ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Public Health Assessment for

INDUSTRIAL EXCESS LANDFILL
UNIONTOWN, STARK COUNTY, OHIO
CERCLIS NO. OHD000377911
JULY 21, 1989

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations 42 C.F.R. Part 90). In preparing this document ATSDR has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 30 day public comment period. Subsequent to the public comment period, ATSDR addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH ASSESSMENT

Industrial Excess Landfill

050HD000377911

Uniontown, Ohio

July 21, 1989

Office of Health Assessment

Agency for Toxic Substances and Disease Registry

United States Public Health Service

Department of Health and Human Services

FOREWORD

The Agency for Toxic Substances and Disease Registry, ATSDR, is an agency of the U.S. Public Health Service. It was established by Congress in 1980 under the Comprehensive Environmental Response, Compensation, and Liability Act, also known as the *Superfund* law. This law set up a fund to identify and clean up our country's hazardous waste sites. The Environmental Protection Agency, EPA, and the individual states regulate the investigation and clean up of the sites.

Since 1986, ATSDR has been required by law to conduct a public health assessment at each of the sites on the EPA National Priorities List. The aim of these evaluations is to find out if people are being exposed to hazardous substances and, if so, whether that exposure is harmful and should be stopped or reduced. (The legal definition of a health assessment is included on the inside front cover.) If appropriate, ATSDR also conducts public health assessments when petitioned by concerned individuals. Public health assessments are carried out by environmental and health scientists from ATSDR and from the states with which ATSDR has cooperative agreements.

Exposure: As the first step in the evaluation, ATSDR scientists review environmental data to see how much contamination is at a site, where it is, and how people might come into contact with it. Generally, ATSDR does not collect its own environmental sampling data but reviews information provided by EPA, other government agencies, businesses, and the public. When there is not enough environmental information available, the report will indicate what further sampling data is needed.

Health Effects: If the review of the environmental data shows that people have or could come into contact with hazardous substances, ATSDR scientists then evaluate whether or not there will be any harmful effects from these exposures. The report focuses on public health, or the health impact on the community as a whole, rather than on individual risks. Again, ATSDR generally makes use of existing scientific information, which can include the results of medical, toxicologic and epidemiologic studies and the data collected in disease registries. The science of environmental health is still developing, and sometimes scientific information on the health effects of certain substances is not available. When this is so, the report will suggest what further research studies are needed.

Conclusions: The report presents conclusions about the level of health threat, if any, posed by a site and recommends ways to stop or reduce exposure in its public health action plan. ATSDR is primarily an advisory agency, so usually these reports identify what actions are appropriate to be undertaken by EPA, other responsible parties, or the research or education divisions of ATSDR. However, if there is an urgent health threat, ATSDR can issue a public health advisory warning people of the danger. ATSDR can also authorize health education or pilot studies of health effects, full-scale epidemiology studies, disease registries, surveillance studies or research on specific hazardous substances.

Interactive Process: The health assessment is an interactive process. ATSDR solicits and evaluates information from numerous city, state and federal agencies, the companies responsible for cleaning up the site, and the community. It then shares its conclusions with them. Agencies are asked to respond to an early version of the report to make sure that the data they have provided is accurate and current. When informed of ATSDR's conclusions and recommendations, sometimes the agencies will begin to act on them before the final release of the report.

Community: ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the comments received from the public are responded to in the final version of the report.

Comments: If, after reading this report, you have questions or comments, we encourage you to send them to us.

Letters should be addressed as follows:

Attention: Chief, Program Evaluation, Records, and Information Services Branch, Agency for Toxic Substances and Disease Registry, 1600 Clifton Road (E-56), Atlanta, GA 30333.

EXECUTIVE SUMMARY

The Industrial Excess Landfill (IEL), a National Priorities List site, is a former sand and gravel quarry located in Uniontown, Ohio. The site was operated as a landfill from 1966 to 1980 and is estimated to have received a minimum of 780,000 tons of waste during that time. Current or potential exposures to contaminants of concern or site-related hazards at or around IEL that could result in an increased risk of adverse health effects include (1) explosive levels of methane gas that may enter residences and buildings adjacent to IEL via migrating soil-gas; (2) chronic ingestion exposure to lead, selenium, vinyl chloride, and several potentially carcinogenic tentatively identified compounds (TICs) in contaminated groundwater; (3) ingestion, dermal, and inhalation exposures to contaminants in various off-site media; (4) ingestion, dermal, and inhalation exposures to contaminants released from on-site areas during remedial activities and trespass events. The Agency for Toxic Substances and Disease Registry (ATSDR) concludes that, absent additional corrective actions, there is a significant risk to human health for persons living or working in structures on some of the properties immediately adjacent to (abutting) IEL because of the potential for off-site migration of methane and other toxic gases.

INTRODUCTION

The Agency for Toxic Substances and Disease Registry (ATSDR) is mandated by Congress to perform a Health Assessment for each hazardous waste site on the National Priorities List (NPL). A Health Assessment is the evaluation of data and information on the release of hazardous substances into the environment in order to (1) assess any current or future impacts on public health, (2) develop health advisories or other health recommendations, and (3) identify studies or actions needed to evaluate and mitigate or prevent human health effects. When ATSDR performs a Health Assessment for a hazardous waste site, the evaluation is ideally based upon a complete environmental characterization, such as is normally contained in a Remedial Investigation/Feasibility Study (RI/FS).

ATSDR is also authorized by Congress to perform Health Assessments for releases or facilities where individuals or licensed physicians provide information that people have been exposed to a hazardous substance. ATSDR accepts such Health Assessment petitions from a wide variety of entities, including individuals, organizations, corporations, other businesses, federal officials or agencies, and state and local government agencies. ATSDR received a February 22, 1987, petition regarding the Industrial Excess Landfill (IEL) from a citizen of Uniontown. This Health Assessment responds to that petition.

A Draft Health Assessment was released for public comment on March 24, 1989. Public meetings with local citizens and petitioners on the Draft Health Assessment were held on April 5 and 6, 1989 in Uniontown, Ohio. The public comment period closed June 1. Comments received on the Draft Health Assessment have been considered during the preparation of this report.

BACKGROUND

A. SITE DESCRIPTION

IEL, located in Lake Township, Stark County, Ohio, is an NPL site. The site is located on Cleveland Avenue, immediately south of the community of Uniontown and about 10 miles southeast of Akron, Ohio. The 29.9-acre site was used as an open-pit sand and gravel mine until 1966 when it was converted to a landfill for disposing of a wide variety of wastes. The landfill was closed in 1980 (CDM Federal Programs Corporation (CDMFPC) 1988).

Metzger Ditch forms the eastern boundary of the site. A chain-link fence delineates the western boundary between the landfill and residential and commercial property located along Cleveland Avenue. A combination of chain-link and barbed-wire fences defines the boundary between the site and residential and commercial property to the north and south. The site is accessible to pedestrians on the northeast, east and southeast boundaries.

The site is situated on the eastern side of an elongated hill or ridge with an estimated on-site relief of 60 feet. Most of the surface slopes to the east and southeast. Surface-water runoff from the site drains into Metzger Ditch. An off-site pond is located across Cleveland Avenue from IEL, but it is not connected with Metzger Ditch or any known drainage pathway from IEL.

B. SITE HISTORY

IEL is a former sand and gravel quarry. The resultant excavation was converted into a landfill. From 1966 to 1980, an estimated minimum of 780,000 tons of waste (including at least 1 million gallons of wastes) were disposed of at the site. The disposal rate for chemical waste increased to a maximum of 11,000 gallons/day in 1972. Up to 60,000 barrelfuls were emptied onto the site with the contents of 75% of these of unknown composition.

The site has been the subject of community complaints and regulatory investigations since 1971. In response to community complaints, the Stark County Board of Health issued a prohibition against the dumping of chemical wastes in 1972. In 1980, because of public concern and because the facility had reached its volumetric maximum capacity, the landfill was closed by means of a consent agreement ordered by the Stark County Court of Common Pleas (CDMFPC, 1988). The site was then covered with a mixture of granular material from the site and "clayey overburden" from a nearby area. Finally, it was seeded.

Concerns about the generation and migration of methane gas from the landfill were expressed before it was closed. Investigations had revealed that methane was migrating off the site. Monitoring for methane was initiated in homes adjacent to the site. The landfill owner had installed an on-site, a passive gas-vent system with ground flares to help mitigate methane migration.

Involvement of the U.S. Public Health Service (PHS) with IEL predates the existence of ATSDR. Since 1979, health consultations for IEL have been provided to the U.S. Environmental Protection Agency (EPA,) on request, by the staff of the Center for Environmental Health, Centers for Disease Control (CDC). In 1984, ATSDR was designated as the PHS agency responsible for health evaluation at hazardous waste sites.

In 1984, EPA and the Ohio Environmental Protection Agency (OEPA) conducted investigations at the site. In January of that year, ATSDR reviewed analytic results from samples of drinking water from private wells located "approximately 100 yards from Industrial Excess Landfill" and concluded that "the concentration of the compounds found is such that consumption of the water does not pose an undue health risk." ATSDR recommended additional monitoring to determine "if and when the water quality becomes such that the water should not be used for human consumption" and sampling to determine background water quality for that area.

In December 1984, OEPA's investigations revealed high on-site concentrations of methane, lateral migration of methane from the landfill, and air methane concentrations in the crawl spaces of the houses adjacent to the site that were up to 100% of the lower explosive limit (LEL). In response to the problem, the EPA Region V Emergency Response Team (ERT) installed an active methane-venting system (MVS) at the site between 1985 and 1987 to control migration of methane. This system was located on the northern, western, and southern edges of the site. EPA proposed in 1984 that IEL be placed on the NPL and began the RI/FS in 1985. Vented gases were initially burned with a candle-flare system, which was later replaced with a ground-flare system.

In March 1986, ATSDR reviewed air-monitoring data from the trace atmospheric gas analyzer for samples taken from ambient air, air at the landfill, and surrounding Uniontown residences. Vinyl chloride was found in an air sample from the backyard of one residence, and vinyl chloride and benzene were found in samples from 10 monitoring wells. ATSDR concluded that

> the concentrations of volatile organic chemicals do not represent a significant public health threat; however...benzene and vinyl chloride are known to cause cancer at higher exposure levels...Because any additional exposure of the public to these chemicals is undesirable, and these chemicals occur in a pattern typically seen at many landfills, immediate steps should be taken to determine if there is a continuing presence of these chemicals and any trend of increasing levels in houses...In the absence of continuous monitoring and data on continuing ambient levels of these chemicals it is not possible to quantify the risk from exposure to the identified substances. Given this data, a more accurate assessment of the potential public health impact of the substances and guidance on emergency action levels could be provided.

Subsequently, ATSDR comments in July 1986 on the air-monitoring results suggested problems with the quality of the data. These comments indicated that the observed contaminant levels were mostly "at levels...reported as common in the published literature," and most likely represented volatile organic compounds (VOCs) found in common household products. Further monitoring was recommended to determine if the contaminants represented migration from the landfill.

ATSDR reviewed the results of groundwater sampling in February 1987 and concluded that

> Several priority pollutants were detected in groundwater collected from residential wells located in the vicinity of the Industrial Excess Site near Akron, Ohio. Most of these appear to be artifacts caused by contamination of the samples. The only potential health threat from organic chemicals appears to be due to 5 ug/L of vinyl chloride found in one well. Appropriate action should be taken to reduce the exposure to vinyl chloride or rule out its presence. Fifteen of the wells show sodium concentrations at or above the 20 mg/L level of concern for people on low sodium diets.

The Health Assessment Coordination Activity (HACA) and Emergency Response Branch (ERB) of ATSDR reviewed additional sampling data from well water in February 1987. Samples from three houses showed vinyl chloride levels in excess of the EPA proposed maximum contaminant level (PMCL) of 1 ug/L. A sample from one of these houses had previously shown a vinyl chloride level of 5 ug/L in the data on well water reviewed by ATSDR in January 1987. The EPA Office of Drinking Water (ODW) stated that the presence of vinyl chloride at these levels posed an unacceptably high excess lifetime risk of cancer from vinyl chloride exposure by the ingestion of drinking water and recommended an alternative supply of drinking water for the houses affected. In response to a consultation request from EPA Region V, HACA and ERB recommended an alternative water supply for all uses at the three houses where samples of well water showed vinyl chloride in excess of the EPA PMCL. The EPA Region V ERT installed in-home air strippers to remove the vinyl chloride.

In response to concerns about the direction of flow for contaminated groundwater, ATSDR enlisted the assistance of the U.S. Geological Survey (USGS) in late 1987. The USGS evaluation was completed in October 1988 and is incorporated in the appendices. Also in 1987, EPA prepared a Focused Feasibility Study (FFS) addressing the need for alternative water supplies for residences having wells with endangered water supplies. From the FFS, EPA selected an alternative water-supply system for some of the residences immediately west and northwest of the site. A Record of Decision for provision of alternative water supplies was signed in September 1987.

In June 1988, the ATSDR Epidemiology and Medicine Branch (EMB) released a final technical-assistance report to the Ohio Department of Health (ODOH) on measurements of VOCs in whole blood for 13 of 16 nearby residents who previously had obtained such measurements privately. In this report, ATSDR concluded that

> The VOC test results were within established norms for all but two participants. These two had high levels of tetrachloroethene. Also reported was the presence of a 6-carbon, 14-hydrogen compound. The level of this compound could not be quantitated because of the absence of laboratory validation standard materials.

In the report, ATSDR further stated that

> A follow-up of the two participants with high tetrachloroethene levels was done by the Ohio Department of Health. Neither participant wanted to discuss potential exposure sources because each was sure that exposure was due to the landfill.

The EPA Proposed Remedial Alternative was released for public comment on December 21, 1988. The remedial alternative proposed by EPA, Region V, for the IEL site includes (1) installation of a multilayered cap that meets the specifications of the Resource Conservation and Recovery Act of 1976 (RCRA cap), (2) expansion of the MVS, and (3) groundwater collection via extraction wells and treatment of the collected groundwater by air stripping, carbon absorption, and "flocculation/sedimentation/filtration." The proposed collection of groundwater is expected to lower the water table under the landfill contents, effecting an "indirect containment" of the landfill contents. Treatment will be discontinued when discharge criteria of the Clean Water Act are met for the effluent. However, groundwater extraction with discharge to Metzger Ditch will continue in perpetuity. A fence will also be installed; and property will be acquired on the north, west, and south edges of the site. Monitoring will also be conducted.

On March 24, 1989, ATSDR issued a Draft Health Assessment for public review and comment. Public meetings with the petitioners and other concerned citizens in Uniontown, Ohio were held on April 5 and 6. The public comment period closed on June 1.

On July 7, 1989, ATSDR notified EPA Region V by telephone of a new public health conclusion and recommendation concerning off-site migration of soil-gases at IEL (the verbal discussion was confirmed in a July 13 letter to Basil G. Constantelos, USEPA from Mark M. Bashor, ATSDR, Appendix A). Also on July 7, ATSDR was verbally informed by EPA of a recent detection of high concentrations of methane gas at a location 10 feet beyond the western boundary and 40 feet east of an adjacent residence. A final RI report was released by EPA in July 1988.

On July 17, 1989, EPA signed a Record of Decision mandating a slightly modified version of the above described remedy . EPA also acknowledged the ATSDR concern for persons living or working on properties adjacent to IEL and offered immediate temporary relocation for those persons. EPA announced that acquisition proceedings for the adjacent properties identified in the ROD would begin immediately.

C. SITE VISIT

ATSDR staff have visited the site and surrounding area several times in the past 2 years. Observations from those visits are listed below:

1. Site access remains essentially unrestricted. Although a chain-link fence is present along the western boundary, the site is essentially unrestricted along the east side bordering Metzger Ditch and is accessible along portions of the northern and southern boundaries because of incomplete fencing or damaged fencing.

2. Children were observed immediately outside the southwestern corner of the site in March of 1989.

3. During a March 1989 visit, patches of bare soil and what appeared to be portions of old tires were observed along the southwestern portion of IEL, near the 4-foot high chain link fence separating the site from the residents' backyards.

4. Seeps issuing along the eastern side of IEL and flowing toward Metzger Ditch were observed in a July, 1989 visit. Edible berries were noted on-site in the area of Metzger Ditch.

D. PUBLIC CONCERNS

Since 1971, residents have expressed many concerns about the disposal site, such as (1) the danger of migrating methane gas; (2) contamination of residential water-supply wells by a variety of metals and organic substances including numerous tentatively identified compounds (TICs); (3) contamination of indoor air in homes from migrating volatile organic compounds (VOC) in soil gas; and (4) exposure to radon and other radionuclides from alleged disposal of radioactive wastes on-site.

