PUBLIC HEALTH CONSULTATION

Groundwater

Industrial Excess Landfill
Uniontown, Ohio
August 21, 1995

U.S. Department of Health and Human Services
Public Health Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment Consultation
Atlanta, Georgia

Concurrence:

Director, DHAC, ATSDR (E32) SWF for
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STATEMENT OF ISSUES

PURPOSE

The Agency for Toxic Substances and Disease Registry (ATSDR) is addressing groundwater data in this health consultation because of groundwater contamination near the Industrial Excess Landfill (IEL), the proximity of private wells users, and community concerns. A few citizens on the outskirts of the original alternate water system have expressed concern about potential private well contamination from the landfill (at Technical Information Committee and other EPA public meetings). Additionally, updates to our 1989 Public Health Assessment have been requested by concerned citizens and recommended by ATSDR staff.

The purpose of this consultation was to determine if private well users near the IEL are or might be exposed to groundwater contaminants from the landfill at levels of health concern. We also reviewed past exposures and their possible health effects.

FINDINGS

Current contamination

Based on this groundwater data review, we have concluded that people near the landfill are *unlikely* to be exposed to landfill contaminants through private well use. Groundwater on-site and immediately west of IEL is contaminated at levels of health concern. Private well users west of IEL were connected to a municipal water system in 1991 (the original alternate water system established by EPA's 1987 Record Of Decision). Since then, additional water systems were constructed and cover areas in the proximity of IEL (Figure 1). *We have recommended that groundwater remediation proceed expeditiously because some residents are not using the additional water systems and the potential for migration of contaminants at levels of health concern still exists.* We have also suggested some additional private well monitoring west of the original alternate water system.

Past Exposures

In the past, residents immediately west and probably due south of IEL (the area of the original alternate water system) were exposed to metals and organic compounds in groundwater through use of their private wells. We estimate the exposed population at less than 50 people (based on past contamination in approximately ten private wells) and the potentially exposed population at less than 500 people (potential past contamination of approximately 100 homes). Based on past (pre-1987) exposure to lead, neurobehavioral effects in children and increases in blood pressure in adults could have occurred. Based on past exposure to volatile organic compounds and other metals, there is a slight increased risk of cancer (leukemia, liver and skin cancer, and perhaps others) and although unlikely, a possibility of increases in the number of birth defects prior to 1987. The possibility of health consequences is greatest for those residents immediately adjacent to the landfill. Federal and

state health agencies should determine if a medical records review, of the exposed and potentially exposed population, for birth defects and cancer is feasible.

BACKGROUND

This consultation is based on seven rounds of groundwater data collected from August 1990 through March 1993. It also incorporates information from the U.S. Geological Survey reports on groundwater flow directions near the landfill and previous health assessments and consultations prepared by ATSDR.

Groundwater Flow

The U. S. Geological Survey has studied groundwater flow near the IEL (1,2). Their most current report indicates that regional groundwater flow is generally east to west. There are some local groundwater mounds: a mound north of the landfill which prevents contamination from migrating northward and diverts the flow east and west and a small mound in the southeast corner of the landfill which diverts groundwater radially (it flows off-site south and east toward Metzgers ditch and also westward). There are bedrock and groundwater highs to the southwest of the IEL which make contaminant migration in that direction unlikely (Figures 2 and 3). Similarly, groundwater does not flow from IEL to the Lake Center Street area or to Northwest Uniontown.

Installation of Water Systems

In September 1987, US EPA signed a Record Of Decision (ROD) to provide alternate water to approximately 100 homes west of IEL (3)(Figure 1). Construction of the alternate water system began in April 1990 and was completed in January 1991. The water is supplied through the North Canton water supply system. *The original water system covered those residents most likely to be exposed to groundwater contaminants from the landfill.*

Existing water systems now cover most of the areas in the proximity of the IEL. Since the original alternate water system, other water systems have been installed. The areas of existing and proposed water service for Lake Township, Stark County, are shown in Figure 1 (4). Some residents, outside of the original alternate water system, are not connected to the additional water systems and may obtain drinking water from private wells. Residential wells are in unconsolidated sand and gravel and in bedrock (shale and sandstone).

Monitoring

As of May 1992, US EPA has been testing well water from approximately 58 monitoring wells (approximately 21 of those wells are off site, as shown in Figure 4) and eight residential wells for contaminants on a quarterly basis (Figure 5). The eight residential wells are on the outskirts of the original alternate water system established by the ROD.

ISSUES OF CONCERN

1. Current groundwater contamination

There is no contamination at levels of health concern from the IEL documented outside the alternate water system established by the 1987 Record of Decision (ROD). There are still contaminants at levels of health concern [particularly arsenic, lead, manganese, benzene, and bis(2-ethylhexyl)phthalate] in groundwater in the immediate vicinity of the IEL. Additional groundwater contaminants are listed in Tables 1 through 3. Contamination is primarily in the shallow aquifer on-site and west of the IEL (the area covered by the original alternate water system). *ATSDR recommends proceeding with groundwater remediation at IEL due to the potential for continued migration of contaminants at levels of health concern and the proximity of private well users.*

Organic Contaminants

Current groundwater data indicates most maximum organic contaminants to be in the shallow aquifer on site in the vicinity of MW15 and off-site in the deep aquifer at MW28 (Table 1) (5). There is an indication of bis(2-ethylhexyl)phthalate] and other organic contaminants in the deep aquifer west/southwest of IEL. However, contamination flowing at the bedrock surface at this location would be directed northwest and then west by the bedrock surface and westerly groundwater flow. The low levels of organic contaminants in MW28 are not anticipated to result in detectable concentrations in residential wells to the west, outside of the original alternate water system. Although ATSDR considered mapping some organic contaminants to show the extent of current contamination, most organic contaminants are not found frequently enough to even be mappable (Table 1). Bis(2-ethylhexyl)phthalate, the most frequently detected organic contaminant, is also found up gradient of the landfill and could be due to additional sources of contamination.

