETHYL)OXYMETHANE						
1,2,4-TRICHLOROBENZENE	25	8				
NAPHTHALENE	33		5		1	4900
4-CHLOROANILINE				8	22	11000
4-CHLORO-3-METHYLPHENOL						
2-METHYLNAPHTHALENE						
2-NITROANILINE						
ACENAPHTHYLENE						
ACENAPHTHENE						
DIBENZOFURAN						
2,4-NITROTOLUENE						
2,6-NITROTOLUENE						
DIETHYL PHTHALATE	4					
FLOURENE						
N-NITROSODIPHENYLAMINE	4					
PENTACHLOROPHENOL	2					
PHENANTHRENE	3					
ANTHRACENE	1					
DI-n-BUTYLPHTHALATE	1				1	
FLUORANTHENE	1					
PYRENE	1					
BENZO(A)ANTHRACENE	1					
BIS(2-ETHYLHEXYL)PHTHALATE	2	7		7		
CHRYSENE	1				17	
BENZO(B)FLUORANTHENE						
BENZO(K)FLUORANTHENE						
BENZO(A)PYRENE						
BENZIDINE						
1-NAPHTHYLAMINE	2800	300	97	16	23	
ANILINE					5	250000
PAH/PHTHALATES (ug/l)	48	7	5	7	19	4900
PAH/PHTHALATES (Lbs/Year)	0.008	0.001	0.002	0.003	0.009	1.074
OTHER SEMI-VOLATILES (ug/l)	30625	3164	112	30	50	261000
OTHER SEMI-VOL.(Lbs/Year)	4.88	0.50	0.05	0.01	0.02	57.22
VOLATILE ORGANICS (ug/l)						
VINYL CHLORIDE						
METHYLENE CHLORIDE	15000	10	3	88	15	58
ACETONE	5400		14000	93	0	2000
CARBON DISULFIDE						
1,1-DICHLOROETHENE		2		8		
1,2-DICHLOROETHENE		6		19		
CHLOROFORM				24		
2-BUTANONE						260
BROMODICHLOROETHANE				7		
TRICHLOROETHENE						3
BENZENE		3	14	10	12	820
4-METHYL-2-PENTANONE						24
TOLUENE	170	1	560	21		4700
CHLOROBENZENE	37000	38	320	420	82	7700
ETHYLBENZENE	43000	130	41	6		350
XYLENE	1700		1200	120		39
VOLATILE ORGANICS (ug/l)	102270	190	16138	816	109	15954
VOLATILE ORGANICS (lbs/Year)	16.29	0.03	6.66	0.33	0.05	3.50
TOTAL METALS (ug/l)						
ANTIMONY				19		
ARSENIC	144	127	7	42	14	277
BERYLLIUM						
CADMIUM	8	5				
CHROMIUM	40	61	16	36	13	71
COPPER	422	745	79	141	24	119
LEAD	66	37	32	11		
MERCURY						
NICKEL	50	60		30		250
SELENIUM						
SILVER			5		11	13
THALLIUM						
ZINC	775	891	156	143	49	90
HEXAVALENT CHROMIUM	6	6		15		
TOTAL METALS (ug/l)	1511	1932	295	437	111	820
TOTAL METALS (Lbs/Year)	0.24	0.31	0.12	0.18	0.05	0.18
IRON						
IRON (ug/l)	62000	76300	8930	22900	15500	8900
IRON (Lbs/Year)	9.87	12.05	3.68	9.23	7.18	1.95
TOTAL ORGANIC CARBON						
TOC (mg/l)	200	200	49	54	50	2350
TOC (Lbs/Year)	31.85	31.59	20.22	21.76	23.15	515.21
TOTAL ORGANIC HALOGEN						
TOX (ug/l)	22600	27200	490	520	560	19200
TOX (Lbs/Year)	3.60	4.30	0.20	0.21	0.26	4.21

Table 7-4 e

LOADING TO RIVER DUE TO GW MIGRATION

WEST SHORE (NORTH)