In June 1987, several residents living near the landfill submitted a list of health concerns for ATSDR review. As follow-up, ATSDR's EMB proposed to perform an investigation that would survey the community living near the landfill for self-reported diseases and health complaints. This proposal was declined by a committee representing the affected citizens until a health assessment can be completed wherein routes of contamination from the landfill are established (ATSDR, 1988c). However, the community currently appears to be divided on the need for and desirability of a health study. During the ATSDR public meeting held on April 5, 1989 and in written comments on the Draft Health Assessment, several citizens requested a health study while others still expressed opposition to the health study.

Lake Township citizens provided ATSDR with many detailed comments on the March 24 Draft Health Assessment during both the public meeting and the public comment period (March 24 to June 1). These comments included the following concerns:

1. <u>If the MVS failed, methane and toxic gases could migrate into nearby homes</u>. An experienced mechanical engineer residing in the area pointed out the frequency of mechanical failures of many technologies and deduced that the components of the MVS, such as motors, mechanical linkages, and electrical switches, would eventually fail. Citizens were concerned that failure of the MVS would lead to explosions from accumulation of methane gases and adverse health effects from inhalation of toxic gases. They expressed similar concerns about possible failures of the proposed groundwater pump and treatment system.

2. <u>Nearby residents may be inhaling unburned toxic gases as the result of improper operation of the MVS</u>. Persons living nearby reported strange odors which they attributed to be emanating from the MVS. Citizens pointed out that several homes were within a few hundred feet of the MVS stack and expressed concern that nearby residents might be inhaling toxic emissions from the MVS stack. Citizens also pointed out that the MVS did not incorporate continuous monitoring devices required by EPA of many industrial air polluters.

3. Residents may be exposed to contaminated soils, sediments, groundwater and surface water in areas not extensively sampled by EPA or OEPA. Residents described past storm events occurring during the operational period of the landfill that resulted in storm-water runoff flowing westward from the landfill, across and to areas west of Cleveland Avenue. Residents conjectured that contaminants may have migrated into these areas with the storm-water.

4. The lack of detailed characterization of waste buried on-site would lead to the selection of a remedy not adequately protective of public health. Citizens were concerned that the proposed remedy could not adequately prevent the release of dioxins, phosgene, radionuclides, and nonaqueous phase liquids (NAPLs) because of a remedial design based on limited site characterization.

5. The indoor air sampling and analysis performed by EPA did not adequately address the potential for increased soil-gas migration from seasonal and climatic changes. Citizens expressed concern that toxic soil-gases were still migrating into homes despite EPA's chemical analysis of indoor air and conjecture that measured air contaminants were the result of household sources and not soil-gases. One citizen commented that elevated levels of "pentanes" were identified in indoor air of homes and in blood analyses. The citizen deduced a possible exposure connection attributable to the site. The citizen was very much concerned that this possible past exposure to pentanes had been ignored as a result of limited sampling and analyses for pentane, both on and off IEL.

6. Adverse health effects may have occurred from past exposures to contaminated groundwater and soil-gases. Citizens and technical consultants for Concerned Citizens of Lake Township (CCLT) expressed concern that ATSDR was ignoring adverse health effects by not addressing possible past exposures of residents to contaminants from IEL.

7. The in-home air strippers installed by EPA may be malfunctioning and allowing unacceptable levels of VOCs to accumulate in homes. Residents indicated that there had not been periodic montoring and maintenance of the air strippers installed to remove vinyl chloride from residential well water. They were concerned that the air strippers might be malfunctioning, thus allowing inhalation of vinyl chloride and other VOCs. At least one resident was concerned about the improper installation of the vent stack for her air stripper, allowing the stack emissions to be vented beneath the eaves of her house and into the breathing zone near the door. ATSDR staff visited the house and confirmed the venting beneath the eaves. EPA has since reported correction of the vent stack to above the roof.

8. The area of residential wells affected by groundwater contamination generated by IEL maybe much larger than depicted by EPA and the area designed to receive alternate water may be too small to adequately protect all potentially affected residents. Citizens pointed out results of EPA residential sampling indicated some contamination outside the EPA delineated groundwater plume. Citizens also expressed their concerns that periodic monitoring was needed to detect and evaluate seasonal or cyclic fluctuations

in contaminant concentrations. Citizens were very concerned that by the time the alternate water is available the groundwater plume would have expanded to contaminate residential wells outside the area served by alternate water.

ENVIRONMENTAL CONTAMINATION AND PHYSICAL HAZARDS

A. ON-SITE CONTAMINATION

According to EPA reports, an estimated 1 million gallons of municipal, commercial, and industrial wastes were deposited at this site. Of this amount, an estimated 60,000 barrelfuls were liquid waste. The liquid wastes, of which 25 % are thought to have been latex, were mixed on-site with fly ash. An evaporation lagoon was constructed on-site for disposal of liquid wastes. Wastes were apparently buried randomly across the site and at least one location off-site. Buried wastes were found behind a tire shop located adjacent to the northwest corner of the site.

The waste disposal actions have resulted in on-site contamination of soil, groundwater, soil gas, surface water, and sediments. Table 1 (Appendix B) lists the contaminants causing concern and the maximum concentrations found both on-site and off-site. This list of contaminants does not include all the chemicals discovered, but only those which, on the basis of current medical and toxicologic knowledge, could most likely result in adverse human health effects if exposure were to occur at the maximum concentrations detected for a sufficient period of time. However, maximum concentrations reported for some sample sources may not, in and of themselves, be at or above levels likely to be of human health concern. Contaminant concentrations are reported for both on-site and off-site media for comparison and to provide some information about the potential for combined exposure to particular toxicants in more than one medium.

Phosgene gas was measured on-site at 12 ppb in March 1986. However, results of 1987 investigations did not show phosgene gas at levels above the 100 ppb detection limit. Remedial investigators assumed that reaction with soil water would break down phosgene before migration could occur. As a result, soil-gas and residential-air samples were not analyzed for phosgene.

Radon gas was also measured on-site. The concentration reported (516 picocuries of radon per liter of air) was considered by EPA to be within the normal background range for that area. However, residents reported that trucks labeled with radioactive waste symbols entered the site during the operational period of the landfill. Additional sampling and analyses for radon or other radionuclides have not been conducted to confirm or deny the presence of radioactive waste.

According to EPA reports, on-site surface soils have been covered with uncontaminated soil to prevent migration of contaminants and exposure to humans. Hazardous waste is presumed to present on the surface only at two small leachate seeps on the eastern slope. However, in March 1989, an ATSDR scientist observed what appeared to be small (1 to 2 feet square) areas of exposed rubbish along the southwestern side. If previously covered rubbish is exposed at the surface, the original soil cover may be eroding in places. Therefore, the potential for surface exposure of contaminated soils or other contaminated materials may exist.

The results of sampling and analysis of the sediments in Metzger Ditch and in four small, on-site ponds revealed the presence of contaminants. These small ponds are located adjacent to Metzger Ditch on the eastern side of the landfill.

B. OFF-SITE CONTAMINATION

As noted previously, at least one area outside the fenced boundary was used to dispose of wastes. The off-site disposal area is assumed to have an adequate soil cover to prevent surface exposure of buried contaminants Investigations to date have not revealed additional off-site disposal locations.

Environmental investigations by both OEPA and EPA have indicated that groundwater and soil-gas are the media for which the results of sampling and analysis have shown the highest concentrations of off-site contaminants. In addition to the contaminants listed in Table 1 for residential wells, numerous TICs were reported for some water samples from residential wells. Water samples from the residential well adjacent to the west side of IEL showed the largest number of TICs, but TICs were also reported in samples from residential wells to the north and southwest.

Indoor air was sampled and analyzed in nearby residences: twice in 1986 and once in 1988. Although the 1986 analyses are considered inconclusive, they are included with 1988 results in Table 1 for evaluation of worst-possible-case conditions.

In the 1988 investigations, three different sampling methods were used to study residential indoor air: a trace-atmospheric-gas analyzer (TAGA), a mobile, tandem mass spectrometer/data system for tracking air contaminants to a possible source, and Tenax/carbonized molecular sieve (Tenax/CMS) absorption tubes and Summa canisters. Tenax/CMS tubes were used to obtain 12-hour samples (two tubes in tandem being used for 24-hour samples) and Summa canisters were used to obtain "grab" or short-interval samples. Conventional gas-chromatographic and mass-spectrophotometric (GC/MS) methods were used to analyze the Tenax/CMS tubes and Summa canisters. Residential air contaminant concentrations listed in Table 1 are maximum concentrations resulting from the use of any of these three methods.

C. PHYSICAL HAZARDS

The possibility of explosions from accidental ignition of methane gas is the primary physical hazard presented by IEL. Explosions in nearby residences and businesses could occur if the MVS fails either partially or completely for a sufficient period of time to allow buildup of explosive levels of methane. The MVS could fail completely because of natural disasters (lightning, ice storms, high winds) damaging power sources or because of direct damage to the MVS. Partial failure of the MVS could occur from encrustation or corrosion of extraction wells and pipes, and breaks in the manifold system from subsidence or other earth disturbances.

The MVS can also fail to prevent off-site migration of methane and other soil-gases if not constantly monitored and maintained at an operational volume and frequency corresponding to the current volume of gas being generated by the landfill. A June and July 1989 incident of off-site methane gas migration emphasized the need for constant monitoring and maintenance of the MVS.

As reported to ATSDR by EPA officials, OEPA detected elevated levels of methane gas in a resident's backyard adjacent to IEL during a routine soil-gas monitoring survey in June 1989. Follow up soil-gas monitoring revealed no indications of methane in residences but up to 49 % by volume of methane was detected at a location 10 feet westward of the chain-link fence bordering the west side of IEL and approximately 40 feet east of a residence (personal communication from Basil G. Constantelos, USEPA, to Mark Bashor, ATSDR, July 7, 1989). The concentration detected is 3 times higher than the upper explosive limit (UEL) of methane and is more than 8 times the lower explosive limit (LEL). The EPA contractors adjusted the MVS to increase the volume of soil-gas evacuated from the site and the methane levels measured by field instruments decreased to 0.

EPA experts conjectured that recent storm events and warm weather increased the volume of methane gas generated on-site, with infiltrating rainfall decreasing the upward movement of methane within the landfill, thereby forcing more lateral (westward) migration of methane toward adjacent residences than the previous MVS evacuation rates could control. Increasing the MVS evacuation rate apparently reduced the volume of methane gas migrating off-site. EPA intends to monitor the area closely and provide immediate improvements to portions of the MVS.

The above incident illustrates the sensitivity of soil-gas generation and migration to changing site conditions such as those produced by storm events. It is therefore reasonable to assume that any physical disturbances to the landfill, such as excavation, boring, placement of impermeable covers, subsidence, and movement of heavy equipment, might also change both the volume and the pathways of soil-gas migration. Subsurface investigations on-site (drilling, boring, and trenching.) could also initiate local explosions and thereby endanger the investigative workers. The risk to on-site workers involved in intrusive activities can be reduced, but not eliminated, with use of preventive measures such as spark suppression and methane detectors.

DEMOGRAPHICS OF POPULATION NEAR SITE

Stark Township contains a mixture of residential, commercial, and agricultural land. Residential subdivisions are located north of and adjacent to the IEL site and west, southwest, and northwest across Cleveland Avenue. Six residences are located adjacent to the IEL site on the east side of Cleveland Avenue. Three commercial structures are also located on the west boundary of IEL: a tire shop, an antique shop (former restaurant), and a pole barn used for storage and auctions.

In general, the land east and southeast of the IEL site is used for agriculture. A sod farm is located east of the IEL site, across Metzger Ditch, and south of the sod farm is a pasture area for dairy cattle.

According to the RI report, approximately 2,500 to 3,000 people live within a 1-mile radius of the IEL site. Although no estimate of water use is currently available, drillers' logs indicate that the population depends on private wells for domestic water supplies.

EVALUATION

A. DATA NEEDS AND EVALUATION

1. Environmental Media

All environmental media except biota were investigated during the RI. The information gathered, however, was limited for some media. The additional information that will be needed to clarify health concerns identified later in this report is listed below.

a. Soil-Gas Migration: Results of investigations of on-site soil gas indicated high concentrations of contaminants near the northeastern and southeastern boundaries. Although monitoring wells for landfill gas (LFG) did not reveal elevated concentrations of soil-gas contaminants migrating off-site, some subsurface migration routes may not be intercepted by the existing monitoring wells. Additional soil-gas monitoring with field instruments on adjacent residential and commercial properties would help to verify the LFG results or locate or rule out unknown subsurface migration routes. Since phosgene was previously detected in on-site, phosgene should be included in any future soil-gas monitoring.

As discussed in the Physical Hazards Section, off-site migration of methane was detected in June and July of 1989. This incident clearly illustrates the fallibility of the MVS and the need for increased frequency of soil-gas monitoring in an attempt to provide adequate warning to persons living and working in adjacent structures of imminent explosion hazards and other adverse health effects from potentially comingled toxic soil-gases.

The incident of off-site methane migration also indicates the need for improvements in the LFG monitoring well system. Additional permanent soil-gas monitoring wells are needed to improve the monitoring of soil-gas pathways at depths below the capability of field instruments. Permanent soil-gas monitoring wells that are constructed to provide continuous gas pressure monitoring and remote sensing of methane concentrations might provide a better means of monitoring changes in off-site methane migrations than the current system.

b. Off-Site Surface Soils: The extent of contamination in off-site surface soils is unknown. Samples of surface soil (from the top 3 inches) were apparently not taken from all adjacent residential properties (CDMFPC, 1988, Figure 4-15.)

Direct observations by ATSDR scientists and the topographic map of the Uniontown area both indicate that the southwestern portion of IEL is approximately 10 feet higher than adjacent residential and commercial properties. If fly ash and other particulate contaminants were dumped in the southwestern portion of IEL, both wind and water could have distributed the contaminants onto adjacent, lower elevation properties during past disposal operations and prior to establishment of soil cover on IEL.

As described in the RI report (CDMFPC, 1988, page 1-16,) lampblack dust was reported blowing off the site and into adjacent homes. It is therefore reasonable to assume that other windblown contaminants could have migrated off-site and onto adjacent properties.

Adjacent properties could contain contaminated surface soils as a result of contaminants migrating off-site during past disposal operations. As previously mentioned, citizens reported historical incidents of storm water run-off flowing from the site westward and across Cleveland Avenue when the landfill was still receiving wastes. Therefore, adjacent properties and possibly properties west and downgradient of Cleveland Avenue could have received contaminants migrating off-site from IEL. Because the adjacent properties and properties immediately west and downgradient of Cleveland Avenue are possible human exposure points, these properties need to be further characterized.

c. Residential Wells: Sampling and analyses of nearby residential wells have generated some anomalous results, particularly for lead. Results from the February 1988 sampling of residential wells indicate the presence of lead at levels above drinking water standards. Results of earlier sampling and analyses in the same wells indicated that lead was not present at levels above detection limits. Because the February 1988 samples were apparently analyzed by a different laboratory method, the results cannot be compared with those from earlier sampling and analyses. These disparate results should be resolved by additional sampling and analyses, using both analytic methods for comparison. Resolution of conflicts in the data will provide a better basis for evaluating potential exposure via ingestion of contaminated groundwater.