Heavy Metals

The metals data was difficult to interpret because of natural background concentrations in unfiltered samples. Most maximum concentrations of unfiltered metals in groundwater occur in the shallow aquifer at MW27, west/northwest of the IEL (Table 2). Corresponding filtered samples often indicate no detectable or background concentrations of these metals (5). For example, the unfiltered calcium and iron values in MW27 (Table 2) both exceed one million ppb but their corresponding filtered samples are background and nondetectable, respectively. No maximum concentrations of filtered metals occurred at MW27 in the shallow aquifer (Table 3). Apparently, the unfiltered metals concentrations are elevated because of the amount of sediment brought into the well at sample collection and probably do not represent the degree of contamination. Furthermore, no one is drinking monitoring well water. Private wells are constructed differently than monitoring wells and should not contain this degree of sediment loading. There are occasional elevations of metals (beryllium, copper, cadmium) in the deep aquifer near the IEL, particularly in unfiltered results from

MW1, MW2, and MW28, respectively. Barium is elevated on the landfill typically in the shallow aquifer at MW17 and MW14 (5).

There are elevated concentrations of metals in filtered water. Arsenic, barium, calcium, iron, lead, and manganese are elevated in shallow groundwater on and immediately adjacent to the IEL (Table 3). Cadmium, lead, and zinc were elevated in the deep aquifer at MW 28 in March 1993 (5). The concentrations in filtered water were 276, 14.8, and 359 ppb, respectively. These metals were not elevated in the three previous samplings, May through December 1992. Even if these metal concentrations were consumed by a private well user, their occasional consumption would be unlikely to result in health effects.

Due to elevated metals in filtered water (particularly cadmium and lead) in the deep aquifer of MW 28 and the potential for westerly migration of these contaminants, *we recommend that EPA consider sampling a few residential wells in the deep aquifer west of the current alternate water system, if any exist, to verify the absence of inorganic contamination from the IEL.* Due to the seasonal nature of contaminant migration, quarterly testing of these wells is recommended until groundwater remediation begins.

North of IEL

There are occasional detections of cyanide and elevated cadmium and sodium in the intermediate aquifer of background well 12, approximately 1000 feet north of the landfill (Figure 4, and Tables 2 and 3). Although groundwater does not flow from the landfill toward well 12, it is possible that landfill gases migrated that direction prior to perimeter landfill gas extraction by the Methane Venting System. The area between this well and the landfill is covered by the existing water system. The cyanide is not at concentrations of health concern. Sodium may be a concern for people on low sodium diets. Cadmium was detected in one out of four samplings of this well (at 35 ppb) and would be unlikely to cause health effects.

Northwest Uniontown

ATSDR does not believe that shallow PCE contamination in groundwater of northwest Uniontown is contamination migrating from the IEL. Contamination in Northwest Uniontown, north of State Route 619 and west of Cleveland Road, is approximately 2000 feet northwest of the landfill (Figure 6). According to the U.S. Geological Survey, groundwater from the landfill cannot flow that direction (6). Furthermore, groundwater data on PCE does not indicate contaminant migration from the landfill: PCE in northwest Uniontown was detected at 0.4 to 48.5 ppb in 11 of the 94 wells sampled between November 1990 and June 1991 (7). PCE was routinely detected in only one well at IEL, MW18 south of the landfill in the shallow aquifer. It was detected once in the shallow aquifer of MW10. The maximum concentration of PCE in MW 18 was 1 ppb, based on the August 1990 through March 1993 data (5). PCE was also detected in several residential wells west of the landfill; The maximum concentration was 1.3 ppb (8). The hydrogeological and chemical

data suggest that although there is some PCE contamination at IEL, PCE contamination in northwest Uniontown is not contamination migrating from the landfill. Separate sources of contamination are indicated. As shown on Figure 1, the existing water system covers the area of contamination in northwest Uniontown.

2. Potential Health Effects from Past Exposures

Residents immediately west (approximately 10 homes or 50 residents) and probably due south of IEL were exposed to metals and volatile organic compounds in groundwater.

During the Remedial Investigation, the United States Environmental Protection Agency (US EPA) determined that a groundwater plume of contaminants was migrating westward off the site, posing a threat to public health (Figure 6)(8). They sampled water from 67 private wells from November 1986 through July 1987. Ten of the wells showed contaminated water. Contaminants at levels of health concern in groundwater of private wells were some metals and volatile organic compounds (VOCs). EPA also sampled monitoring wells during the remedial investigation and found VOCs (vinyl chloride and others) at levels of health concern.

Population Estimate

Based on hydrogeology and private well contamination, the residents west of IEL were exposed to landfill contaminants. Based on hydrogeology, we think residents immediately due south (to Metzgers ditch) were probably also exposed to landfill contaminants.

We estimate the exposed population at less than 50 people (based on past contamination in approximately ten private wells) and the potentially exposed population at less than 500 people (potential past contamination of approximately 100 homes). The window of possible exposure is approximately 21 years (1966 through 1987).

Levels of Exposure

In 1986 through 1987, elevated concentrations of metals (barium, lead) and organic contaminants (vinyl chloride, chloroethane, and tetrachloroethene [PCE]) were found in private well water from wells located on Cleveland Avenue adjacent to and west of the IEL. Maximum concentrations of these contaminants were 1370 ppb barium, 239 ppb lead, 7 ppb vinyl chloride (estimate), 2 ppb chloroethane, and 1.3 ppb PCE (8). Vinyl chloride and lead exceeded our screening criteria (Appendix). The toxicologic implications of exposure to those contaminants are discussed below under Health Effects. The elevated but low concentrations of the other contaminants are unlikely to have caused adverse health effects.

Data Gaps

Residents may have been exposed to higher concentrations and more contaminants than were detected in the mid-1980s. Since contaminants were present in 1966, it is possible that maximum concentrations and extent of the contamination were not captured in the 1986/1987 private well sampling. Contaminants could move rapidly in the glacial sand and gravel. Horizontal groundwater flow velocities near the IEL range from 0.43 to 6.3 feet per day (4). Due to the potential for rapid flow velocities, it's feasible that other wells west of IEL were contaminated. Therefore, we have estimated the potentially exposed population at 100 homes or less than 500 people west of the landfill.

ATSDR has recommended a review of the birth defects and cancer registries when data are sufficient to give reliable rates (13). A review of the birth defects registry data for the IEL area has been completed by the Ohio Department of Health and is being provided to ATSDR. Currently, there are not enough data in the cancer registry to give reliable rates. In addition to the review of these registries, *federal and state health agencies should determine if a medical records review is feasible since the birth defects and cancer investigations, at the county or city level of the people living around the site, would be unlikely to detect a statistically significant increase in disease in the potentially affected population.*

Health Effects

Since ATSDR's involvement in 1987, residents have reported the following health concerns which they believe were or are related to landfill contaminants (13): nausea, headaches, miscarriages, birth defects, low birth weights, urticaria/angioedema or skin rash, leukemia and other cancers (lymphoma, chondroblastoma, chondrosarcoma, breast cancer, and soft tissue cancers).