SAMPLE NUMBER	MW-5	MW-5	MW-6	MW-6
SAMPLE DATE (1988)	6-22	8-17	6-22	8-16
AQUIFER DEPTH (Feet)	572.78	572.83	572.88	572.68
SHORELINE PERIMETER (Feet)	288	288	178	178
GRADIENT (Feet/Feet)	0.0009	0.0009	0.0009	0.0009
HYDR. CONDUCTIVITY (cm/sec)	0.0001	0.0001	0.0001	0.0001
FLOW RATE (Gal/Day)	9.2	9.2	5.7	5.6
SEMI-VOL. ORGANICS (ug/l)				
PHENOL				
2-CHLOROPHENOL				
1,3-DICHLOROBENZENE				
1,4-DICHLOROBENZENE				
1,2-DICHLOROBENZENE				
2-METHYLPHENOL				
N-NITROSO-DI-n-PROPYLAMINE				
NITROBENZENE	11	5		
2,4-DIMETHYLPHENOL				
BENZOIC ACID				
BIS(2-CHLOROETHYL)OXYMETHANE				
1,2,4-TRICHLOROBENZENE				
NAPHTHALENE				
4-CHLOROANILINE				
4-CHLORO-3-METHYLPHENOL				
2-METHYLNAPHTHALENE				
2-NITROANILINE				
ACENAPHTHYLENE				
ACENAPHTHENE				
DIBENZOFURAN				
2,4-NITROTOLUENE				
2,6-NITROTOLUENE				
DIETHYL PHTHALATE				
FLOURENE				
N-NITROSODIPHENYLAMINE				
PENTACHLOROPHENOL				
PHENANTHRENE				
ANTHRACENE				
DI-n-BUTYLPHTHALATE				
FLUORANTHENE				
PYRENE				
BENZO(A)ANTHRACENE				
BIS(2-ETHYLHEXYL)PHTHALATE	5		5	5
CHRYSENE				
BENZO(B)FLUORANTHENE				
BENZO(K)FLUORANTHENE				
BENZO(A)PYRENE				
BENZIDINE				
1-NAPHTHYLAMINE				
ANILINE				
PAH/PHTHALATES (ug/l)	5	0	5	5
PAH/PHTHALATES (Lbs/Year)	0.000	0.000	0.000	0.000
OTHER SEMI-VOLATILES (ug/l)	11	5	0	0
OTHER SEMI-VOL.(Lbs/Year)	0.00	0.00	0.00	0.00
VOLATILE ORGANICS (ug/l)				
VINYL CHLORIDE				
METHYLENE CHLORIDE	4	9	2	6
ACETONE	380	120	5	19
CARBON DISULFIDE				
1,1-DICHLOROETHENE				1
1,2-DICHLOROETHENE		3		3
CHLOROFORM				
2-BUTANONE				
BROMODICHLOROETHANE				
TRICHLOROETHENE		1		
BENZENE	1		1	2
4-METHYL-2-PENTANONE			3	
TOLUENE	1		1	
CHLOROBENZENE	2			
ETHYLBENZENE				
XYLENE		6		9
VOLATILE ORGANICS (ug/l)	388	139	12	40
VOLATILE ORGANICS (lbs/Year)	0.01	0.00	0.00	0.00
TOTAL METALS (ug/l)				
ANTIMONY				
ARSENIC	20		35	22
BERYLLIUM				
CADMIUM	13		5	
CHROMIUM		16	25	45
COPPER	20	25	40	137
LEAD		11	68	217
MERCURY			1	2
NICKEL	40		40	40
SELENIUM				
SILVER				16
THALLIUM				
ZINC	84	86	213	453
HEXAVALENT CHROMIUM	7	25	7	
TOTAL METALS (ug/l)	184	163	434	932
TOTAL METALS (Lbs/Year)	0.01	0.00	0.01	0.02
IRON				
IRON (ug/l)	30100	32600	4960	18800
IRON (Lbs/Year)	0.84	0.92	0.09	0.32
TOTAL ORGANIC CARBON				
TOC (mg/l)	32	74	13	27
TOC (Lbs/Year)	0.90	2.08	0.23	0.46
TOTAL ORGANIC HALOGEN				
TOX (ug/l)	83	85	35	26
TOX (Lbs/Year)	0.00	0.00	0.00	0.00

Table 7-4 f

LOADING TO RIVER DUE TO GW MIGRATION

WEST SHORE (SOUTH)