Although residential wells have been sampled and analyzed several times by EPA and OEPA, periodic monitoring of residential wells has yet to be established. Without periodic monitoring of these potentially affected wells, possible fluctuations in the contaminant concentrations cannot be adequately determined. Over the period of 1 year, contaminant concentrations could fluctuate from below detection limits to above levels likely to merit concern. For a better assessment of potential exposure from ingestion of contaminated groundwater, a program of periodic monitoring (with quarterly monitoring as the minimal acceptable period) is needed for potentially affected residential wells. Of special concern are those residences in the vicinity of IEL that do not have alternative water supplies.

d. Determination of Groundwater Flow: The estimated direction of contaminant flow in groundwater is not based on a comprehensive, periodic system of water level measurements but is estimated from a combination of drillers' logs of residential wells and measurements from monitoring wells. As indicated by the attached USGS report (Appendix C), groundwater may move from IEL in somewhat of a radial pattern. Contaminants may thus be moving toward nearby residential wells that are currently considered upgradient based on the limited data. Monthly measurements of the water level performed not only at current locations of monitoring wells but also at nearby residential wells would help determine whether the latter are potential receptors of contaminated groundwater. Information collected from installation and monitoring of piezometers would add greatly to the needed data base. The additional piezometer data provided would help determine the best location for and effectiveness of extraction wells proposed in the EPA Record of Decision for IEL.

e. South Off-Site Area: The extent of contaminant migration via surface soils, leachate, groundwater, and soil gas is not as well characterized in the RI report for properties adjacent to the southern side of IEL. An additional report on soil-gas concentrations in this area was provided to ATSDR in January 1989. However, information about other possible environmental pathways is still needed. Additional environmental characterization of this area would help evaluate possible concerns for the health of current or future populations that use the area for residential, commercial, or recreational purposes.

f. Metzger Ditch: The EPA proposed groundwater treatment system would discharge directly into Metzger Ditch. Nearby properties could be flooded with treated wastewater if the discharge rate exceeded the capacity of Metzger Ditch. Permanent stream monitoring stations (constructed with weirs for measuring discharge rate) located upstream and downstream of IEL, and at the discharge point would provide an estimate of appropriate discharge rate and consistent points for periodic monitoring of surface water and sediment. Permanent monitoring of Metzger Ditch is needed to assure proper remedial design and construction as well as provide an adequate data set to evaluate the potential for adverse health effects of effluent upon recreational users of Metzger Ditch.

g. Radioactive Waste: Citizens have reported observing trucks labeled with radioactive waste symbols entering IEL during active waste disposal operations. One on-site measurement of 516 picocuries of radon was reported, though considered by EPA to be indicative of background concentrations. However, additional sampling and analyses for radon and other radionuclides would provide a better data base for evaluating the potential for adverse health effects.

h. Non-Aqueous Phase Liquids (NAPLs): A potential for subsurface contamination from NAPLs may be deduced from reports of disposal of liquid wastes on-site. The EPA proposed pump and treatment system might intercept NAPLs, if present, during remedial operations. If the design and construction of the treatment system does not include provisions for NAPLs, the treatment plant may be disrupted and discharge of contaminants at concentrations above levels of health concern may result in dermal and incidental ingestion of contaminants by recreational users of Metzger Ditch.

Information gathering during the remedial design phase should incorporate monitoring for NAPLs.

i. Monitoring of MVS emissions and ambient air. Although limited monitoring of MVS emissions has been performed, frequent periodic or continuous monitoring has not been initiated. Fluctuations in the volume and chemistry of evacuated soil-gases may affect the efficiency of the flare and possibly result in release of unburned toxic gases. Frequent periodic monitoring or continuous monitoring would provide a data set to evaluate potential for inhalation of MVS emissions by nearby populations.

Permanent ambient air monitoring stations have not been constructed either on-site or on adjacent properties in the vicinity of potentially exposed populations. Proper construction of permanent monitoring stations (both on and off-site locations) with frequent periodic or continuous monitoring would provide a better data base to evaluate the potential for inhalation of air contaminants from IEL by nearby populations. Design should include sampling intakes to include breathing zones of children..

j. Biota: Information was not available on potentially contaminated consumable plants and animals. If contaminants have migrated off-site and onto garden plots (if any) on adjacent properties, contaminants could be ingested as a result of their accumulation in garden vegetables. Identification of these and other (as discussed below) potentially contaminated consumable plants and animals (if any) and potential human consumers would help evaluate potential exposure. A more comprehensive evaluation of off-site soil contamination (as previously discussed) could rule out potential exposure resulting from contaminated garden vegetables.

k. Data base: Continued environmental investigations and periodic monitoring are essential to determine if the intended remedy will effectively prevent migration of IEL contaminants and eliminate potential for human exposure. Investigation and environmental data may be collected by a different organizations over the life of the containment remedy. Without a common data base for storage, retrieval, and analysis of the collected data, critical data may be lost, and time critical health decisions and preventive measures may be delayed.

All data generated by environmental investigations and periodic monitoring should be available to all concerned organizations and individuals in an easily understood format. EPA has utilized a Geographic Information System (GIS) in other parts of the nation (notably the southeast, Region IV) to synthesize, analyze, and visually illustrate complex environmental data for long-term monitoring and decision-making purposes. Use of a GIS data base for IEL would provide a common data base for all interested parties to use in reviewing the remedial design and monitoring the implementation of the remedy. A GIS data base could also serve as a critical component of a site contingency plan for emergency evacuation of remedial workers, nearby residents and off-site workers.

2. Demographics and Land Use

The information from EPA and other sources is adequate for a general evaluation of potential exposures from this site.

3. Quality Assurance and Quality Control (QA/QC)

Contaminant concentrations cited in this Health Assessment were derived from information supplied by EPA. A majority of the samples were processed through the EPA National Contract Laboratory Program, which uses mandated QA/QC programs for review and reporting of data before use. Although no QA/QC documentation was specifically reviewed, the data provided are assumed for the purposes of this Health Assessment to be of acceptable quality. Because the conclusions presented in this Health Assessment are based on the information provided, the accuracy of these conclusions depends on the completeness and reliability of those data.

The TICs reported in some of the residential well samples presented the only appreciable QA/QC problem noted on review. The presence of the reported possible contaminants needs to be ruled out or confirmed before ATSDR can adequately evaluate this information for public health purposes.

B. ENVIRONMENTAL PATHWAYS

Sufficient information is available on five environmental media--air, soil, surface water, sediment, and groundwater--for a discussion of possible contaminant migration toward human exposure points. As indicated in the Data Needs and Evaluation Section, however, additional sampling, analytical data, and demographic information would allow a more definitive assessment. Information was not available on potentially contaminated consumable plants and animals.

1. Air

The RI report divides the air investigations into four areas: (1) the MVS, (2) the landfill gas (LFG) monitoring well system, (3) the soil-gas investigation, and (4) the in-home air sampling and analysis. The MVS investigation was limited to on-site gases, and the soil-gas investigation was directed at evaluating both on-site and off-site soil-gas concentrations with limited on-site ambient air monitoring. The investigation of the gas-monitoring well system was directed at contaminant migration at the landfill boundaries, whereas the in-home investigation provided an evaluation of potential off-site exposure points.

On-Site Soil Gas and Ambient Air

Gas samples were taken in the blower house at a point in the MVS close to the flare. Analytic results of these samples were used to develop a list of target compounds for the overall air investigation. An analysis of the MVS gases was assumed to yield the most comprehensive list of soil gases generated by IEL. Chemicals with concentrations less than 100 ppb were eliminated from the target compound list by remedial investigators. The 100 ppb limit was chosen on the assumption that lower concentrations would not result in appreciable off-site migration. A few chemicals, however, were placed on the target list even though their concentrations did not exceed the 100 ppb limit. These chemicals were 1,1-dichloroethylene, 1,1,1-trichloroethane, methylene chloride, and chlorobenzene.

Results of sampling and analysis of the ground-flare emissions in 1988 indicated destruction of methane and other gases with no detectable residual measurements of target compounds. According to the RI report, test results indicate that the ground flare is more effective than the previous candle-flare operation.

LFG Monitoring-Well System

The 15 gas-monitoring wells at IEL were installed in three sets between 1984 and 1986. In 1984, OEPA initiated and currently maintains a compliance-monitoring program at IEL, in cooperation with EPA. OEPA has used punch-hole sampling to augment sampling of LFG monitoring-wells (CDMFPC, 1988). As previously discussed in the Physical Hazards section of this report, punch-hole monitoring by OEPA in June and July of 1989 revealed methane gas migrating off-site in concentrations above the LEL . The results of the punch-hole soil gas sampling performed in June and July 1989 indicate a need to improve the LFG monitoring well system through either improved design and construction or more well locations, or both.

Soil-Gas Investigation

An extensive on-site and near-site soil-gas investigation was performed in February 1988. An on-site sample grid was used to locate points for punch-probe sampling and was extended to near-site locations. Some results of on-site sampling indicate methane concentrations at or above the LEL. Other gases were also measured by field instruments and in air-bag samples.

In the RI report, investigators concluded that although substantial quantities of gases were being produced in the central portion of the landfill and emitted into the atmosphere, results of ambient monitoring in the breathing zone (an estimated 5 feet above ground surface) did not reveal appreciable levels of these gases. These results appear to confirm the results of the 1985 ambient-air investigation by the EPA Region V Environmental Response Team (ERT) that revealed low concentrations of organic contaminants (less than 6 ppb, the maximum for xylenes), with the majority of detected contaminants at concentrations less than 0.8 ppb. However, permanent air monitoring stations with daily or continuous monitoring would provide a better indication of contaminant concentrations in ambient air during a variety of climatic conditions.

Results of the on-site soil-gas investigation revealed high concentrations of a few gases at sample points near the north and south landfill boundaries. At the north boundary, benzene was reported at concentrations of 1,450 ppb and 2,430 ppb for sample points NE11 and NE13, respectively. Also at sample point NE13, toluene was measured at a level of 247 ppb. At the northeast corner of IEL, six contaminants were measured at sample point NE23: 1,1,1-trichloroethane at 205 ppb, benzene at 1,400 ppb, toluene at 1,600 ppb, two-carbon-alkyl-aromatic compounds at a total level of 11,150 ppb, ethylbenzene at 4,100 ppb, and m-xylene at 5,650 ppb.

An additional soil-gas investigation was performed in April 1988 by EPA's ERT to extend the area sampled. The results revealed soil-gas contaminants along the south boundary. Vinyl chloride was measured by a photovac gas chromatograph/photoionization detector at concentrations of 110-160 ppb at four sample points in the central portion of the south boundary. At sample point L-04, analysis of tedlar-bag samples revealed benzene at 460 ppb and toluene at 190 ppb, and results of the field instrument measurements showed vinyl chloride at 130 ppb (EPA, Environmental Response Team, unpublished communication, December 23, 1988.)

The results of the 1988 soil-gas investigations tend to support previous investigations and conclusions of OEPA. OEPA noted elevated methane concentrations in the north and south boundary areas in the results of the 1986 OEPA soil-gas investigation. They concluded that residences on Amber Ridge Drive, north of IEL, were not at risk from off-site methane migration (OEPA, unpublished communication, August 11, 1987).

When LFG-monitoring-well samples were analyzed, they did not show the same high concentrations found when field instruments were used. However, the LFG monitoring wells may not be intercepting the paths of maximal soil-gas migration. The high concentrations of soil-gas contaminants measured at the north boundary of IEL indicate a possibility of off-site migration of soil-gas contaminants by undetected flow paths into areas outside the monitoring zones of LFG monitoring wells . The relatively deep surface depression at the north boundary may prevent migration toward residences, but no field measurements are available to rule out this possibility.

The 1988 soil-gas investigations followed a detailed sampling pattern on the east side of Cleveland Avenue. The analytic results from this north-south line of samples revealed only benzene at one ppm near the tire shop. The results reveal no evidence of appreciable soil-gas migration at that time along the east side of Cleveland Avenue. Therefore, on the basis of this information, soil-gas contaminants at or near levels likely to be of human health concern were not migrating further west than the east side of Cleveland Avenue during the sampling period..

As previously discussed, soil-gas investigations in June and July 1989 revealed off-site migration of methane gas along the western boundary of IEL. Apparently methane was the only contaminant tested for with field instruments. Therefore, off-site migration of other soil-gas contaminants may have occurred during the same incident but was not detected. The incident in June and July of 1989 demonstrates a potential for future off-site migration of soil-gas contaminants toward and possibly into adjacent homes and buildings during operation of current MVS.

The majority of adjacent residences and businesses were included within a area outlined by EPA consultants (CDMPFC, 1988-Appendix O) as the potential area affected in the MVS failed for prolonged period of time (number of hours or days not specified). This "worst-case" evaluation was based on professional judgement and not detailed calculations and empirical measurements of pressures, gas volumes, soil permeabilities or gas velocities. Such calculations and empirical data would provide a better basis to predict a "worst-case" threat to nearby residents and workers.

Residential Air

Residential air sampling and analyses were performed three times during the RI. In January 1986, 13 houses were sampled; and, in September 1986, 8 houses were sampled. The results were considered inconclusive. Therefore, in February 1988, EPA performed additional air investigations in 8 occupied houses, two unoccupied houses, and three control houses. Results of air sampling and analyses of nearby residences did not reveal any appreciable concentrations of gases readily attributable to IEL. Results obtained for indoor residential air with field instruments indicate that the detected contaminants resulted from household sources.

However, the off-site excursion of methane in June and July of 1989 indicates that fluctuations in methane concentrations may occur in response to climatic events or seasonal changes. Concentration fluctuations and migration of other soil-gases may also be occurring but remain undetected by the limited monitoring performed to date. Therefore, the potential for soil-gas migration into nearby homes or structures should not be eliminated from consideration based upon the three indoor air sampling investigations previously performed.

2. Soil

Results of the RI soil investigations indicate that surface (undefined depth) soils and subsurface soils are contaminated with a variety of metals and organic chemicals. During the RI, samples for on-site and near-site surface and subsurface soil were taken from locations which encircled the site; however, only a limited number of soil samples were taken at or near the center of the landfill.

In 1980, the surface of IEL was graded, covered, and seeded. On-site contaminated surface soils have apparently been isolated from possible wind and water erosion, thereby eliminating the concern for migration of soil contaminants off-site for the majority of the site area. However, a ATSDR scientist observed some patches of bare soil and rubbish along the southwestern boundary of IEL. Therefore a potential exists for erosion and off-site migration of contaminated soil from the bare areas along the southwestern portion of IEL.

As previously indicated, investigation of near-site subsurface soil revealed that waste had been disposed of outside the fenced boundaries at the tire shop. No other near-site or off-site area of heavily contaminated soils was discovered.

Information in the RI does not indicate whether the surface soil was investigated in the yards and properties of all adjacent residences and businesses. Therefore, no conclusive information is available to determine whether soil contaminants are present on adjacent properties other than the tire shop. However, as previously discussed, surface soils in adjacent properties could have become contaminated as the result of contaminants migrating off-site during past disposal operations. Only additional sampling and analyses of surface soils of adjacent properties can confirm or rule out off-site surface soil contamination.

3. Surface Water and Leachate

Metzger Ditch is the predominant body of surface water in the vicinity of IEL. This drainage ditch is apparently an artificial drainage channel that was dredged at least as recently as 1976. The channel is reported to be ten feet deep in the vicinity of IEL. It has a circuitous flow pattern south from IEL, but turns west at approximately 2 miles and then north, eventually flowing into the Tuscarawas River, approximately 4 miles northwest of IEL. According to citizens' comments received by ATSDR during the public comment period, Metzger Ditch is used by local children for recreational activities such as fishing and swimming. The ditch may also be used for watering livestock by a cattle or dairy operation located approximately 1 mile south of IEL.

Four small ponds of water are located on-site at IEL, adjacent to Metzger Ditch. Samples of surface water were taken from the on-site ponds, Metzger Ditch, and six off-site ponds. Only three organic chemicals (4-methylphenol at 4.9 ppb, benzoic acid at 27 ppb, and bis [2-ethylhexyl] phthalate at 4 ppb) were detected in these samples. Several inorganic chemicals were measured at greater than background levels (e.g., arsenic, barium, cadmium, and lead.) In general, the samples from on-site ponds contained higher concentrations than those from the Metzger Ditch. The highest lead concentration (68 ppb), however, was found in an off-site pond located west of IEL, across Cleveland Avenue.

Two on-site leachate seeps were also sampled. Analysis of these leachate samples revealed more organic chemicals (10 chemicals) and higher concentrations of some inorganic chemicals than were found in surface-water samples. Lead and cadmium, however, were at lower concentrations than the maximum surface-water concentrations.

4. Sediment

Sampling and analysis of sediments from the four on-site surface ponds and adjacent Metzger Ditch revealed the same variety of chemicals found in the soil investigation. Spoil piles from the 1976 dredging of Metzger Ditch were also investigated.

Analysis of the on-site or near-site samples consistently revealed contamination with phthalates and toluene. Metals levels, although greater than background, were not as high as might be expected from a review of soil and groundwater contamination. Pesticides (4,4-DDE and 4,4-DDT) were detected in at least four of the 19 samples, and these were assumed in the RI to come from nearby farms.

Sampling of downgradient sediment indicated fewer contaminants at much lower concentrations. From these downgradient results, contaminated sediments do not appear to have migrated in large quantities beyond the immediate vicinity of IEL.

5. Groundwater

The following discussion of the groundwater pathway is based upon EPA investigations and an independent USGS evaluation of the local and regional hydrogeology. This discussion does not duplicate the detailed analysis incorporated in the USGS evaluation. For a detailed analysis of the local and regional hydrogeology, please review the USGS report in Appendix C.