There could have been or could be health effects from past exposures to lead and vinyl chloride in private well water. Private well data from one sampling round in 1986/1987 indicates that lead and vinyl chloride were detected in several private wells immediately adjacent to the IEL. Health effects were previously reported in our 1989 Public Health Assessment and are restated below (9). This information is followed by a current analysis of the health implications.

Residents who drank groundwater in the area now covered by the original alternate water system could have health effects related to landfill contaminants. The analysis below indicates that the most likely health effects related to past exposure to landfill contaminants are subtle neurobehavioral effects in children and increases in blood pressure in adults due to possible lead exposure and a slight increased risk of cancer (leukemia, liver and skin cancer, and perhaps others) from possible exposure to volatile organic compounds and some heavy metals. Although unlikely, there is a possibility of increases in the number of birth defects prior to 1987. Other health effects could include circulatory/neurological effects, kidney

damage, bone fragility, gastrointestinal upset, blood disorders, and damage to reproductive organs and the immune system. Residents in the area of the original water system (Figure 1) should consult their physicians if they think these health effects may be occurring.

Lead

The maximum concentration of lead in a private drinking water well was 239 ppb, detected in RW40 (8) (Figure 5). This concentration was high for lead in groundwater considering the levels in the other wells sampled in 1986/1987. All but one other well had concentrations near the background concentration of 3.3 ppb. Since monitoring wells on the landfill currently have elevated lead concentrations (Table 3), it is feasible that this well and perhaps other private wells now covered by the original alternate water system were contaminated by IEL. However, contaminant data suggest that elevated metals concentrations were sporadic. If past exposures occurred at the maximum concentration detected in one residential well, one might expect the blood lead in children ages 1-7 to exceed 10 micrograms per deciliter (μg/dl) during their exposure.

The Center for Disease Control and Prevention consider children to have an elevated level if the amount of lead in the blood is at least 10 micrograms per deciliter. Children are especially sensitive to the toxic effects of lead. At blood lead concentrations exceeding 10 μg/dl, some studies have shown subtle neurobehavioral effects in children. These neurobehavioral effects include slightly decreased performance on Intelligence Quotient tests (IQ test) and electrophysiological changes in the brain (10). Adults, particularly middle-aged men, may have experienced increases in blood pressure due to exposure to lead.

Vinyl Chloride

Vinyl chloride was detected in three private wells in 1986/1987. The maximum concentration was 7 ppb. The DHHS (Department of Health and Human Services) has determined that vinyl chloride is a known human carcinogen associated with cancer of the liver and perhaps with other cancers. Laboratory experiments with animals indicate that ingestion of vinyl chloride can cause liver damage (11). In our 1989 public health assessment, we indicated that vinyl chloride could cause birth defects (9). Toxicological information now indicates that ingestion and inhalation of vinyl chloride ~~based on reported well water levels near IEL were too low~~ to contribute to birth defects and would result in no to a low increased risk of cancer (11). Residents in the area of the original water system (Figure 1) should consult their physicians if they think these health effects may be occurring.

Other Contaminants

Additionally, there are contaminants in off-site monitoring wells (some metals and benzene) which may have reached residential wells in the past. Benzene was detected in an off-site monitoring well, south of the IEL property boundary. The DHHS has determined that benzene is a known human carcinogen based on inhalation studies. Benzene exposure can

cause leukemia, or cancer of the blood and other adverse health effects. Depending on the extent and duration of exposure, benzene can produce different health effects, including gastrointestinal upset, blood disorders, and damage to reproductive organs and the immune system (12). Other possible, but unlikely, health effects based on exposure to metal contaminants in monitoring wells include skin cancer, circulatory/neurological effects, kidney damage, and bone fragility. Residents in the area of the original water system (Figure 1) should consult their physicians if they think these health effects may be occurring.

CONCLUSIONS

Current Contamination

1. There are no known current exposures to groundwater contamination coming from the IEL.

2. The U. S. Geological Survey reports indicate that regional groundwater flow is generally east to west and that the original alternate water system covered those residents most likely to be exposed to groundwater contaminants from the landfill (Figure 1).

3. The groundwater in the immediate vicinity of the IEL is contaminated at levels of health concern. Contamination is primarily in the shallow aquifer on-site and west of IEL. This area is covered by the original alternate water system.

4. The unfiltered monitoring well water contains sediment with naturally occurring metals. The metals concentrations in some of these wells are not indicative of contamination because of sediment loading.

5. The shallow PCE contamination in groundwater of northwest Uniontown is not contamination which has migrated from the IEL.

Past exposures and potential health effects

1. Residents immediately west (approximately 10 homes or less than 50 people) and probably due south of IEL were exposed to metals and volatile organic compounds in groundwater.

2. Based on past (pre-1987) exposure to lead in drinking water, neurobehavioral effects in children and increases in blood pressure in adults could have occurred in residents in the area of the original alternate water system.

3. Based on past exposure to volatile organic compounds and some heavy metals, there is a slight increased risk of cancer (leukemia, liver and skin cancer, and perhaps others) and although unlikely, a possibility of increases in the number of birth defects prior to 1987.

4. Other unlikely but possible health effects from past exposure to groundwater contaminants could include gastrointestinal upset, blood disorders, damage to reproductive organs and the immune system, circulatory/neurological effects, kidney damage, and bone fragility.

RECOMMENDATIONS

1. EPA should proceed expeditiously with groundwater remediation. The sphere of influence of the pump and treat system should extend at minimum to MW28 in all depth intervals.

2. Due to sediment loading, unfiltered monitoring well results for metals at the IEL site should not be used in risk assessment (since the metals concentrations in monitoring wells are much higher than what is anticipated and detected in private wells) or compared to drinking water standards.

3. EPA should evaluate sediment loading at IEL to minimize future impacts on sampling results.

4. EPA should consider sampling a few residential wells in the deep aquifer west of the current alternate water system, if any exist, to verify the absence of inorganic contamination from the IEL.

5. Federal and state health agencies should determine if a medical records review of the exposed and potentially exposed population (residents living in the area of the original alternate water system) for birth defects and cancer is feasible.