SAMPLE NUMBER	MW-2	MW-2	MW-3	MW-3	W-9	W-9
SAMPLE DATE (1988)	6-22	8-16	6-22	8-16	6-24	8-16
AQUIFER DEPTH (Feet)	573.73	573.25	573.01	572.46	572.9	572.5
SHORELINE PERIMETER (Feet)	333	333	302	302	262	262
GRADIENT (Feet/Feet)	0.0057	0.0057	0.0009	0.0009	0.0009	0.0009
HYDR. CONDUCTIVITY (cm/sec)	0.0230	0.0230	0.0016	0.0016	0.0034	0.0034
FLOW RATE (Gal/Day)	12191	11746	113.4	108.4	209.2	202.4
SEMI-VOL. ORGANICS (ug/l)						
PHENOL			57	77		
2-CHLOROPHENOL			5	7	1	
1,3-DICHLOROBENZENE				3		
1,4-DICHLOROBENZENE			130	220		
1,2-DICHLOROBENZENE			52	96	2	
2-METHYLPHENOL				6		
N-NITROSO-DI-n-PROPYLAMINE		24				
NITROBENZENE						
2,4-DIMETHYLPHENOL			18	13		
BENZOIC ACID				18		
BIS(2-CHLOROETHYL)OXYMETHANE		20				
1,2,4-TRICHLOROBENZENE						
NAPHTHALENE		4	30	43		
4-CHLOROANILINE		25				
4-CHLORO-3-METHYLPHENOL				4	7	
2-METHYLNAPHTHALENE						
2-NITROANILINE						
ACENAPHTHYLENE						
ACENAPHTHENE						
DIBENZOFURAN						
2,4-NITROTOLUENE						
2,6-NITROTOLUENE						
DIETHYL PHTHALATE						
FLOURENE	15					
N-NITROSODIPHENYLAMINE						
PENTACHLOROPHENOL						
PHENANTHRENE						
ANTHRACENE						
DI-n-BUTYLPHTHALATE				1		
FLUORANTHENE						
PYRENE						
BENZO(A)ANTHRACENE						
BIS(2-ETHYLHEXYL)PHTHALATE				8	5	
CHRYSENE						
BENZO(B)FLUORANTHENE						
BENZO(K)FLUORANTHENE						
BENZO(A)PYRENE						
BENZIDINE						
1-NAPHTHYLAMINE	2900	240				
ANILINE		460				
PAH/PHTHALATES (ug/l)	15	4	30	52	5	0
PAH/PHTHALATES (Lbs/Year)	0.557	0.143	0.010	0.017	0.003	0.000
OTHER SEMI-VOLATILES (ug/l)	2900	769	262	444	10	0
OTHER SEMI-VOL. (Lbs/Year)	107.68	27.51	0.09	0.15	0.01	0.00
VOLATILE ORGANICS (ug/l)						
VINYL CHLORIDE						
METHYLENE CHLORIDE	2	4	2000	6	5	9
ACETONE	6			740	190	63
CARBON DISULFIDE	1					
1,1-DICHLOROETHENE				2		1
1,2-DICHLOROETHENE		3		4	1	3
CHLOROFORM						
2-BUTANONE						
BROMODICHLOROETHANE						
TRICHLOROETHENE						
BENZENE	6	8	28000	1100	24	46
4-METHYL-2-PENTANONE						
TOLUENE	1	1	160	20	1	1
CHLOROBENZENE	6	9	3600	750	130	220
ETHYLBENZENE	1		1200	220		1
XYLENE	1	8	750	130		10
VOLATILE ORGANICS (ug/l)	24	33	35710	2972	351	354
VOLATILE ORGANICS (lbs/Year)	0.89	1.18	12.33	0.98	0.22	0.22
TOTAL METALS (ug/l)						
ANTIMONY	24	37				
ARSENIC	208	36	45		52	31
BERYLLIUM						
CADMIUM	116	17	6		11	
CHROMIUM	2140	1340	27	20		21
COPPER	860	520	20	16	15	16
LEAD	2670	145	28		22	
MERCURY	50	13				
NICKEL	180	90				
SELENIUM						
SILVER						
THALLIUM					94	
ZINC	9950	4590	237	82	38	23
HEXAVALENT CHROMIUM	6	59		8		7
TOTAL METALS (ug/l)	16204	6847	363	126	232	98
TOTAL METALS (Lbs/Year)	601.69	244.98	0.13	0.04	0.15	0.06
IRON						
IRON (ug/l)	381000	254000	14100	15300	23700	30500
IRON (Lbs/Year)	14147	9088	4.87	5.05	15.10	18.80
TOTAL ORGANIC CARBON						
TOC (mg/l)	120	85	96	190	44	62
TOC (Lbs/Year)	4456	3041	33.15	62.71	28.03	38.22
TOTAL ORGANIC HALOGEN						
TOX (ug/l)	160	140	1310	1610	240	520
TOX (Lbs/Year)	5.94	5.01	0.45	0.53	0.15	0.32

West Shore
loading to River