Groundwater flows through two hydrogeologic systems beneath the IEL site. The upper hydrogeologic system is composed of glacially deposited sands and gravels ranging in thickness from 50 to 100 feet. Groundwater flow in the glacial aquifer system is under water-table conditions with generally rapid, vertical infiltration from the surface. Groundwater flow is influenced by the general topography and the orientation of buried, ancient glacial valleys and channels.

Beneath the glacial aquifer is the bedrock aquifer system. The bedrock aquifer system is composed of sandstone, siltstone, shale, coal, and limestone beds of the Pottsville Formation lies . Groundwater flow is assumed to be generally within fractures and bedding planes under semiconfined conditions though drilling information from the RI was inadequate to determine whether fractures or bedding planes were present.

The two hydrogeologic systems at the IEL site are assumed to be hydraulically interconnected, but no definitive aquifer-pumping tests have been performed to verify this assumption. Regional groundwater flow in the glacial aquifer appears to be west from IEL. The USGS evaluation indicates, however, that a groundwater ridge underlies the site and results in a more radial pattern of groundwater flow from IEL.

Both aquifer systems are used for supplies of domestic and municipal drinking water. Residences and businesses in the immediate vicinity of IEL have always used private wells for drinking water and household uses. The nearest municipal wells are the Village of Lakemore wells, located approximately 3 miles northwest of IEL, which are completed in the bedrock aquifer system.

Sampling and analysis by both OEPA and EPA have confirmed the finding of contamination in residential wells in the immediate vicinity of IEL. Results from EPA monitoring wells have indicated that groundwater in the glacial aquifer beneath the site is heavily contaminated with a variety of metals and organic chemicals. Results from bedrock monitoring wells have not indicated on-site contamination of the bedrock aquifer system.

Analytic results from one sample of a residential well screened in the bedrock aquifer indicate a high level of lead (239 ppb). This well is located northwest of IEL, across Cleveland Avenue. A nearby residential well screened in the glacial aquifer is contaminated with vinyl chloride (2 ppb), chloroethane (1 ppb), lead (18 ppb), and with high levels of iron (5,110 ppb) and magnesium (46,900 ppb).

On the northeast side of Cleveland Avenue, adjacent to IEL, residential wells drawing water from the glacial aquifer are contaminated with lead (78 ppb), vinyl chloride (7 ppb), and chloroethane (2 ppb). A residential well adjacent to the southwest portion of IEL, along Cleveland Avenue, was contaminated with barium (1,140 ppb) and lead (22 ppb). In general, metals levels were high in all wells located on Cleveland Avenue adjacent to IEL. The analyses of samples from these wells revealed numerous tentatively identified compounds.

The RI report depicts a two-pronged plume of groundwater contaminants, extending from IEL with a northwest component and a generally westward component. Depiction of the plume is only an approximation, however, based on the results from residential and monitoring wells. Not all residential wells within the approximate boundaries of the plume are contaminated at or above levels that are likely to result in adverse human health effects. Furthermore, no residential wells lying outside the approximate boundaries should be considered safe from the threat of contamination unless information collected in addition to the RI data (e.g., OEPA investigation results) verifies the absence of contamination. Continued monitoring of residential wells just outside the approximate boundary of the plume is needed to rule out completely the presence of site contaminants.

6. Biota

Information on potentially contaminated consumable plants and animals was not available for this report. The highest concentrations of toxicants detected in near-site ponds and sediments were located at the base of the landfill slope at the east site boundary. The small size of these potential entry points for contaminants into food chains by plant or aquatic biota uptake would seem to decrease the likelihood of resultant adverse human health effects. Information on off-site surface soil contamination is too limited to rule out potential human health concerns because of contamination of garden plots and subsequent ingestion of contaminated vegetables. Present or future use of contaminated surface water, groundwater, soil, or sediment for gardening or farming could result in contamination of consumable plants.

7. Environmental Pathways Summary

Contaminants from IEL are migrating or have a potential to migrate via air, soil-gas, soil (via wind or water erosion), surface water, sediment and groundwater toward nearby human populations. Currently the off-site migration of contaminants via soil erosion has been reduced by establishment of a soil cover and sparse vegetation. However, visual observations indicate a potential for renewed soil erosion and contaminant migration. Off-site soil-gas migration has been reduced by continuing operation of MVS. However, significant concentrations of soil-gas may be migrating off-site continually or periodically but not detected by present monitoring system.

The EPA decision to cap the landfill should eliminate the potential for contaminant migration via soil erosion and migration of contaminants via leachate discharge to Metzger Ditch. The cap should also prevent vertical migration of soil-gases into on-site ambient air. However, the soil-gases will have a greater tendency to migrate laterally when the vertical pathway is blocked.

An improved MVS with an improved gas monitoring program could intercept all significant quantities of migrating soil-gas. However, combination of technical failure and human errors could allow significant quantities of soil-gas to migrate into homes and buildings adjacent to IEL.

Migration of groundwater contaminants could be greatly reduced by the EPA decision to pump and treat. However, contaminants will continue to migrate into nearby residential wells until an effective groundwater containment system is fully functional which could take from 2 to 5 years.

C. EXPOSURE PATHWAYS

As indicated previously, a variety of contaminants have been identified in several different environmental media at the IEL site. Based on currently available site information and current medical and toxicologic knowledge, the human exposure pathways likely to be important now or in the future, at this site, include:

1. Accumulation of Explosive Concentrations of Methane Gas in Structures Bordering IEL

2. Inhalation Exposure to Migrating Soil Gases and to VOCs Released from Contaminated Groundwater during Household Uses

3. Ingestion, Dermal Contact, and Inhalation of Contaminants in Off-site soils, sediments, and surface water

4. Ingestion, Dermal Contact, and Inhalation of Contaminants Released From On-Site Areas During Remedial Activities and Trespass Events

Proper maintenance and monitoring of the current residential air strippers will reduce concern for inhalation exposure to organic compounds volatilized from contaminated groundwater during household uses. However, they do not eliminate all potential concerns for this exposure pathway.

PUBLIC HEALTH IMPLICATIONS

A. SAFETY CONCERNS

1. Accumulation of Explosive Concentrations of Methane Gas in Structures Bordering IEL.

ATSDR believes that potentially explosive levels of methane have migrated in the past and could again migrate into structures immediately bordering the IEL site. These concerns have been addressed in a recent letter to EPA Region V (see Appendix A) and will not be discussed further in this section of the Health Assessment.

B. HEALTH CONCERNS

As indicated in the preceding Human Exposure Pathways Section, the potential exists for exposure of area residents and on-site remedial workers to site-related contaminants in a variety of environmental media. The public health implications of IEL are discussed below according to these potential human exposure pathways.

1. Ingestion Exposure to Contaminants in Groundwater by Users of Residential Wells.

Analytic results of samples of residential well water in the vicinity of IEL showed elevated concentrations of lead, barium, selenium, and vinyl chloride in some wells at concentrations above relevant EPA Maximum Contaminant Level (MCLs). The analyses also indicated the presence of TICs in low (<5 ppb) concentrations (CDMFPC, 1988).

Short-term (less than a year) and long-term (a year or more) ingestion exposure to groundwater containing contaminants at the maximum levels detected at IEL could pose increased health risks, particularly to a developing fetus and young child, as well as an increased carcinogenic risk to exposed populations. To err conservatively in protecting human health, ATSDR must assume that ingestion of residential well water with elevated levels of these contaminants is ongoing, until such time that alternate water supplies are provided or available data indicate otherwise.

If ingestion exposure to levels of lead above 50 ug/L (ppb) in residential water is ongoing, ATSDR considers such exposures to be an urgent human health concern. Results of continuing investigations have shown adverse human health effects at lower and lower whole blood levels of lead (now 10-15 ug of lead per deciliter of whole blood), with the developing fetus and young children being particularly sensitive (ATSDR, 1988b,c). It has been demonstrated in these sensitive populations, that recurrent, low-level exposure to environmental levels of lead could result in elevated body burdens of the metal--leading to neurologic effects (e.g., aggressive behavior, permanent learning disability, defects in cognitive ability, and defects in intelligence quotient), altered heme synthesis, decreased red-blood-cell enzyme activities, reductions in gestational duration and birth weight resulting from prenatal exposure, and high blood pressure. Many factors--including nutrition, health status, and actual exposure conditions--will determine, what, if any, health effects may result. Persons with renal or hepatic disorders may also be more susceptible to the adverse effects of lead than the general population (ATSDR, 1988c). Because there is accumulating evidence that toxic effects of lead may occur at levels below current EPA drinking water standards, EPA has recently proposed regulations to lower the MCL for municipal drinking water supplies to 5 ug/L (EPA, 1988).

Although the maximum level of barium (1,370 ug/L)) detected in samples of some residential well water exceeds EPA's MCL of 1,000 ug/L (ppb), this level, if present, is not likely to pose a significant human health concern at this site. Studies in laboratory animal and epidemiologic studies in humans indicate that barium has a low degree of toxicity when ingested in drinking water at concentrations well above the extant EPA MCL. For example, the Safe Drinking Water Committee of the National Academy of Sciences suggested that concentrations as high as 4,700 ug/L in drinking water would still provide an adequate margin of safety for humans chronically exposed to barium (Drinking Water and Health, 1982).

Selenium is considered an essential nutrient; a recommended daily intake from the diet of 55-70 ug/day for North American females and males, respectively, has been proposed (Levander, 1987). Various estimates of the average intake of selenium from food for the U.S. population range from 50-200 ug of selenium per person per day (ATSDR, 1988d).

Although the maximum level of selenium (20 ug/L; ppb) detected in some samples of residential well water exceeds the EPA MCL of 10 ug/L (ppb), this level would not be expected to cause health problems in the healthy, nonpregnant adult. Ingestion of such contaminated groundwater would add an additional 40 ug per day (assuming ingestion of 2 L of drinking water per day) to that ingested in the normal diet. Dr. Mathew Longnecker noted in a recent article (Longnecker, 1989) that the National Academy of Sciences recommends the ingestion of 200 ug of selenium per day as a safe intake. However, experts disagree since it appears that most healthy, nonpregnant adults with intakes ranging from 200-750 ug of selenium per day are unlikely to suffer any adverse health effects (ATSDR, 1988d; Longnecker, 1989). At some undefined level above this exposure range, selenium can cause toxicity. A study of populations in China living in areas with extremely high selenium levels in the vegetables and rice they consumed has provided some of the only data available about chronic human exposures to elevated levels of selenium. These people experienced loss of hair, loss and deformities of nails, and neurological problems manifested as problems with walking, diminished reflexes, and some paralysis when exposed to high levels of selenium in their food (ATSDR, 1988d); average daily intakes were estimated to be between 3,200-6,700 ug of selenium per day. Evidence of selenium toxicity was not observed in another area with high levels of selenium where average daily intakes averaged 750 ug of selenium per day (ATSDR, 1988d). However, there appears to be a fairly narrow range between the recommended nutritional requirements (55 -70 ug/day) and potential toxicity (210 ug/day for a 70 kg man) as defined by the EPA's Allowable Chronic Intake (AIC) of 0.003 mg/kg/day (ATSDR, 1988d).

The presence in residential well water of vinyl chloride, a known human carcinogen, and several TICs which are potential human carcinogens (based on animal studies), raises a concern about the long-term ingestion of water contaminated with these substances. Since limited information is available for many of the TICs, they will not be discussed further, except to indicate the need for continued monitoring and analysis for these chemicals.

Vinyl chloride is rapidly absorbed after ingestion and inhalation exposures (ATSDR, 1988e). Evidence establishing the human carcinogenicity of vinyl chloride is based on occupational studies involving inhalation exposures, but results of animal studies using oral routes of exposure suggest that vinyl chloride could be a human carcinogen by the oral route (ATSDR, 1988e). Ingestion exposure to vinyl chloride at the levels detected in the well water of the three residences for which alternative water supplies were recommended could present an increased risk of cancers of several types. Results of animal studies suggest that the developing fetus and newborns may be especially sensitive to the carcinogenic effects of vinyl chloride (ATSDR, 1988e). Noncarcinogenic effects of vinyl chloride include effects on the blood (increased numbers of abnormal blood lymphocytes), fetal loss, birth defects, abnormalities of liver function and structure, and neurologic abnormalities. Reproductive-age women, newborns, alcohol consumers, and persons with preexisting liver, kidney, cardiovascular, neurologic, and pulmonary diseases could be at increased risk of adverse health effects from exposure to vinyl chloride. Some of these effects have been associated with chronic occupational exposures (ATSDR, 1988e).

The air strippers installed to remove vinyl chloride from the water of the three houses in which unacceptably elevated levels were present should remove concern for chronic ingestion exposure to vinyl chloride and other carcinogenic VOCs (benzene, TCE, and PCE) that may migrate from the site into residential drinking water. However, the strippers will not remove lead, which represents both a short- and a long-term health concern. Alternate water supplies will alleviate the concern for both short- and long-term health concerns.

2. Inhalation Exposure to Migrating Soil Gases and to VOCs Released From Contaminated Groundwater During Household Uses

Chronic or recurrent inhalation exposure to a number of the soil gas contaminants detected at the boundaries of IEL or at the methane vent could increase the risk of adverse human health effects (CDMFPC, 1988). The elevated levels of the human carcinogens benzene and vinyl chloride and of other toxic VOCs (e.g., TCE, PCE, and methylene chloride), and one or more of the TICs (e.g., dimethylformamide) in various aqueous media (groundwater and leachate), soil gases, and on-site soils indicate that future contamination of groundwater and soil gases is possible and that contaminants could migrate off-site toward nearby residences and businesses. Furthermore, there is a concern that NAPLs, which are suspected of being present at the site, could also contribute to the contamination of groundwater and soil gases. The proposed RCRA cap is expected to increase the lateral migration of soil gases toward adjacent areas. Thus, the MVS and the air strippers must be properly operated and maintained to mitigate concerns for chronic inhalation exposure to soil gases and VOC contaminants migrating with the groundwater. To date, no evidence indicates that toxic levels of VOCs are migrating to residences via soil gases. Ongoing monitoring (at a minimum quarterly) will help to assure the continued protection of any persons living and working on properties near IEL.

Other substances present in soil gases and groundwater can produce a variety of noncarcinogenic effects; but these effects generally occur only at concentrations much greater than those detected at IEL. However, vinyl chloride and benzene are known human carcinogens (ATSDR 1988e; 1989a), and a number of other VOCs (e.g., PCE, TCE, and methylene chloride) are considered possible or probable human carcinogens on the basis of animal studies (ATSDR 1987; 1988f; 1989b). The health concerns of vinyl chloride have already been discussed.

Chronic or recurrent occupational exposures to high concentrations in air (>100 ppm) of benzene have been associated with the development of blood dyscrasias and leukemia (ATSDR, 1989a). Moreover, some evidence exists that exposures as low as 2 ppm may also have contributed to the development of blood dyscrasias (ATSDR, 1989a). The National Institute for Occupational Safety and Health (NIOSH) has recommended that workers not be exposed to air concentrations exceeding 0.1 ppm (100 ppb) (time-weighted average based on 10-hour workday) during any 10-hour workday (ATSDR, 1989a). Chronic inhalation exposure to benzene at the maximum levels detected in soil gas from IEL (6.7 ppm) could increase the risk of developing blood dyscrasias, aplastic anemia, or leukemia (in particular, acute myelogenous leukemia), probably as a result of direct bone-marrow damage. Mixed-function oxidases in the liver produce the reactivc metabolites that are probably responsible for benzene toxicity. Therefore, substances that increase mixed-function oxidase activity (such as alcohol or some sedative-hypnotic drugs) may increase the toxicity of benzene. Conversely, substances that decrease mixed-function oxidase activity (like toluene) may decrease the toxicity of benzene (ATSDR, 1989a). In addition, concurrent exposure to other VOCs such as methylene chloride could increase the carcinogenic risk of vinyl chloride or benzene exposure through additive or even synergistic actions.

Finally, some data indicate that phosgene, a potent respiratory irritant, and radon gas, a lung carcinogen, are present in IEL soil gases. Phosgene was detected in vent gases at 12 ppb but not above 100 ppb; radon was detected at a reported concentration of 516 picocuries per liter of vent gas. No additional data are available to confirm the presence or absence of these contaminants.