6. Residents in the area of the original alternate water system should consult their physicians if they think health effects, as described in this consultation, may be occurring.

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Environmental Health Scientist

REFERENCES

1. Bair, E.S., and Norris, S.E., 1989, Ground-water levels and flow near the Industrial Excess Landfill, Uniontown, Ohio: U.S. Geological Survey Open-File Report 89-272.

2. Bair, E.S., and Dumouchelle, D.H., March 1994, Ground-water levels and directions of flow near the Industrial Excess Landfill, Uniontown, Ohio: U.S. Geological Survey Water-Resources Investigations Report 94-4136.

3. U.S. EPA Record of Decision & Responsiveness Summary, July 1989.

4. Water map from the Stark County Metropolitan Sewer District, December 1994.

5. U.S. EPA Final Technical Memorandum, March 1993, Groundwater monitoring, residential and observation well sampling results, Industrial Excess Landfill, Uniontown, Ohio.

6. Public meeting presentation by USGS on October 11, 1994.

7. Final Report: Potable Water and Soil Gas Sampling, Northwest Uniontown, Uniontown, Ohio, prepared by Roy F. Weston, Inc., prepared for A. Humphrey, U.S. EPA, February 1994.

8. U.S. EPA Final Remedial Investigation Report, July 1988, Vol.I, Vol II-Appendices, Appendix G.

9. ATSDR Public Health Assessment for Industrial Excess Landfill, Uniontown, Ohio, July 21, 1989.

10. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Lead. Atlanta, Georgia: ATSDR, April 1993.

11. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Vinyl Chloride. Atlanta, Georgia: ATSDR, April 1993.

12. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Benzene. Atlanta, Georgia: ATSDR, April 1993.

13. ATSDR health consultation on health outcome data, December 13, 1994.

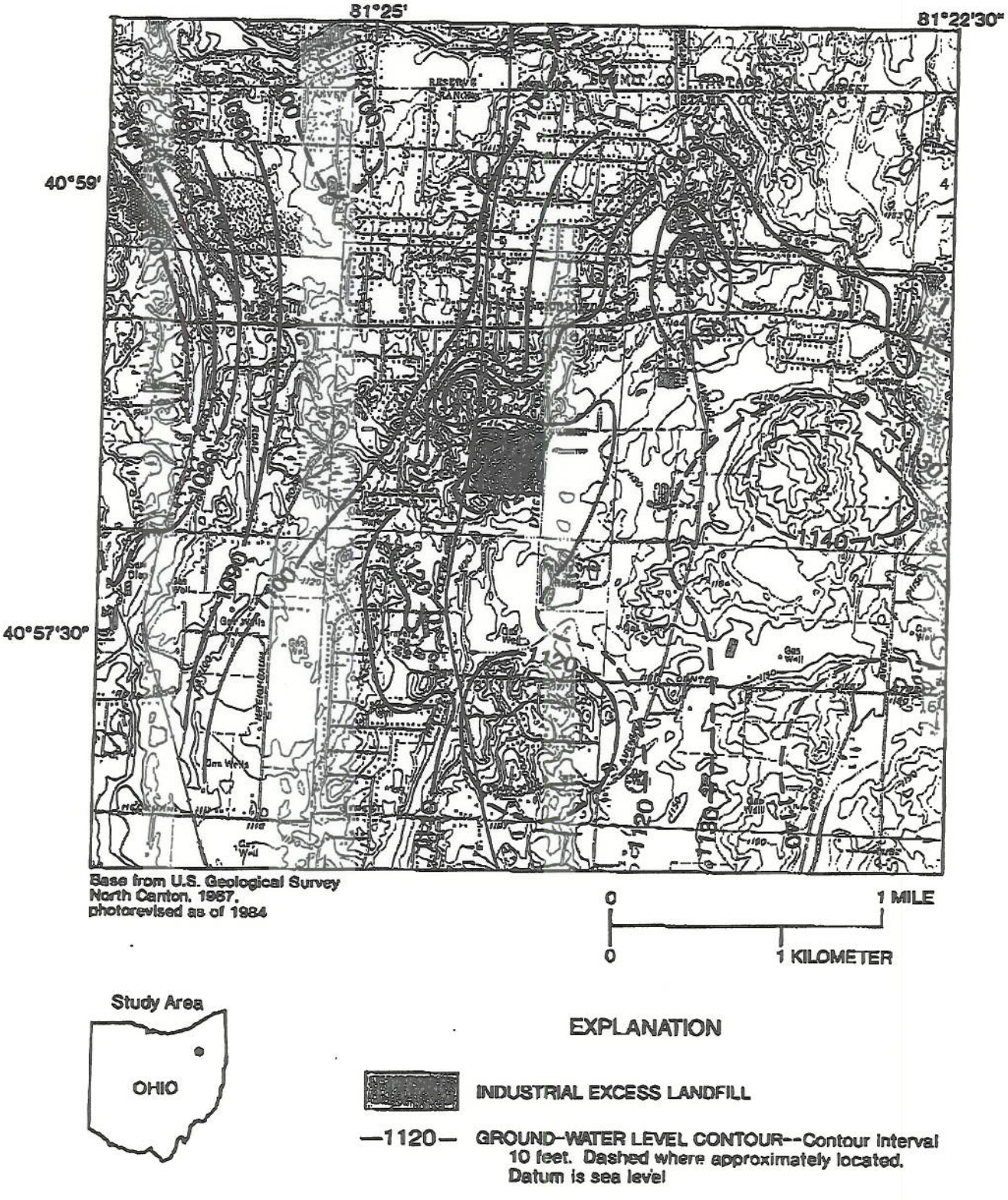


Figure 2. Regional ground-water levels near Uniontown, Ohio, based on March 1994 water-level data.

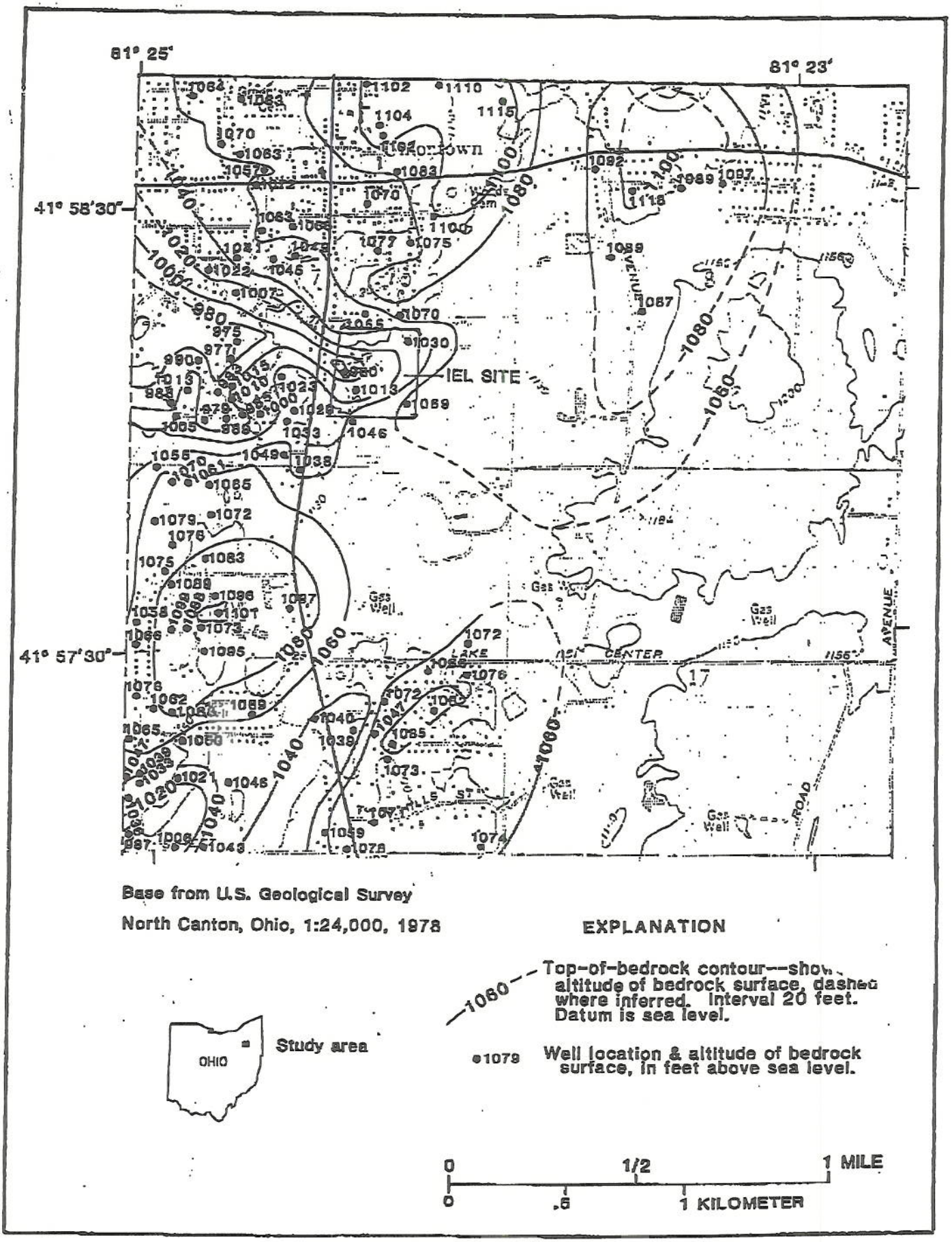
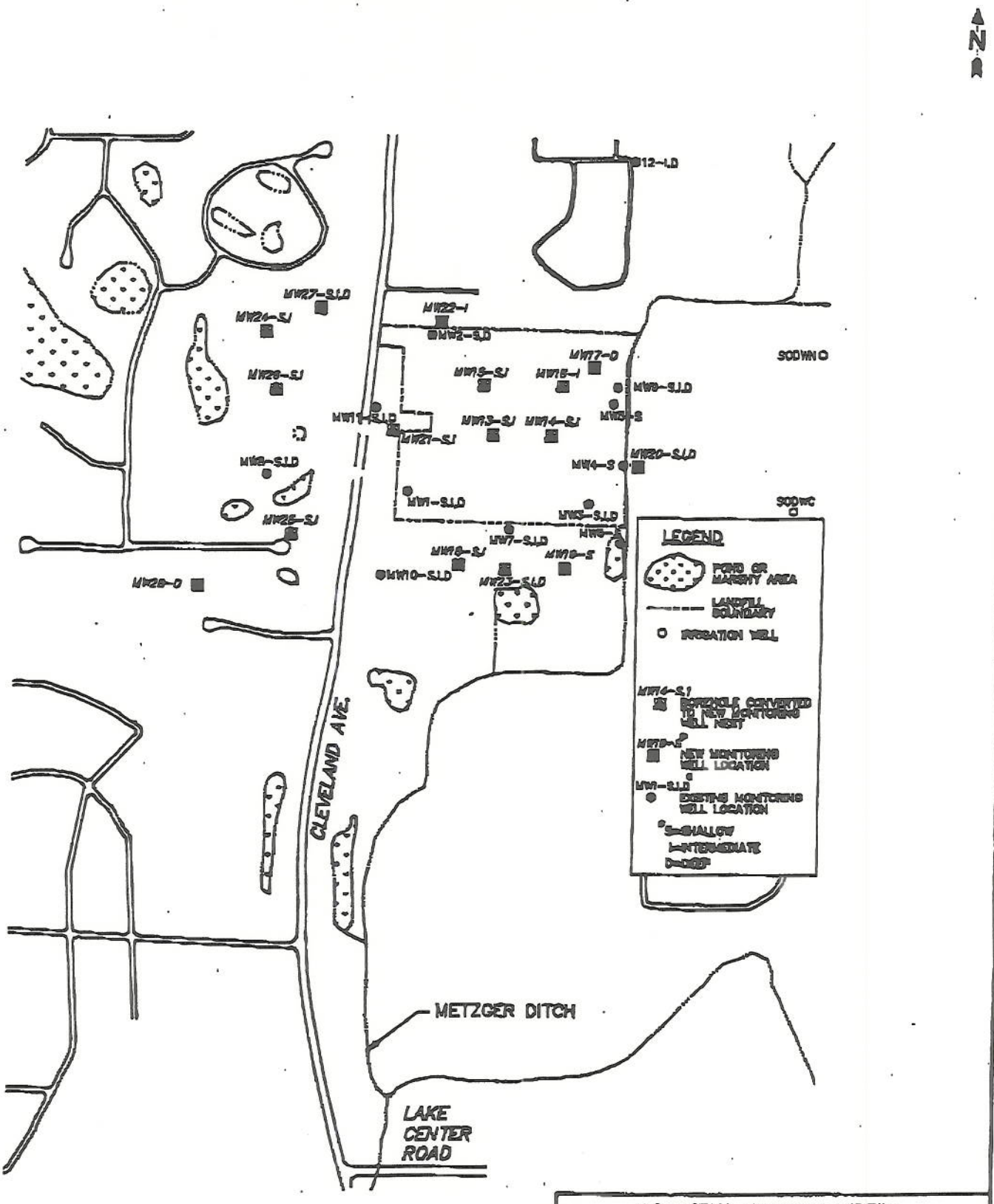


Figure 3.--Top-of-bedrock map based on drillers' logs.