Phosgene may be formed under circumstances where intense heat or fire causes decomposition of solvents or paint strippers that contain halogenated solvents such as methylene chloride and trichloroethylene (NLM, 1989). Concentrations of phosgene gas as low as 3,000-4,800 ppb have been claimed to be capable of causing, in exposed humans, immediate irritation of the eyes and coughing; acute exposures to 50,000 ppb can be rapidly fatal (NIOSH/OSHA, 1978). Results of animal studies suggest that brief exposures (4 hours) to concentrations as low as 200 ppb can produce pulmonary edema (Hatch et al., 1986). NIOSH (1976) has proposed that no worker be exposed to phosgene at concentrations greater than 0.1 ppm (100 ppb) as a time-weighted average for a 10-hour workday and a 40-hour workweek, or to peak concentrations greater than 200 ppb for any 15-minute period. There are no data on the effects of recurrent or chronic exposure to concentrations below 100 ppb.

The levels of radon detected at IEL (reported as 516 picocuries/L) appear to represent a considerable hazard when one compares the reported level to the radon concentration (greater than 4 picocuries of radon per liter of air) that EPA considers a significant health concern for indoor radon exposure. In EPA's laboratory report, it was not clearly explained why the detected concentration did not represent a potential health concern (unpublished memorandum to Julie Matheisen, USEPA, December 23, 1988). Moreover, in a report to the CCLT, it was noted that the proposed method of flaring-off landfill gases would not destroy radon and suggested that maximum concentrations of radon (or other pollutants escaping the flare) would occur 200 meters downwind of the stack. The 200-meter radius could encompass residential areas. Thus, additional sampling of landfill gases is needed to determine if phosgene and radon are present and at what concentrations.

3. Ingestion, Inhalation, and Dermal Exposures to Contaminants in Off-Site Soils, Sediments, and Surface Water.

The surface of IEL has been covered, graded, and seeded. Most of the surface is covered with grass although there are patches of exposed soil, some standing water, and evidence of leachate seeps near Metzger Ditch and near the western boundary close to the fence. Although off-site dispersions of contaminated soils via surface-water runoff and by windblown dusts are not currently a problem, contaminants may have been dispersed of off-site during the active operational period of the landfill.

Elevated levels of several toxic metals and organic chemicals have been detected in near-site soils and sediments. Children's recreational activities could bring them in contact with contaminants in these media. Inhalation and subsequent ingestion of contaminants in entrained dusts and dermal contact with contaminants in several media are possible. Some children may purposefully ingest considerable quantities of dirt. Exposures to airborne dusts containing arsenic and chromium can cause mucous membrane irritations of the eyes, nose, and throat and can cause dermatitis (allergic as well as irritant dermatitis in the case of repeated exposures to chromium). Of particular concern would be the short-term but recurrent ingestion and inhalation exposures of sufficient amounts of lead-contaminated soil by young children which could increase the risk of adverse neurological health effects previously discussed. The Centers for Disease Control has cautioned that exposure to concentrations of lead in residential soil or dust greater than 500 to 1,000 ug per gram (ug/g; ppm) could lead to elevated blood lead levels in children inhaling and/or swallowing the dirt (ATSDR, 1988c). No near-site location has been shown to have these concentrations. However, extensive testing of near-site soils in areas adjacent to the site has not been done. Moreover, because there appears to be no threshold below which lead will not induce toxicity in susceptible populations, that is, the developing fetus and young children (ATSDR, 1988b,c), ATSDR considers this pathway plausible and thus a public health concern for children until data are available to indicate otherwise.

4. Ingestion, Inhalation, and Dermal Exposures to Contaminants Released From On-Site Areas During Remedial Activities and Trespass Events.

The disruption of contaminated surface and subsurface soils and the boring of wells into the landfill during remedial activities could increase the likelihood of contaminants being volatilized or reentrained in dust. Unless precautions are taken, persons residing, working, or playing in areas adjacent to the site could, in addition to on-site remedial workers, be exposed to site contaminants during these activities. The remedial activities could also increase the risk of exposures to toxic substances in the landfill, many of which may not yet have been identified. The release and subsequent ignition or explosion of uncaptured methane gas should also be contemplated, and steps to prevent this should be incorporated into safety plans for site cleanup. The presence of edible berries on-site may entice children or other trespassers to enter the site. Because of the potential for these berries to contain elevated levels of toxic substances (e.g., cadmium) and because of the other potential hazards (including explosions), access to the site should be restricted as soon as possible.

CONCLUSIONS AND RECOMMENDATIONS

Based on information reviewed, ATSDR concludes that:

1. If additional corrective actions are not implemented, a significant risk to human health exists for persons living or working in structures on some of the properties immediately adjacent to (abutting) the Industrial Excess Landfill Site because of the potential for off-site migration of methane and other toxic gases.

The residences and businesses of concern relative to this conclusion include one commercial operation and one home on properties abutting the southern boundary of the site, all homes and other structures on properties abutting the western boundary of the site, and all homes and other structures on properties abutting the northern boundary of the site along what is now known as Hilltop Avenue.

2. The Industrial Excess Landfill site represents a public health concern because of possible exposures to hazardous substances at concentrations that unacceptably increase the risk of adverse health effects following both short- and long-term exposures. In particular, if ingestion of residential well water with levels of lead above the EPA MCL of 50 ppb is ongoing, it is of urgent human health concern and should be stopped as soon as possible.

Potential exposures to elevated levels of other contaminants at or around IEL that could result in an increased risk of adverse human health effects represent a potential public health concern and include the (1) chronic ingestion of contaminated groundwater containing selenium, vinyl chloride, and several potentially carcinogenic TICs; (2) chronic inhalation exposure to elevated levels of the human carcinogens, benzene and vinyl chloride, which could enter residences as a result of volatilization from contaminated groundwater during household uses or through contaminated soil gases migrating from IEL; (3) ingestion, dermal, and inhalation exposures to contaminants in various off-site media; and (4) ingestion, dermal, and inhalation exposure to contaminants released during remedial activities and trespass events. During remedial and cleanup operations, contaminants also could migrate via windblown dusts or gases to off-site adjacent areas. The populations with the highest possibility of exposure to contaminants from IEL are those persons living or working in residences or buildings adjacent to IEL and those persons using contaminated groundwater for domestic water supplies.

Provision of alternative water supplies for all uses to residents with contaminated wells should prevent future exposures to contaminants in residential well water. However, alternative water supplies have not been provided to the affected households as of July, 1989. If properly constructed and maintained, the proposed RCRA cap should prevent, or at least minimize, future migration of contaminated soil and leachate. However, available information is too limited to eliminate concern for exposure to contaminated off-site soils.

ATSDR recommends:

1. The EPA should take the following actions <u>immediately</u> to eliminate or substantially mitigate the significant health risk from off-site migration of methane and toxic gases identified above:

SHORT-TERM In the short-term, the recommendation to substantially mitigate the significant health risk may be addressed through options such as:

OPTION #1: Implementation of an appropriate combination of (A) engineering and construction improvements and enhancements of the existing methane venting system; (B) expanded environmental monitoring, including the installation of operational detectors and alarms in the affected buildings (note: current alarms in the houses go off, even in the absence of methane); and (C) a public awareness effort coupled with an effective evacuation contingency plan.

OPTION #2: Relocation of persons living or working in the structures discussed above.

LONG-TERM In the long-term, or whenever on-site activities occur that could adversely impact the effectiveness of the methane venting system, the ATSDR recommendation to substantially mitigate the significant health risk can be addressed by the relocation of those persons living or working in homes or other buildings on properties abutting the southern, western, and (a portion of the) northern boundaries of the IEL site. Such a relocation would, at a minimum, remain in effect until the site conditions were again judged to be "stable" and the gas venting system was determined to be fully operational and effective in preventing the off-site migration of methane and other toxic gases.

2. Interim protective measures (bottled water, individual treatment systems) should be implemented immediately for residences with wells contaminated at levels likely to be of public health concern.

3. Additional characterization of off-site surface soil (top 3 inches) on property adjacent to IEL should be carried out because the extent of contamination for this possible source of human exposure is unknown.

4. Contradictory data for nearby residential wells should be resolved with additional sampling and analyses. Analytic methods used in February 1988 and those used in the earlier analysis should both be employed to compare.

5. Because over the period of a year contaminant concentrations may fluctuate from below detection limits to levels likely to pose a human health threat, a periodic monitoring program (with at least quarterly monitoring) should be established for potentially affected residential wells. Residences in the vicinity of IEL that do not have alternative water supplies should be targeted.

6. Long-term groundwater monitoring (at least quarterly) should be established to detect any renewed migration of site contaminants in groundwater if site conditions change or if a breakdown in the groundwater-recovery system occurs. Further Health Assessment evaluation should be performed if information becomes available indicating renewed migration of site contaminants.

7. Because information from the borehole samples of the present bedrock monitoring wells is inadequate to determine fracture orientation and bedrock flow zones, drilling techniques that emphasize better recovery of geologic core samples should be used in construction of the needed additional monitoring wells and piezometers for the bedrock aquifer. The additional information would improve the evaluation of potential migration of contaminants into residential wells drawing water from the bedrock aquifer. The periodic monitoring of the additional monitoring wells and piezometers would also improve the evaluation of the influence of the groundwater recovery wells upon the bedrock aquifer.

8. Monthly monitoring should be performed for those residential wells contaminated with vinyl chloride that have air strippers installed. This monitoring should verify the ongoing effectiveness of the air strippers in removing vinyl chloride. If data become available indicating that humans are being exposed to vinyl chloride at levels likely to be of health concern, additional Health Assessment evaluation should be performed at that time.

All in-home air strippers should be constructed with vent stacks above the roof of the homes to reduce the possibility of air contaminants in the breathing zone. In-home air strippers should have monthly operational and maintenance checks by skilled technicians.

9. Monthly measurements of water levels should be performed not only at current monitoring-well locations but also at nearby residential wells to help determine if those wells are potential receptors of contaminated groundwater. These measurements are needed because groundwater may move in a somewhat radial pattern from IEL, and contaminants may be moving toward nearby residential wells that are currently considered upgradient because of limited data. If piezometers are installed and monitored, the information collected would also add substantially to the needed data base. Piezometer data will also help determine the best location for and effectiveness of groundwater extraction wells.

10. Additional characterization of surface soils, leachate, groundwater, and soil gas on properties adjacent to the southern side of IEL would better define the extent of contaminant migration in this area.

11. Additional soil-gas monitoring of near-site areas using field instruments would help verify the LFG results or locate unknown subsurface migration routes, particularly in adjacent residential areas. As discussed previously, phosgene should be included in any future soil-gas monitoring.

12. Periodic monitoring should be performed to verify the ongoing effectiveness of the MVS in preventing, or at least minimizing, soil-gas migration. If information becomes available indicating that off-site soil-gas migration is occurring, additional Health Assessment evaluation should be performed at that time.

13. Consumable animals and plants that may be contaminated should be identified by reviewing local animal and plant habitats and nearby agricultural activities. If such species are identified, a survey to determine the amount of local consumption and the extent of non local marketing for consumption of these animals and plants would help define the likelihood of human health effects resulting from contaminated, consumable biota. This information would provide a sound basis for deciding whether sampling and analysis of local animal and plant species are indicated for the IEL site.

14. Preventive measures and adequate environmental monitoring should be implemented during and after site remediation to protect the health and safety of people residing or working adjacent to IEL. Site-safety plans should include provisions for evacuation of people living or working near IEL, if a release of site contaminants at levels likely to be of human health concern is detected by monitoring or if such a release results from remedial activities.

15. Remedial workers should adhere to all applicable guidelines, regulations, and advisories of the National Institute for Occupational Safety and Health and the Occupational Safety and Health Administration. Optimal dust-control measures should be implemented, and appropriate real-time monitoring should be conducted at the worksite periphery during working hours to help protect nearby residents.

16. Access to IEL should be restricted on all sides of the site by using such methods as 8-foot-high chain-link fencing. Access to the portion of Metzger Ditch that borders IEL should also be restricted by a similar means.

17. Additional sampling and analysis of the MVS emissions and groundwater should be performed for radon and other radionuclides to determine if a health hazard exists from possible exposure to these contaminants from alleged disposal of radioactive waste at IEL.

18. Environmental monitoring plans for the remedial design should include assessment of the presence of non-aqueous phase liquids (NAPLs). Monitoring should be designed for NAPLs lighter than water that tend to be found at the top of the saturated zone and for NAPLs denser than water that tend to sink. If the presence of NAPLs is confirmed or cannot be eliminated, then the remedial design and construction of the groundwater treatment system should include provisions for the possibility of NAPLs and prevention of their discharge to Metzger Ditch. Discharge of NAPLs to Metzger Ditch might lead to unacceptable exposure to persons (particularly children) using Metzger Ditch for recreation. NAPLs could also reduce the effectiveness of pumps in wells used to lower the water table.

19. The remedial design should include provide for long-term, periodic monitoring of ambient air (including breathing zone monitoring) and MVS emissions. Optimal air monitoring would include continuous monitoring stations. Permanent air-monitoring stations should be located both on-site and off-site, in the vicinity of the potentially exposed populations.

20. Permanent stream-monitoring stations should be constructed on Metzger Ditch at the following locations: immediately upstream of IEL, at the south boundary of IEL, and at the treatment system discharge point into Metzger Ditch. Periodic monitoring should include both physical (such as flow velocity and quantity) and chemical characteristics of the surface water.

21. A computerized system for storage, retrieval, and spatial analysis of all pertinent environmental and demographic information gathered at IEL should be available for use by all interested parties. The EPA Geographical Information System (GIS) already in use in other regions would be the most appropriate system. A fully operational GIS would greatly enhance any site emergency contingency program implemented by EPA. An operational and updated GIS data base would also enhance any future Health Assessment addenda, health consultations, or health studies.

In accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, the Industrial Excess Landfill site has been evaluated for appropriate follow-up with respect to health effects studies. ATSDR previously identified the IEL site for a pilot health study. However, the pilot health study was declined by a group of Uniontown citizens.

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APPENDICES

APPENDIX A

LETTER TO BASIL G. CONSTANTELOS, USEPA

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

JUL 13 1989

Mr. Basil G. Constantelos
Director, Waste Management Division
Superfund Region V
U.S. Environmental Protection Agency
230 South Dearborn
Chicago, Illinois 60604

Dear Mr. Constantelos:

The Agency for Toxic Substances and Disease Registry (ATSDR), on March 24, 1989, issued for public comment a Draft Health Assessment for the Industrial Excess Landfill (IEL), a site in Uniontown, Ohio, that is listed on the National Priorities List.

The public comment period closed on June 1, 1989, and the Health Assessment is being prepared in final based upon comments and additional information received from the public and other agencies during that period. As a result of the public comment process, the final Health Assessment will incorporate several additional conclusions and recommendations.

On Friday, July 7, 1989, the ATSDR headquarters was notified by our Senior Regional Representative that EPA planned to sign the Record of Decision (ROD) on July 14, 1989. After a review of the proposed plan of action, ATSDR has identified specific recommendations which are more protective of public health to bring to the attention of EPA before the ROD is finalized. The proposed plan contained provisions to relocate several residents on the western boundary for engineering purposes for remediation activities. As a result of our activities related to the preparation of the final Health Assessment, we have concerns about other residents on the western boundary, as well as on the northern and southern boundaries. Because ATSDR had not previously provided these specific concerns to EPA, we contacted by telephone EPA Region V and EPA Washington on July 7, 1989, to notify them of our concern. At that time, we related our plan to provide EPA Region V with a letter that briefly outlined our major public health concerns, to be followed by the final Health Assessment.

This letter is to bring to your attention the one new recommendation of significance, as well as an ATSDR recommendation made in August 1987, which has not been implemented by EPA and which ATSDR feels requires immediate attention.

Additionally, ATSDR is concerned that other hazardous gases could co-migrate with the methane, posing an additional health threat.

New Recommendation

ATSDR recommends that the EPA take the following actions immediately to eliminate or substantially mitigate the significant health risk described above:

Short Term--in the short term, the recommendation to substantially mitigate the significant health risk may be addressed through options such as:

Option #1: implementation of an appropriate combination of (A) engineering and construction improvements and enhancements of the existing methane venting system; (B) expanded environmental monitoring, including the installation of operational detectors and alarms in the affected buildings (note: current alarms in the houses go off, even in the absence of methane); and (C) a public awareness effort coupled with an effective evacuation contingency plan.

Option #2: relocation of persons living or working in the structures discussed above.

Long Term--in the long term, or whenever on-site activities occur which could adversely impact the effectiveness of the methane venting system, the ATSDR recommendation to substantially mitigate the significant health risk can be addressed by the relocation of those persons living and working in homes or other buildings on properties abutting the southern, western, and (a portion of the) northern boundaries of the IEL site. Such a relocation would at a minimum remain in effect until the site conditions were again judged to be "stable" and the gas venting system was determined to be fully operational and effective in preventing the off-site migration of methane and other toxic gases.