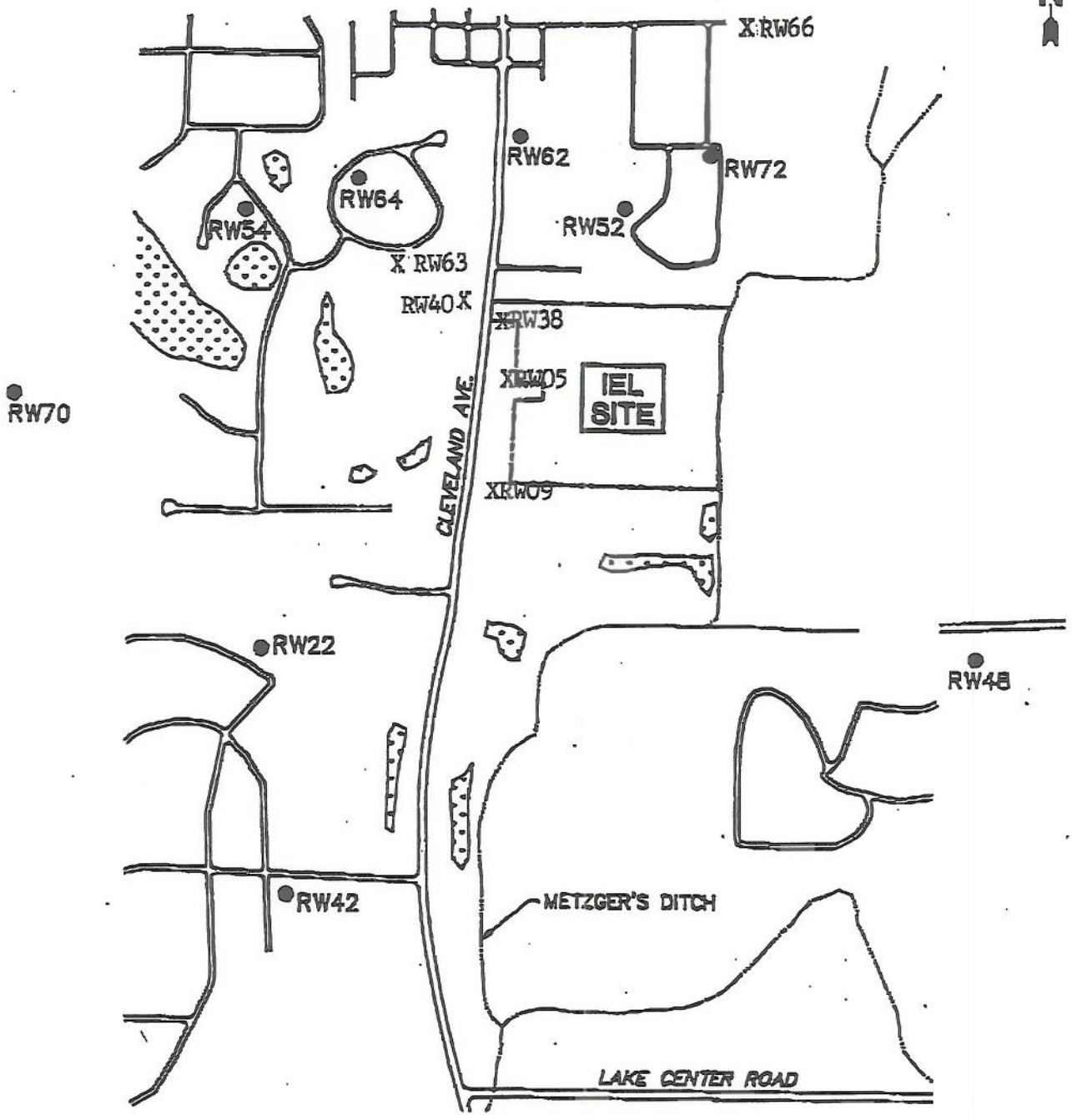


INDUSTRIAL EXCESS LANDFILL
UNIONTOWN, OHIO

FIGURE 4

EXISTING AND NEW
MONITORING WELL LOCATION MAP

PRC ENVIRONMENTAL MANAGEMENT, INC.