The second purpose of this letter is to bring to your attention a recommendation made by ATSDR in August 1987 and on subsequent occasions. Quoting from the August 1987 document: "The site is still accessible to the general public on the southern, northern, and eastern borders. Public access to the site should be restricted around the entire site perimeter." During a site visit and walk around the site perimeter by ATSDR representatives on July 10, 1989, it was observed that the fence along the northern boundary has been breached in at least one place by a fallen tree; there is still no fence on the eastern boundary; and only a portion of the southern boundary is fenced. The western boundary, while fenced, is fenced to a height of about 4 feet, and can be easily crossed. ATSDR again makes the recommendation for restricting access to the site, and by this letter emphasizes the importance of addressing this recommendation in the very near future.

New Conclusion

The ATSDR has determined that, absent additional corrective actions, there is a significant risk to human health for persons living or working in structures on some of the properties immediately adjacent to (abutting) the Industrial Excess Landfill due to the potential for off-site migration of methane and other toxic gases.

The properties of concern relative to this conclusion include one commercial operation and one home on properties abutting the southern boundary of the site; all homes and other structures on properties abutting the western boundary of the site; and all homes and other structures on properties abutting the northern boundary of the site along what is now known as Hilltop Avenue.

Basis for the Finding of a Significant Risk to Human Health

Prior to the installation of the existing methane venting system for the IEL site, high levels of methane were detected in off-site soil gases; additionally, levels of methane exceeding the lower explosive limit were detected below one of the homes on the western border of the site, clearly indicating the potential for off-site migration of substantial levels of methane.

Since the present venting system has been operational, there have been no documented reports of methane within adjacent homes or businesses. EPA has told ATSDR that the methane detectors and alarms placed in the homes by the Ohio EPA are frequently set off, but the local fire department responds, investigates, and to date has not confirmed the presence of methane within the homes.

In recent weeks, while the existing methane venting system has been operational, increasing levels of methane have been detected in soil gases by punch-probe monitoring off-site in the backyards of homes along the western border of the site. During the monitoring and adjustment of the venting system, the off-site soil gas methane levels reached as high as 49% by volume, well above the lower explosive limit for methane, within 40 feet of one residence on property abutting the IEL western boundary. It is reported by EPA Region V that this situation has been corrected.

The ATSDR believes that potentially explosive levels of methane have in the past and could again migrate into those structures immediately bordering the IEL site should the existing methane venting system fail and/or due to some unexpected change in the landfill conditions such as might occur during remedial activities.

This finding by ATSDR is in agreement with a report prepared by EPA's engineering consultants (SCS Engineers, Gas Migration Analysis) which outlines an "8-hour" and a "worst-case" migration path for methane which includes structures on some properties abutting the south, west, and north boundaries of the IEL site.

If you or your staff should have any questions regarding this letter or our Health Assessment which will follow shortly, please contact our Senior Regional Representative in Chicago, Louise Fabinski (FTS 353-8228), or call me directly (FTS 236-4810).

Sincerely yours,

Mark M. Bashor

Mark M. Bashor, Ph.D.
Director
Office of Health Assessment

APPENDIX B

TABLE 1

CONTAMINANTS OF CONCERN

TABLE 1: MAXIMUM CONCENTRATIONS OF CONTAMINANTS CAUSING CONCERN
INDUSTRIAL EXCESS LANDFILL, 1986 TO 1988

AIR

Maximum concentrations detected, in parts per billion (ppb)

CONTAMINANT	ON-SITE SAMPLE SOURCES MVS[1]	SOIL GAS	1986 VENT GAS WELLS
benzene	2,200	6,700	42,700
chloroform	NM[2]	NM	12,333
1,1-dichloroethane	630	110	ND[3]
1,1-dichloroethylene	14	75	ND
ethylbenzene	1,200	39,400	48,200 (BLOWERHOUSE)
hexane	NM	NM	NM
methylene chloride	BMDL[4]	30	ND
tetrachloroethene	300	790	100
trichloroethylene	280	410	1,900
toluene	1,500	47,000	14,400
vinyl chloride	6,700	790	ND
xylenes	1,860	14,000	NM
1,2-dichloroethene	NM	NM	74,100
1,2-dichloroethane	NM	NM	297,733

CONTAMINANT	OFF-SITE SAMPLE SOURCES RESIDENTIAL AIR* 1986	1988
benzene	7	2.9
1,1-dichloroethane	88	95
1,1-dichloroethylene	NM	[illegible]
ethylbenzene	20	95
hexane	12	4.1
methylene chloride	21**	10
toluene	110	230
tetrachloroethene	NM	2.4
trichloroethylene	NM	0.2
vinyl chloride	2	BMDL
xylenes	20	25

TABLE 1--CONTINUED

SURFACE SOILS

Maximum concentrations detected, in parts per billion (ppb)

CONTAMINANT	ON-SITE	NEAR-SITE
aldrin	410	ND
arsenic	35,000	167,000
barium	547,000	200,000
benzene	9	ND
bis(2-ethylhexyl) phthalate	680,000	754
cadmium	13,300	9,400
chlorobenzene	310	ND
chlordane	280	ND
chromium	53,000	140,000
chrysene	4,700	ND
cyanide	22,100	42,000
4,4'-DDE	200	ND
4,4'-DDT	170	4,800
di-n-butyl phthalate	250	2,255
ethylbenzene	980,000	ND
lead	699,000	283,000
mercury	230	650
polychlorinated biphenyls	320	ND
pyrene	8,400	380
selenium	ND	1,100
tetrachloroethene	8	ND
toluene	20	810
trichloroethylene	16	8
xylenes	13,000	5

TABLE 1: MAXIMUM CONCENTRATIONS OF CONTAMINANTS CAUSING CONCERN
INDUSTRIAL EXCESS LANDFILL, 1986 TO 1988

AIR

Maximum concentrations detected, in parts per billion (ppb)

	ON-SITE SAMPLE SOURCES			
CONTAMINANT	MVS[1]	SOIL GAS	1986 VENT GAS WELLS	
benzene	2,200	6,700	42,700	
chloroform	NM[2]	NM	12,333	
1,1-dichloroethane	630	110	ND[3]	
1,1-dichloroethylene	14	75	ND	
ethylbenzene	1,200	39,400	48,200	(BLOWERHOUSE)
hexane	NM	NM	NM	
methylene chloride	BMDL[4]	30	ND	
tetrachloroethene	300	790	100	
trichloroethylene	280	410	1,900	
toluene	1,500	47,000	14,400	
vinyl chloride	6,700	790	ND	
xylenes	1,860	14,000	NM	
1,2-dichloroethene	NM	NM	74,100	
1,2-dichloroethane	NM	NM	297,733	

	OFF-SITE SAMPLE SOURCES	
	RESIDENTIAL AIR*	
CONTAMINANT	1986	1988
benzene	7	2.9
1,1-dichloroethane	88	95
1,1-dichloroethylene	NM	ND
ethylbenzene	20	95
hexane	12	4.1
methylene chloride	21**	10
toluene	110	230
tetrachloroethene	NM	2.4
trichloroethylene	NM	0.2
vinyl chloride	2	BMDL
xylenes	20	25

TABLE 1--CONTINUED

LEACHATE, SURFACE WATER & SEDIMENT

Maximum concentrations detected, in parts per billion (ppb)

CONTAMINANT	ON-SITE LEACHATE	SURFACE WATER[5]	SEDIMENT[6]
arsenic	ND	51	91
barium	1,710	8,130	308
benzene	41	ND	ND
bis(2-ethyl-hexyl)phthalate	4	4	26,000
cadmium	16	49	9.3
chlorobenzene	6	ND	ND
chromium	12	42	57
chrysene	ND	ND	198
cyanide	ND	11	1
4,4'-DDE	ND	ND	240
4,4'-DDT	ND	ND	1,800
di-n-butyl phthalate	ND	ND	8,095
ethylbenzene	94	ND	ND
lead	22	68	93
n-nitrosodiphenylamine	38	ND	ND
selenium	ND	0.8	ND
toluene	8	ND	620
xylenes	100	ND	ND

TABLE 1--CONTINUED

GROUNDWATER

Maximum Concentrations detected, in parts per billion (ppb)

CONTAMINANT	ON-SITE MONITORING WELLS	OFF-SITE RESIDENTIAL WELLS
arsenic	6	9.1
barium	1,430	1,370
benzene	10	ND
cadmium	21	0.58
chlorobenzene	27	ND
chromium	9.2	11
cyanide	ND	26
1,1-dichloroethane	25	ND
ethylbenzene	110	ND
lead	60	239
n-nitrosodiphenylamine	15	ND
selenium	6.8	20
tetrachloroethene	ND	1.3
toluene	13	ND
vinyl chloride	ND	7
xylenes	355	ND

KEY

1 Methane Venting System

2 Not Measured

3 Not Detected

4 Below Mean Detection Limit

5 All values reported are for on-site or near-site samples, except that for lead, which was obtained from the off-site pond.

6 All values reported are for on-site or near-site samples, except those for DDE and DDT, which were obtained from Metzger Ditch, downstream of IEL.

* Results of TAGA field measurements in February 1988 appear to indicate that contaminants in residential air result from household sources.

**Reported as methylene chloride/chloroform.

APPENDIX C

U.S. GEOLOGICAL SURVEY REPORT

OCTOBER 21,1988

United States Department of the Interior

GEOLOGICAL SURVEY

Water Resources Division
975 W. Third Avenue
Columbus, OH 43212-3192
(614) 469-5553

October 21, 1988

Mr. John H. Mann
Office of Health Assessment
Agency for Toxic Substances and
Disease Registration
1600 Clifton Road
Chamblee Mail Stop F-38
Atlanta, GA 30333

Dear Mr. Mann:

In December 1984, the U.S. Environmental Protection Agency (USEPA) authorized performance of a Remedial Investigation Feasibility Study (RI/FS) at the Industrial Excess Landfill (IEL) site in Uniontown, Ohio. The primary purposes of the RI/FS study were site characterization and data collection. During these studies and in another study by the Ohio Environmental Protection Agency (Ohio EPA), ground-water contamination was detected in observation wells installed at the site and in residential wells located in the vicinity of the site.

Under an interagency contractual agreement with the Agency for Toxic Substances and Disease Registration, the U.S. Geological Survey evaluated geologic and hydrogeologic data available from the RI/FS, and from U.S. Geological Survey data bases, with emphasis on how well the available data describe ground-water flow within and around the IEL site. Technical review of available data was done by E. Scott Bair and S. E. Norris. This letter, which was written primarily by E. Scott Bair, presents the findings of that evaluation.

The IEL is a closed sanitary landfill located in northeastern Ohio, about 10 miles southeast of Akron, in Lake Township, Stark County, adjacent to Uniontown (fig. 1). The IEL site covers approximately 30 acres in a rural residential area. The site was a sand and gravel quarry until 1966. The excavation remaining after aggregate mining ceased was converted into a landfill that received a variety of industrial, commercial, and municipal wastes until it was closed in 1980 pursuant to a court-ordered consent agreement (USEPA, 1988). Available information indicates that 80 to 85 percent of the property is underlain by buried wastes.

The IEL site borders a strip of residential and commercial properties on the west, Metzger ditch and agricultural land on the east, residential property on the north, and agricultural land on the south. Topographic relief at the site is approximately 60 feet. The site was graded and sloped to promote runoff to Metzger ditch. The highest elevation on the site, approximately

1,180 feet above sea level, is in the northwestern part, whereas the lowest elevation, approximately 1,120 feet above sea level, is in the southeastern part along Metgzer ditch.

From 1966 to 1968, the landfill operated under a conditional license and accepted various municipal, commercial, and industrial wastes containing hazardous substances of largely undetermined and unknown composition (U.S. Environmental Protection Agency, 1988). In 1968, Lake Township zoning licenses were issued allowing a variety of solid-waste materials to be disposed of at the site. A solid-waste-disposal license was issued in 1969, and was reviewed annually by the Ohio Department of Health from 1968-72 and by the Ohio EPA from 1972-80. According to Ohio EPA, the IEL received industrial waste primarily from the rubber industry in Akron, but reports also document receipt of general household wastes and wastes from hospitals and septic-tank cleaning firms (U.S. Environmental Protection Agency, 1988).

Ohio EPA estimated that about 780,000 tons of waste was buried at the site. Information solicited from potentially responsible parties indicate that they disposed of nearly 1,000,000 gallons of waste at the site. In addition, substantial quantities of chemical and liquid wastes were dumped on the ground at the site either from 55-gallon drums and from tank trucks (U.S. Environmental Protection Agency, 1988). Information from the potentially responsible parties indicates that about 60,000 barrels of liquid waste were dumped on the ground at the site, 25 percent of which was believed to be liquid latex. The composition of the other 75 percent is not known. Liquid wastes commonly were mixed with fly ash and deposited on the ground. An evaporation lagoon also was used for the disposal of liquid wastes.

In January 1972, the Stark County Board of Health ordered cessation of disposal of chemical (liquid) waste at the IEL site. In 1980, the Stark County Board of Health and the Stark County Court of Common Pleas ordered closure of the facility. A closure plan was developed, approved, and implemented. Subsequent to closure, gas-monitoring activities by various organizations indicated elevated concentrations of methane gas around the site.

In 1984, the USEPA proposed that the IEL site be put on the National Priorities List. An RI/FS work assignment was issued in December 1984 and work began in 1985. Available reports and other information on the site and the adjacent area are listed under the selected references at the end of this letter.

Uniontown, Ohio, is located in an area of hummocky terrain consisting of irregularly shaped knolls and hills that commonly are underlain by deposits of sand and gravel. Undrained depressions also are common. The northern part of Stark County is within the glaciated part of the Appalachian Plateaus physiographic province. The thickness of glacially derived material in the area of the IEL site ranges from about 50 feet to more than 100 feet. These materials consist predominantly of interbedded sand and gravel with minor amounts of silt and clay that were deposited during the Wisconsinan glaciation. In the Uniontown area, these deposits are water bearing and commonly function as a source of residential, commercial, and industrial water.

Although the Pleistocene Kent Till and the Mogadore Till have been mapped in Stark County, it is not known whether either till is present at the IEL site. Geologic sections were prepared by the U.S. Environmental Protection Agency (1988) from soil-boring logs from drilling of observation wells at and adjacent to the IEL site and from data available from water-well drillers' logs for nearby wells. Figure 2 is an east-west geologic section constructed from logs immediately south of the IEL site, whereas figure 3 is a north-south geologic section constructed from logs immediately west of the IEL site. Note that most of the glacial material adjacent to the site consists of sand and gravel. Minor, discontinuous lenses of clay, and silt with sand and clay, also are present. The deposits are thought to be part of a kame-moraine complex (White, 1984).

The glacial deposits are underlain by the Pottsville Formation, a Pennsylvanian sequence of interbedded sandstone, shale, siltstone, limestone, and coal. In the area of the IEL site, the Pottsville Formation is about 400 feet thick. The sandstone and shale units also are used as a residential water source in the Uniontown area.

The bedrock surface in the Uniontown area generally represents the preglacial topography, which appears to have been characterized by moderate relief, steep slopes, and narrow ridges that separated deeply incised streams (DeLong and White, 1963). Glacial erosion has modified the bedrock surface, generally forming wide bedrock valleys and broad ridges with rounded hills. A top-of-bedrock map (fig. 4) was constructed from more than 200 drillers' logs from the area surrounding the IEL site. A similar map, but for the immediate vicinity of the IEL site, was prepared by the U.S. Environmental Protection Agency (1988, fig. 4-3, page 9/128, section 4.2.3). Both maps show an eastward-trending bedrock valley that underlies the IEL site. The area just north of the IEL site appears to represent a bedrock knoll. Relief between the top of the bedrock knoll and the bottom of the bedrock valley underlying the IEL site is nearly 80 feet.

The drillers' logs indicate that the shallowest bedrock commonly consists of either shale or sandstone. Because of the shallow southeastward regional dip, differences in the lithology of the shallowest bedrock unit probably reflect either differences in the depth of erosion or facies changes in the Pottsville Formation. The drillers' logs also commonly indicate the presence of one or more local, thin limestone beds.

Water levels recorded on drillers' logs were used to assess the regional ground-water flow system in the area of the IEL site. Drillers' logs from 279 wells were examined to determine the completion depth of the well, the lithology of the open/screened interval, and the reliability of the recorded water level.

On the basis of the gross lithologic differences between the unconsolidated glacial-drift materials and the indurated bedrock, and the inferred differences in their hydraulic properties, the flow system in the area of the IEL site was divided into two regional aquifers: a shallow, unconfined glacial-drift aquifer and a deeper, semiconfined bedrock aquifer. About 33 percent of the driller's logs were from wells completed in the glacial-drift aquifer, whereas 67 percent were from wells completed in bedrock.

A total of 93 wells were completed in the glacial-drift aquifer. Water levels recorded on the drillers' logs from five of these wells were considered to be unreliable. Another eight wells were outside the area shown on figure 5. The geographic distribution of the remaining 80 wells is shown on figure 5.

A total of 186 wells were completed in the bedrock aquifer. The lithology of the open interval of these wells is as follows: shale, 38 wells; shale underlain by sandstone, 90 wells; sandstone, 52 wells; sandstone underlain by shale, 6 wells. Water levels from 17 bedrock-well logs were judged to be unreliable. Another six wells were outside the area shown on figure 6. The geographic distribution of the remaining 163 wells is shown on figure 6.

In addition to the water levels recorded on the well logs, water levels in 25 residential wells were measured by Ohio EPA in March 1984 (Mohr and Khourey, 1984), and water levels in 23 observation wells at or near the IEL site were measured by the U.S. Geological Survey in January 1988.

The depth-to-water measurements recorded on the drillers' logs were converted to water-level elevations relative to sea level by estimating the collar elevation of the well using topographic maps of Stark County with a 2-foot contour interval and a scale of 1:24000. Wells whose position could not be located on these maps were field located and added to the data base. The region of study encompasses about 4 square miles; the IEL site is located slightly northwest of the region's approximate center.

Although water levels recorded on the drillers' logs include temporal variations and may not be measured precisely, the flow patterns shown on potentiometric surfaces constructed from these data are consistent with regional hydrodynamic principles and with local water levels measured in the area of the IEL site. On the basis of five sets of water-level measurements made over a 13-month period, figure 4-13 of the Final Remedial Investigation Report (U.S. Environmental Protection Agency, 1988) shows that water levels at the IEL site in the glacial-drift aquifer and in the bedrock aquifer vary only slightly over time. The maximum amplitude of water-level change in any of the observation wells was slightly less than 1 foot. This limited amount of data indicates that inclusion of nonsynoptic water-level measurements probably would not introduce gross errors in the general interpretation of regional flow patterns in the area of the IEL site.

Figure 5 is a composite potentiometric surface of the glacial-drift aquifer. It is based on water levels measured in 80 wells from April 1962 through January 1988. As can be seen from the equipotential lines, a prominent ground-water ridge trends northeast-southwest across the northwestern corner of the IEL site. Ground water flows radially away from this ridge, primarily to the northwest and to the southeast. The ground-water ridge corresponds to a topographic ridge oriented in the same direction, as shown on figure 1.

The IEL site appears to straddle the ground-water ridge. As a result, flow in the glacial-drift aquifer at the IEL site moves in a radial pattern away from the site in all directions and across the eastern, northern, western, and southern borders of the IEL site. This flow pattern also is shown in the more localized potentiometric surface of the shallow observation wells in the area of the site (U.S. Environmental Protection Agency, 1988, fig. 4-9, p. 21/128 in section 4).

A composite, regional potentiometric surface also was constructed for the bedrock aquifer from 163 water levels recorded on drillers' logs from February 1953 through January 1988. Figure 6 shows a similar elongated ground-water ridge trending northeast-southwest across the northwestern corner of the IEL site. In the area of the IEL site, flow patterns in the bedrock aquifer appear to be similar to those in the glacial-drift aquifer; however, on the basis of the available well control, it does not appear that the IEL site straddles the ground-water ridge in the bedrock potentiometric surface. Another difference in the two potentiometric surfaces is the presence of a small potentiometric mound due north of the IEL site with 20 feet of relief.

The water-level data plotted on figure 4-13 in the Final Remedial Investigation Report (U.S. Environmental Protection Agency, 1988) and the water-level data measured at the IEL site by the U.S. Geological Survey (fig. 6) generally indicate a downward flow component from the shallow observation wells to the deep observation wells, as manifested by a reduction of hydraulic heads in wells with increasing depth. This is consistent with the location of the IEL site along a ground-water ridge, which would serve as a local recharge area within the regional flow system.

As a consequence of the radial-type of flow pattern in the glacial-drift aquifer at the IEL site (fig. 5), the direction of movement of a contaminant would, in large part, depend on the original location of the contaminant at the IEL site. For example, if contaminant A were to intercept the water table in the northwestern corner of the site, it would flow to the northwest away from the site. However, if contaminant B were to intercept the water table in the southern part of the site, it would flow to the southwest away from the site. As a result of this flow pattern, contaminant A would be found in the northwestern part of the study area but not in the southwestern part, and contaminant B would be found in the southwestern part of the study area but not in the northwestern part. This radial type of flow pattern may explain the nonuniform distribution of some of the contaminants detected in observation and residential wells, particularly if specific contaminants were not disposed of uniformly across the site. It is highly unlikely that specific contaminants were disposed of uniformly across the site.

The vertical movement of contaminants within the glacial-drift aquifer is controlled by the vertical hydraulic gradient within the glacial materials. Water-level measurements made by the U.S. Geological Survey in January 1980 in 23 observation wells at or near the IEL site indicate that a downward component of flow exists between the shallow observation wells and the intermediate-depth observation wells. Both sets of wells are completed in the glacial-drift aquifer. A comparison of water levels in the shallow observation wells with those in the deep observation wells, which are completed in the bedrock aquifer, also indicates a downward component of flow. Consequently, contaminants present at the site will flow both laterally within the local flow patterns indicated on figures 5 and 6 and vertically downward within the flow system.

The amount of vertical flow depends on the vertical hydraulic gradient, the ratio of vertical to horizontal hydraulic conductivity of the various aquifer materials, and the chemical properties of the particular contaminant. At present, no data are available concerning the vertical hydraulic conductivity (K_v) of the glacial-drift aquifer at the IEL site. This information can only be determined from an aquifer test. Slug tests, which were the only type of hydraulic test performed at the IEL site, are not useful for determining values of K_v.

The number of domestic wells along the eastern and southern borders of the immediate site area is insufficient to make any reliable interpretations concerning flow directions in either the glacial-drift aquifer or the bedrock aquifer. Acquisition of water-level data in these areas would improve estimates of flow directions and rates of contaminant-migration in these areas.

An improved understanding of the regional flow patterns in the Uniontown, Ohio, area could be made if a synoptic set of water-level measurements were made. This would be particularly worthwhile if additional observation wells were constructed.

Within the framework of the ground-water flow patterns previously described, the rate of movement of contaminants away from the IEL site is controlled, in large part, by spatial variations in the advective transport velocity (average linear flow velocity) of the local flow system. These variations reflect differences in the horizontal hydraulic gradient and the horizontal hydraulic conductivity (K_h). Temporal variations in hydraulic gradient are considered to be minor and, therefore, to have only a minor influence on rates of contaminant movement.

K_h values for the glacial-drift aquifer and the bedrock aquifer at the IEL site were determined by performing slug tests in the observation wells. This method does not put a sufficient stress on the aquifer tested to obtain representative values of K_h. The K_h values obtained from this method represent a "point permeability" measurement. An improved estimate of the K_h of the glacial-drift aquifer could be obtained from an aquifer test performed at the site. The aquifer test also would enable estimation of K_v. This information, along with additional water-level data from new additional observation wells located to the east and south of the IEL site, would improve understanding of the rates of contaminant movement at the site.

Many organic contaminants are attenuated by organic material in soil horizons, in unconsolidated materials, and, to a lesser extent, in lithified rocks. Data need to be collected to determine variations in the total organic-carbon content of the glacial-drift aquifer and the unsaturated zone. This information would enable estimation of contaminant migration rates based on a more realistic method than on mere calculations of the average linear flow velocity.

Sincerely yours,

Steven M. Hindall
District Chief

ESB/ccv

Attachments (references
and illustrations)

SELECTED REFERENCES

Camp, Dresser, & McKee, Inc., 1986, Geophysical survey investigations at Industrial Excess Landfill (prepared for C. C. Johnson & Associates), 16 p.

-----1987, Addendum to geophysical survey at Industrial Excess Landfill (prepared for C. C. Johnson & Malhotra), 17 p.

Camp Dresser, & McKee Federal Programs Corporation, 1987. Focused Feasibility study for evaluating alternative water supplies at the Industrial excess Landfill, Uniontown, Ohio (prepared by C. C. Johnson & Malhotra).

DeLong, R. M., and White, G. W., 1963, Geology of Stark County, Ohio: Ohio Department of Natural Resources Division of Geological Survey.

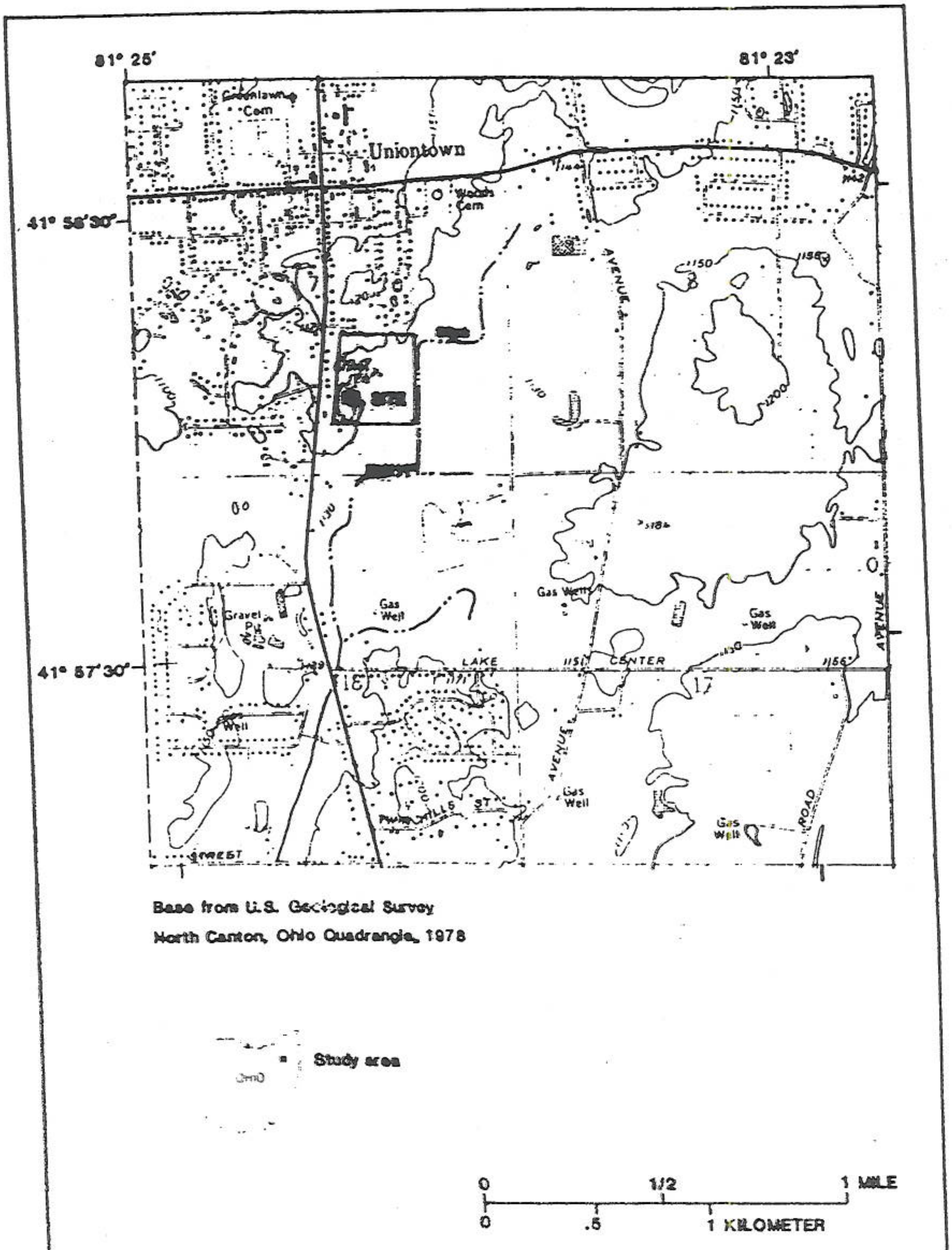
Mohr, E. T., and Khourey, C. J., 1984, Report on sampling of residential well water supplies in the vicinity of the Industrial Excess Landfill, Uniontown, Ohio: Ohio Environmental Protection Agency, Northeast District Office, 17 p.

U. S. Environmental Protection Agency, 1984, Glacial geology of Summit County, Ohio: Ohio Geological Survey Report of Investigations no. 123, 1 pl.

-----1985, Performance of remedial response activities at uncontrolled hazardous waste sites (REM II) prepared by C. C. Johnson & Associates).

-----1988, Final remedial investigation report for Industrial Excess Landfill, Uniontown, Ohio.

White, G. W., 1984, Glacial geology of Summit County, Ohio: Ohio Geological Survey Report of Investigations 123, 1 map, 25 p.



Base from U.S. Geological Survey
North Canton, Ohio Quadrangle, 1978

Study area

Figure 1.—IEL site area in Stark County, Ohio.

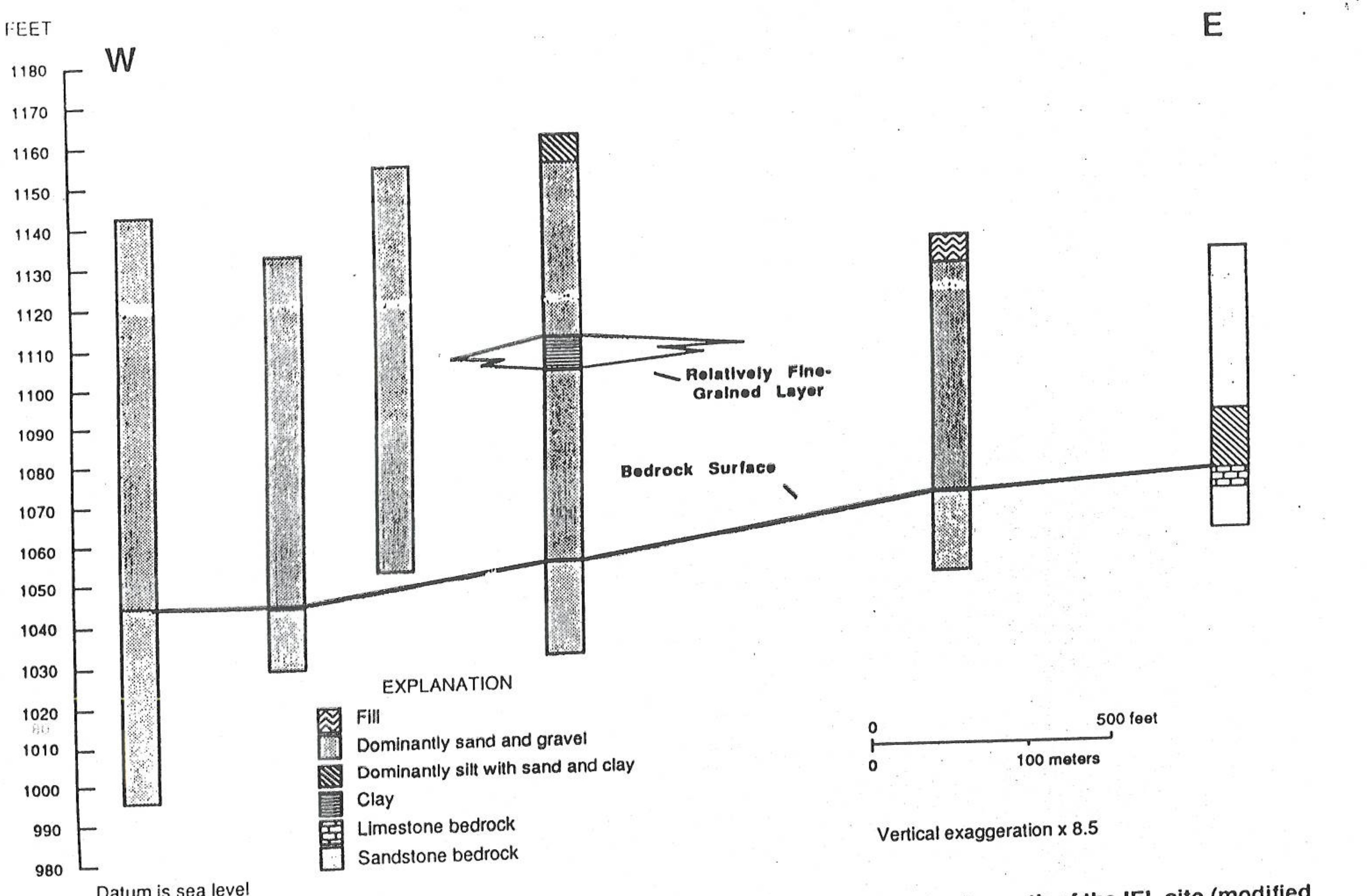


Figure 2.—Generalized east-west geologic section constructed from logs immediately south of the IEL site (modified from U.S. Environmental Protection Agency, 1988).