LEGEND

POND OR MARSHY AREA

LANDFILL BOUNDARY

RW48 RESIDENTIAL WELL

X RW66 Historical Residential Well Locations

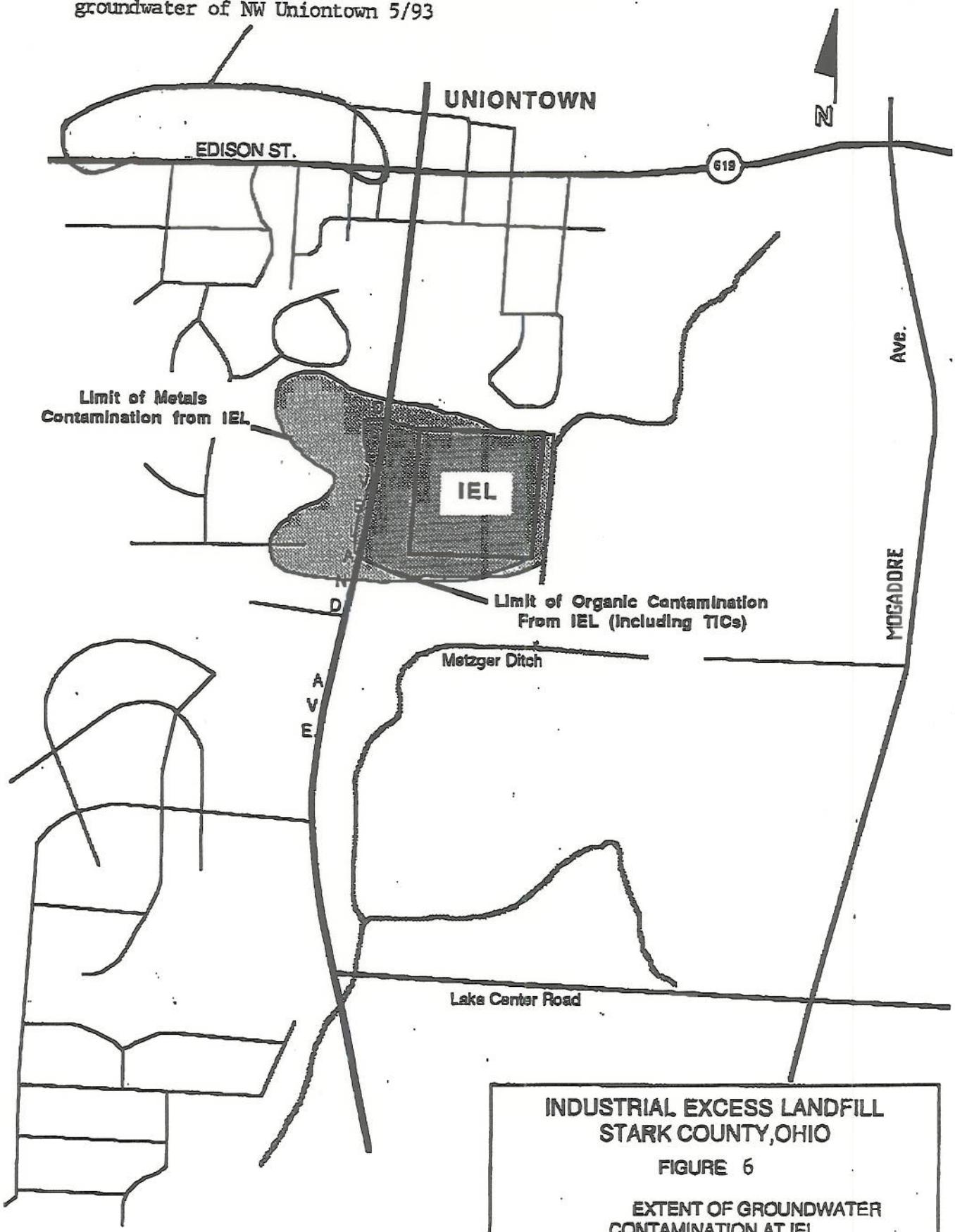
INDUSTRIAL EXCESS LANDFILL
UNIONTOWN, OHIO

FIGURE 5
RESIDENTIAL WELL LOCATIONS

PRC ENVIRONMENTAL MANAGEMENT, INC.

EL-RWWL.DWG - 11/14/03 - MJP-DAZ- ASD-093114

Shallow PCE contamination in groundwater of NW Uniontown 5/93



INDUSTRIAL EXCESS LANDFILL
STARK COUNTY, OHIO

FIGURE 6

EXTENT OF GROUNDWATER CONTAMINATION AT IEL

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Modified by ATSDR

APPENDIX

Explanation of Tables

In the data tables that follow, the listed contaminant does not mean that it will cause adverse health effects from exposures. Since the data are on monitoring wells and not drinking water wells, the list identifies which contaminants should be explored further should the water be used as drinking water. As explained in this consultation, the unfiltered metal results are not compared to drinking water standards, however, they were used to determine what contaminants needed further evaluation.

Comparison values are compared to contaminant concentrations in specific media on site and off site, in this case, groundwater. Contaminants that exceed comparison values are further evaluated in this consultation if they are or could be consumed in drinking water. Those values include Environmental Media Evaluation Guides (EMEGs) based on ATSDR's Minimal Risk Levels (MRLs) and are the estimated contaminant concentrations in water, soil, or air at which there is very little or no chance of noncarcinogenic health effects occurring at this or lower levels (Guidance Manual). Reference Dose Media Evaluation Guide (RMEGs) are the same as EMEGs, except that they are based on EPA's Reference Dose (RfD) rather than MRLs. Exceeding the EMEGs and RMEGs does not mean that health effects will occur, just that further evaluation is needed.

EMEGs and RMEGs for water are computed using 2 liters/day for adults and 1 liter/day for children. A bodyweight of 70 kilograms is assumed for adults and 10 kilograms for children. CREGs are estimated contaminant concentrations based on one excess cancer in a million persons exposed over a lifetime. CREGs are calculated from EPA's cancer slope factors.

The data tables include the following abbreviations:

- **CREG** = Cancer Risk Evaluation Guide
- **EMEG** = Environmental Media Evaluation Guide
- **iEMEG** =Intermediate EMEG
- **RMEG** =Reference Dose Evaluation Media Guide
- **MCL** = Maximum Contaminant Level
- **RfD** = Reference Dose
- **LTHA** = Lifetime Health Advisory
- **ppb** = parts per billion

Table 1.

Groundwater Contaminants*
Monitoring Wells- On & off site
Organic Compounds
August 1990 - March 1993

Contaminant	Maximum Conc. (ppb)	Date	Well	Frequency of Detection	Comparison Value	
					ppb	Source
Aldrin	0.005 JP	3/93	25I	6/247	0.002	CREG
Benzene	1500	12/91	14S	30/283	1	CREG
bis(2-ethylhexl) phthalate	930 D	3/93	10I	64/283	3	CREG
Bromodichloromethane	7J	5/92	28D	2/283	0.6	CREG
Bromoform	12	5/92	28D	3/283	4	CREG
Chloroethane	13	8/92	21S	3/283	27?	MCL
Chloromethane	20	12/92		1/283	3	LTHA
Dibromochloromethane	13	5/92	28D	4/283	0	MCL
1,2 Dichloroethane	36 J	5/92	15S	4/283	0.4	CREG
1,2-Dichloroethene(total)	240	5/92	15S	6/247	70	MCL
cis-1,2-dichloroethene	960	12/91	15S	2/36	70	MCL
Dieldrin	0.12P	3/93	20D	13/283	0.002	CREG
Ethylbenzene	1300	12/91	15S	16/283	1000	RMEG
Heptachlor	0.031 J	5/92	14S	8/283	0.008	CREG
Heptachlor Epoxido	0.0058 JP	5/92	15S	2/283	0.004	CREG
Methylene chloride	220	12/91	15S	21/283**	5	CREG
n-Nitrosodiphenylamine	42	5/92	7S	8/283	7	CREG
Tetrachloroethene	1	12/91&5/92	18S	2/283	0.7	CREG
1,1,2,2-tetra-chloroethene	9	12/91	7S	1/283	0.2	CREG
Toluene	4100	12/91	15S	5/281	2000	RMEGc
1,1,1-trichloroethane	70	12/91	15S	4/283	200	LTHA
Trichloroethene	440	5/92	15S	2/283	3	CREG
Vinyl chloride	19	3/93	15S	5/283	0.2	EMEGc