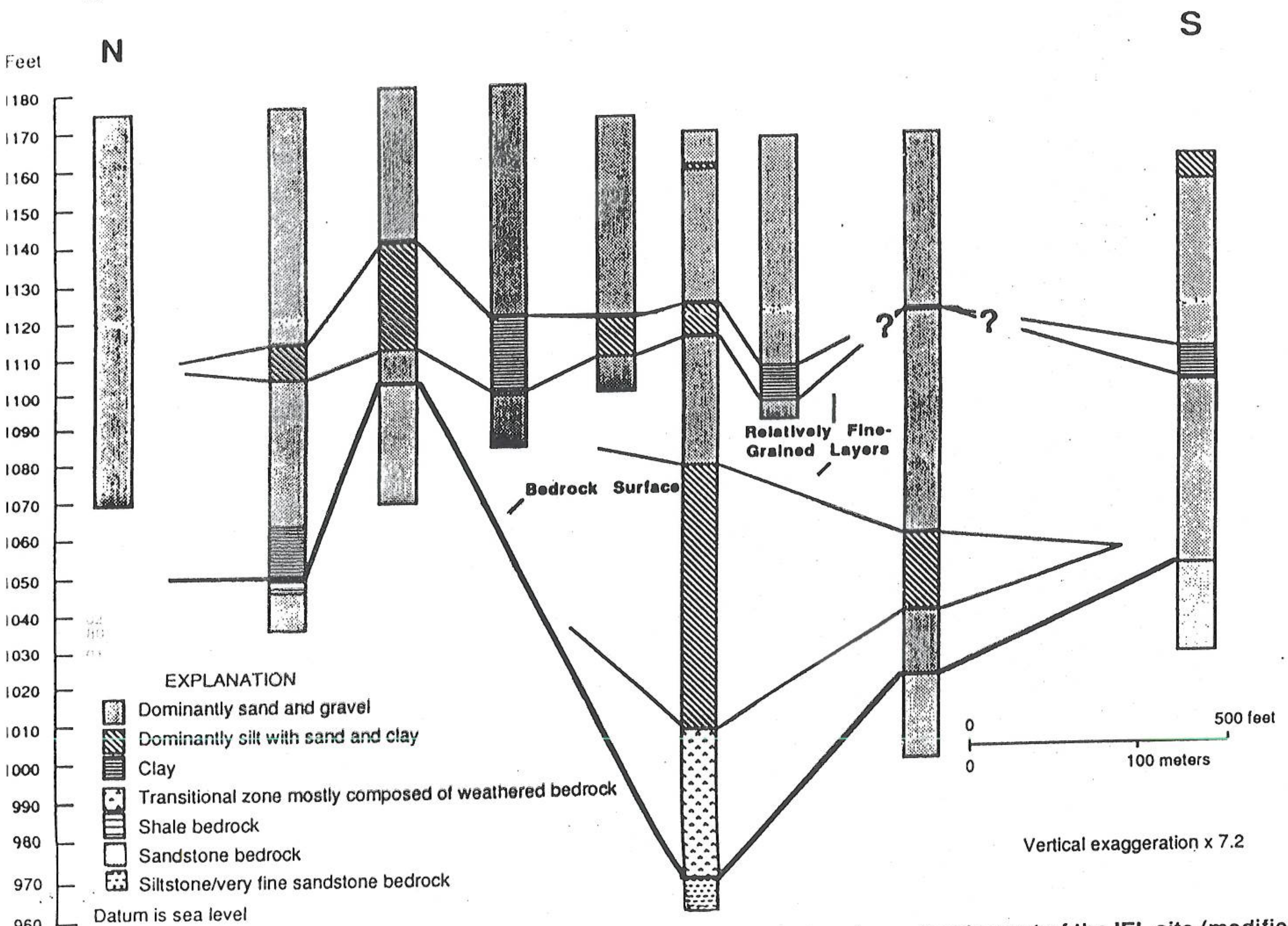


Figure 3.—Generalized north-south geologic section constructed from logs immediately west of the IEL site (modified from U.S. Environmental Protection Agency, 1988).

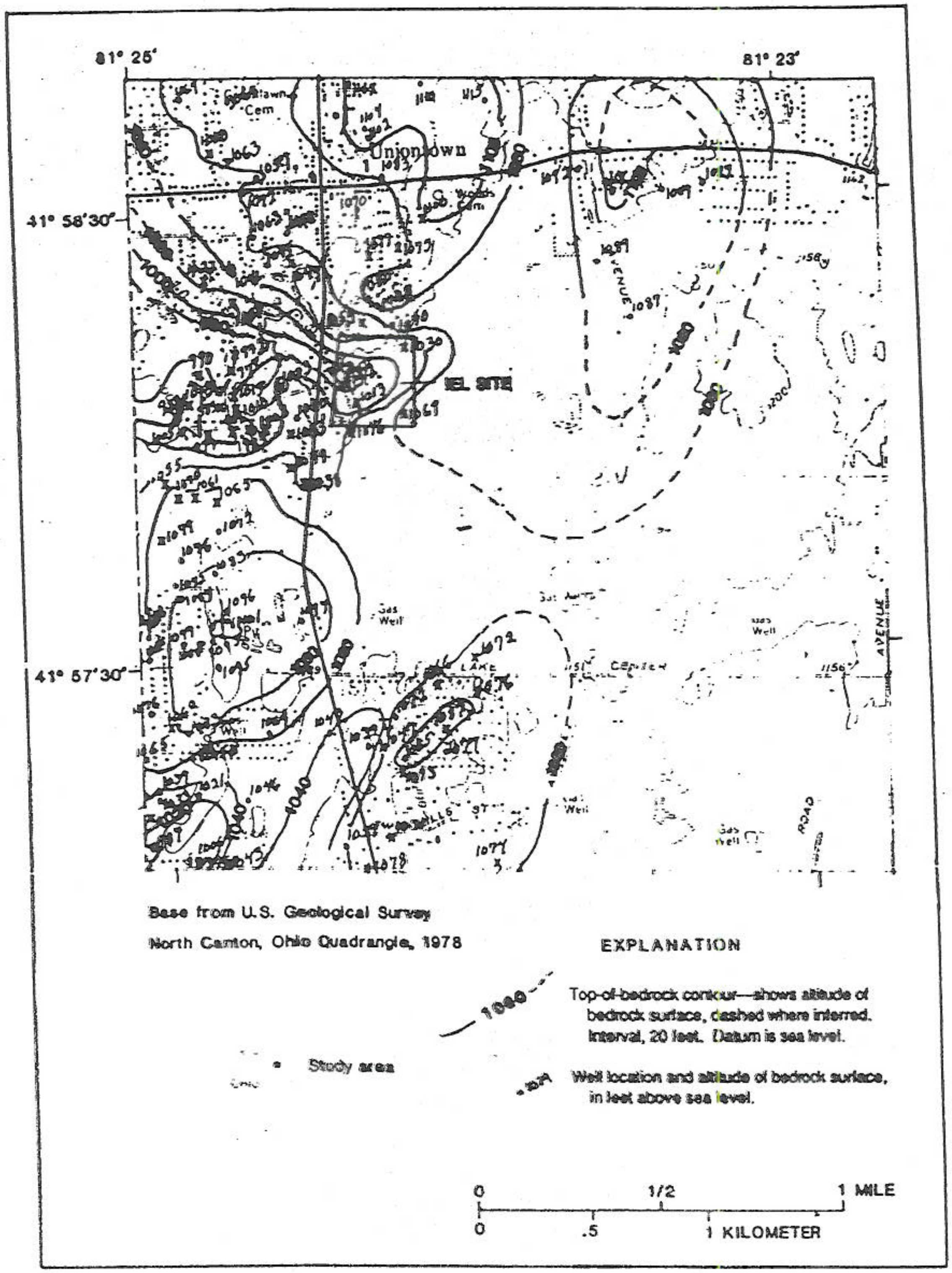


Figure 4.—Top-of-bedrock map based on drillers' logs.

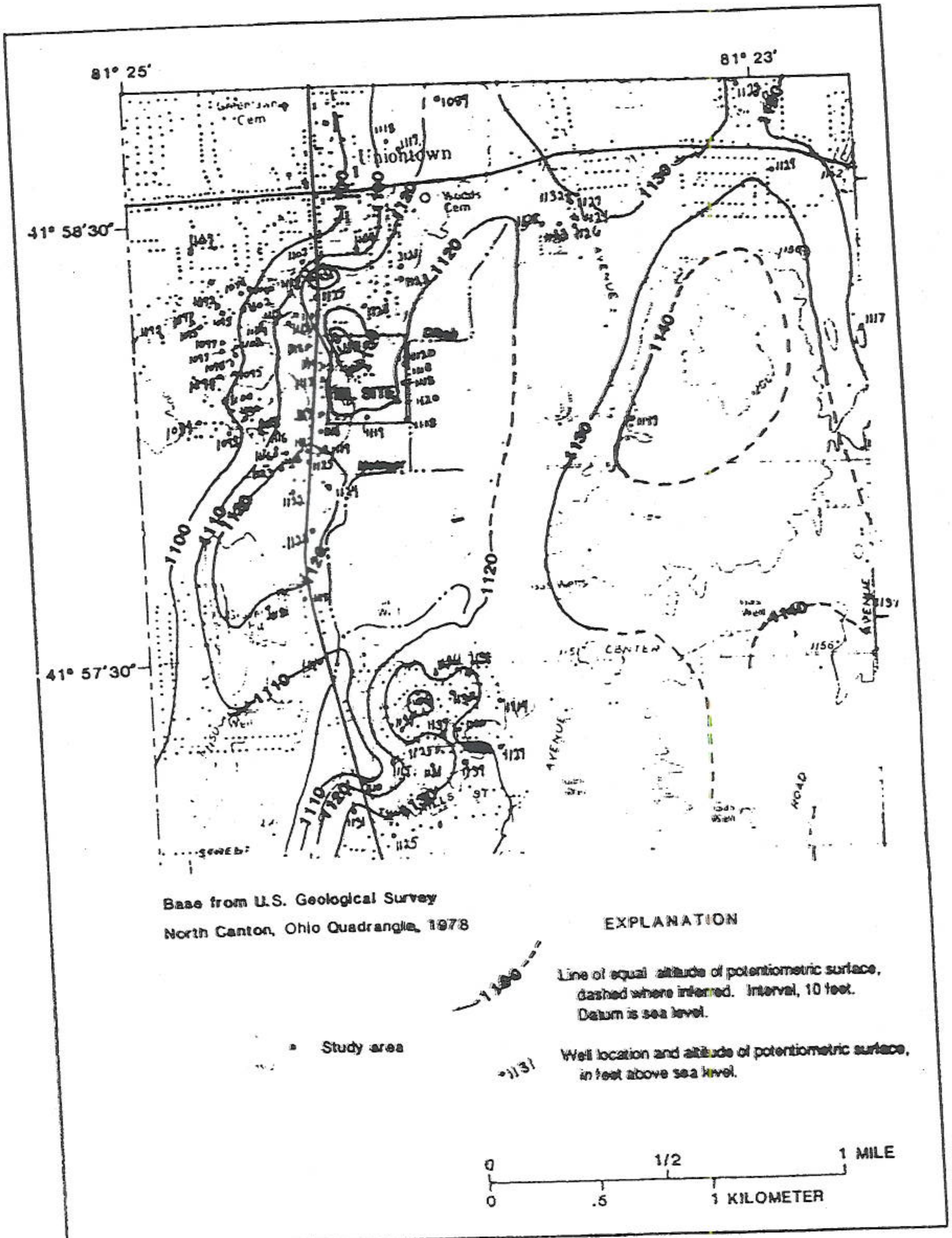


Figure 5.—Composite potentiometric surface of the glacial-drift aquifer near the IEL site, based on water levels measured from April 1962 through January 1988.

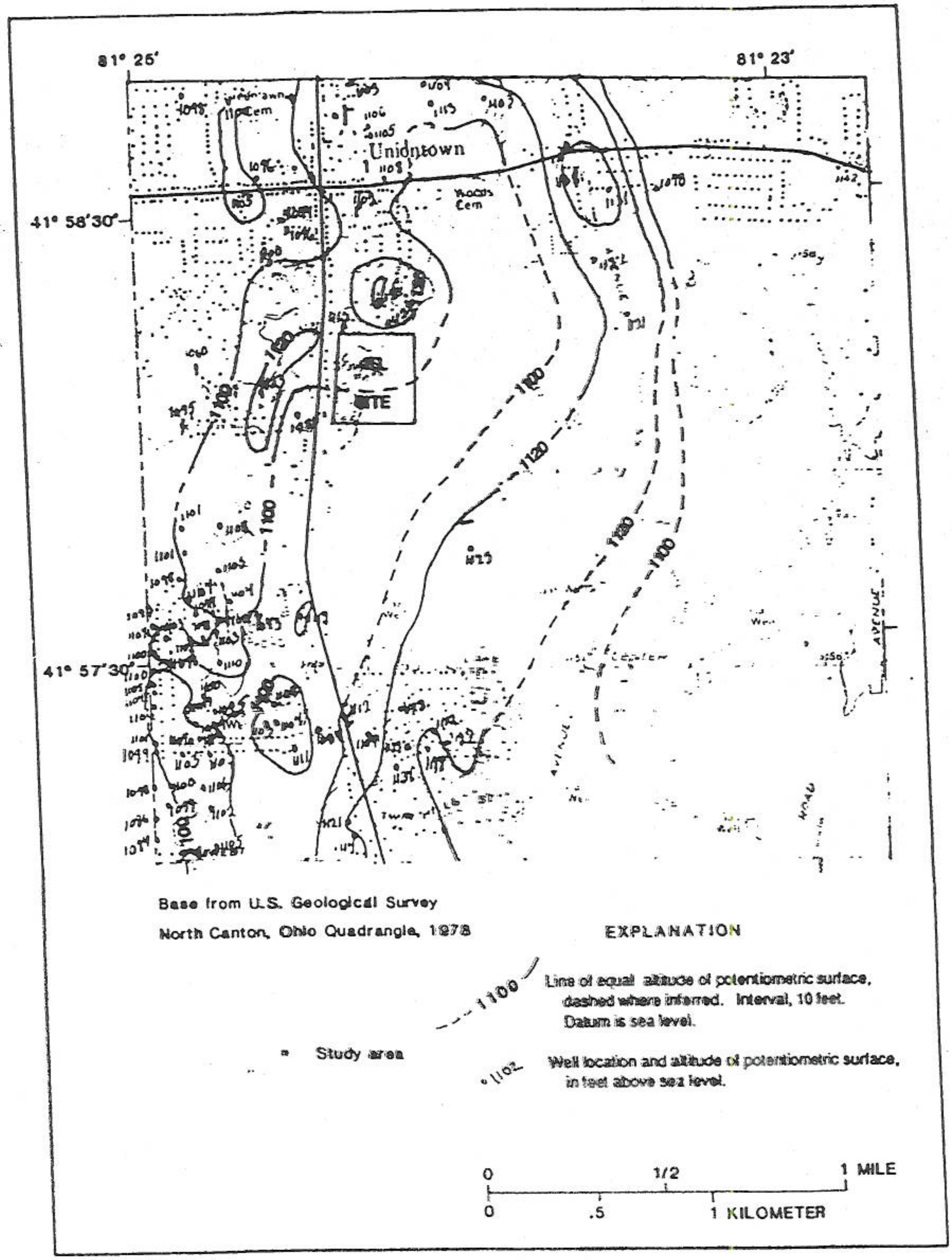


Figure 6.—Composite potentiometric surface of the bedrock aquifer near the IEL site, based on water levels measured from February 1953 through January 1988.