* The contaminants listed are those which have ATSDR comparison values and whose concentrations exceed that comparison value.
J = Estimated Result
P = Lower concentration of two detected with 25 percent difference
D = Compound found in diluted sample
** Methylene chloride is detected in basically 2 wells, many of the detections were also found in the blanks and the majority of these concentrations are less than the C.V.

Table 2.

Groundwater Contaminants
Monitoring Wells
Maximum concentrations of unfiltered metals and their corresponding filtered results
August 1990 - March 1993

Contaminant	Maximum Unfiltered Conc. (ppb)	Date	Well*	Filtered sample result (ppb)	Background (ppb)**
antimony	175J	8/92	25S	ND	
aluminum	153,000	12/92	27S	ND	88
arsenic	203J	5/92	27S	ND	9
barium	3460	12/92	17S	1710	394
beryllium	216J	12/91	1D	ND	2
cadmium	265	3/93	28D	276	
calcium	1,130,000	8/92	27S	120,000	153,000
chromium	375J	12/92	18S	ND	
cobalt	349	12/92	27S	ND	
copper	1500	12/91	2D	ND	
cyanide	52.4	5/92	12I	ND	
iron	1,070,000	12/92	27S	ND	2150
lead	700J	12/92	27S	1 UJ	3
magnesium	422,000	8/92	27S	25,100	29,500
manganese	14,600	8/92	27S	408	465
mercury	2.6	12/92	27S	ND	
nickel	1240	12/92	24I	1700	
sodium	716,000	3/93	12I	706,000	187,000
vanadium	311	12/92	27S	ND	
zinc	4160	12/92	27S	4.8 BJ	108

* S, I, or D indicates shallow, intermediate, or deep intervals within the aquifer

** Background data taken from the Remedial Investigation, Table 4-14.

J= estimated value
ND = not detected
U = found below quantitation limit
B = found in the associated blank, indicating laboratory contamination

The nickel maximum was a one time high.

Table 3.

Groundwater Contaminants
Monitoring Wells
Filtered Metals
August 1990 - March 1993

Contaminant	Maximum Conc. (ppb)	Date	Well*	Drinking water Comparison Value	
				ppb	Source
antimony	1. 43 .2 B	8/92	14S	4	RMEG
aluminum	6400	8/90	6S	10,000	proposed**
arsenic	63.7	5/92	13S	0.02	CREG
barium	1900	3/93	17S	700	RMEG
beryllium	5J	12/90	1D, 11S&D	0.008	CREG
cadmium	276	3/93	28D	7	EMEG
calcium	284,000	8/92	13S	200,000	proposed
chromium	18.9BJ	3/93	28D	50	RMEG
cobalt	22.8B	8/92	14S	40	proposed
copper	46.8	3/93?	16I	400	proposed
cyanide	38.9	12/91	12I	200	RMEG
iron	52,200	12/90	7S	20,000	proposed
lead	49.5	8/90	6S	15	MCLG
magnesium	99,000	8/92	17S	300,000	proposed
manganese	4630	8/92	3S	50	RMEG
mercury	0.39	8/92	23I	2	LTHA
nickel	1700	12/92	17I	100	LTHA
sodium	706,000	3/93	12I	20,000	proposed
vanadium	21.5B	12/92	14S	30	EMEGi
zinc	359	3/93	28D	2000	LTHA

* S, I, or D indicates shallow, intermediate, or deep intervals within the aquifer

J= estimated value
B = found in the associated blank, indicating laboratory contamination

**proposed indicates the value is under consideration by ATSDR

Table 4

Groundwater Contaminants*
Residential Wells- off site
August 1986 - January 1987 (Remedial Investigation)

Contaminant	Maximum Conc. (ppb)	Well	Background (max in ppb)	Comparison Value	
				ppb	Source
Bromodichloro-methane*	10	54*	NA	0.6	CREG
Chloroethane	2	05	NA	2	MCL
Dibromochlorom ethane	7	54*	NA	0	MCL
Tetrachloro-ethene	1.3	38	NA	0.7	CREG
Vinyl Chloride	7	05	NA	0.2	EMEGc
arsenic	9.1	66**	9	0.02	CREG
barium	1370	09	394	700	RMEG
cadmium	0.58	09	<1?	7	EMEG
lead (total)	239	40**	3	15	MCLG
manganese	489	39	465	50	RMEG
nickel (total)	48	63	<50?	100	LTHA
sodium	342,000	39	187,000	20,000	proposed

If an organic contaminant is not listed this means that it was not detected in private wells or that it was found in field or laboratory blanks. The contaminants listed have ATSDR comparison values and concentrations which exceed the comparison value and/or background or were detected at levels of concern on the landfill.
* according to EPA, contamination from a chlorinator
** = bedrock well or possibly a bedrock well
NA = not applicable

Table 5

Groundwater Contaminants* Residential Wells- off site December 1991 - March 1993						
Contaminant	Maximum Conc. (ppb)	Date	Well	Background (max in ppb)	Comparison Value	
					ppb	Source
Bromodichloro-methane*	1	8/92, 3/93	62,54 54		0.6	CREG
arsenic	6	5/92	64	9	0.02	CREG
lead	3.3	12/91	42	3	15	MCLG
manganese	249	8/92	48	465	50	RMEG
sodium	206,000	3/93	54	187,000	20,000	proposed

The contaminants listed are those which have ATSDR comparison values and whose concentrations exceed the comparison value or background.
J = Estimated Result
P = Lower concentration of two detected with 25 percent difference
D = Compound found in diluted sample
* according to EPA, contamination from a chlorinator
The majority of these residential wells are in the shallow aquifer. No residential wells currently sampled represent the deep aquifer.