Health Assessment for

REICH FARM NATIONAL PRIORITIES LIST (NPL) SITE

PLEASANT PLAINS, OCEAN COUNTY, NEW JERSEY

CERCLIS No. NJD980529713

Agency for Toxic Substances and Disease Registry
U.S. Public Health Service

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SUMMARY

The Reich Farm is a National Priorities List (NPL) site located in the City of Pleasant Plains, Ocean County, New Jersey. The area of the site is predominantly agricultural and residential; however, two commercial enterprises are immediately adjacent to the site. Because of past removal actions, on-site subsurface soils are likely to be the only remaining source of contaminated medium. Elevated levels of various organic compounds and heavy metals have been identified in on-site subsurface soils and in on-site and off-site ground water. Because of the potential for plume migration in the lower sand aquifer, additional private wells in Zone II and other potentially affected areas should be monitored. This site is of potential public health concern because of the risk to human health that could result from possible exposures to hazardous substances at levels that may result in adverse health effects over time. However, previous remedial actions and future remediation plans proposed by the U.S. Environmental Protection Agency should reduce or completely eliminate exposure to contaminants at levels that are of public health concern.

BACKGROUND

A. SITE DESCRIPTION

The Reich Farm is an NPL site located in the City of Pleasant Plains, Ocean County, New Jersey. The site is situated about 500 feet east of New Jersey Highway Route 9, one mile northeast of the Toms River and 1,000 feet from an intermittent stream draining into the Toms River. The site encompasses approximately three acres of land which are in a relatively open, flat, sandy surface and are surrounded by wooded areas to the north and east. The entire area of consideration, including the site, includes about fifteen acres of land. Access to the site is unrestricted.

During the five-month period from August 1971 to December 1971, the site, which had been leased from the Reich Farm owners by an independent waste hauler, was used illegally for the disposal of drums containing organic solvents, still bottoms, and residues from the manufacturing of organic chemicals, plastics, and resins. In December 1971, the Reich Farm owners discovered about 4,500 drums still containing chemical wastes, 450 empty drums, and a number of trenches into which chemical wastes had been discharged. The New Jersey Department of Environmental Protection (NJDEP) and the responsible chemical manufacturer (identified by the labels on the drums) were informed about the contamination. In February 1972, the responsible chemical manufacturer removed all visible drums (a total of 5,096 drums) and all visible trench wastes.

In early 1974, analyses of well water from several residential wells were conducted following complaints of unusual taste and odor emanating from the well water. Petrochemical contamination was confirmed. This prompted additional investigation at the site. Another 51 drums and substantial quantities of buried wastes were found and removed. Contaminated soils (approximately 1,000 cubic yards) were also removed to a depth between 12-15 feet and transported to a licensed off-site disposal area. "Clean" soil was brought in to backfill the area. The fill soil, however, was apparently not analyzed for contaminants at that time.

On September 16, 1974, the Township of Dover ordered a number of wells in the vicinity of the site closed and sealed (see Appendix I for the delineation of the area of well closures). A zone system restricting ground water usage was established. Zone I encompassed the area of closed wells, within which all new wells were prohibited (NUS, 1986). Temporary alternate water supplies were provided until all residences within Zone I were placed on municipal water provided by the Toms River Water Company (TRWC). Zone II was peripheral to Zone I, and encompassed an area within which no wells were permitted in the upper sand aquifer (Cohansey Aquifer). In April 1976, organic chemical contamination was found in 13 private wells located in Zone II south of the site (Dugan and Wallach Lanes). From 1974 to 1976, 161 wells, both upgradient and downgradient of the site, were condemned. Temporary alternate water supplies were provided until all residences within the affected area were placed on municipal water provided by the TRWC. Monitoring wells were installed by TRWC to check contaminant movement towards the deep aquifer and municipal wells. Annual sampling of these wells occurred between 1976 and 1980.

The site and surrounding areas have been the subject of two recent investigations and reports. A draft Preliminary Remedial Investigation (P-RI) report was completed by the NUS Corporation in 1986 (NUS, 1986), and more recently, in August 1988, a Final Draft Supplemental (RI) report was completed by Ebasco Services, Inc (Ebasco, 1988). Data from these investigations were used in the preparation of this Health Assessment. The Record of Decision (ROD) was signed on September 30, 1988. Planned remediation of the site, as delineated in the ROD, includes the following:

(1) Additional ground water sampling to further delineate the leading edge of the contaminant plume and to support existing data on the contaminants of concern at the site.

(2) Extraction of contaminated ground water through pumping followed by on-site treatment and reinjection of the treated effluent into the ground. This process will continue until federal and state cleanup standards are attained to the maximum extent practicable and to insure levels are achieved that are protective of the public health.

(3) Excavation and treatment of contaminated soil to meet the New Jersey Soil Cleanup Guidelines. A soil which cannot be treated to meet these guidelines by enhanced volatilization will be taken off-site for incineration and disposal.

B. SITE VISIT

An adequate site description was obtained from the RIs and from conversations with the EPA Project Manager, Region II and the Agency for Toxic Substances and Disease Registry (ATSDR) Regional Representative. Therefore, no site visit was conducted.

ENVIRONMENTAL CONTAMINATION AND PHYSICAL HAZARDS

Elevated levels of organic and inorganic contaminants were detected in samples of subsurface soil and ground water. Concentrations of the contaminants of concern found on-site and off-site are presented in Tables 1 and 2, respectively. All ground water and soil samples collected during the P-RI were analyzed for compounds on the Hazardous Substance List (HSL) (NUS, 1986). Soil and ground water samples from monitoring wells collected for the RI were analyzed for compounds on the Target Compound List (TCL); the RI did not include analyses for TCL inorganic compounds in private and municipal wells (Ebasco, 1988). It is important to note that it has not been established if the contamination found in the TRWC wells is site-related.

A. ON-SITE CONTAMINATION

Maximum concentrations for contaminants of concern found on-site are shown in Table 1 only for ground water (monitoring wells (MW) #5, 13, 14, 15) and subsurface soils. The ground water data for inorganic compounds is based solely on samples taken from MW-5 since the other on-site monitoring wells were not sampled for inorganic chemicals. Analyses of surface soils in 1986 showed low levels of contamination that were not considered likely to be of public health concern (NUS, 1986). No on-site surface water bodies or areas of standing water were present for sampling. Eighty soil gas samples were collected in grid fashion from four to six feet depths within and just south of the site boundaries. Samples were analyzed for volatile organic chemicals (VOCs), primarily toluene, trichloroethene (TCE), and tetrachloroethene (PCE). Reported levels (in parts per million; ppm) for each of these compounds were significantly over background in only one on-site area, just east of Le-Ed's Concrete Construction Company shop building. The levels detected were: toluene, 151 ppm; TCE, 5 ppm; and PCE, 1.6 ppm. This area was consistent with the location of the former drum staging area. These data are not shown in Table 1 but are discussed under Public Health Implications. Ambient air monitoring was not performed.

B. OFF-SITE CONTAMINATION

Off-site ground water sampling data were obtained from 19 monitoring wells in Zone I and one monitoring well (TRWC-MWD) in Zone II (see Appendix II). Ground water samples were also obtained from eight residential wells (RW), three of which (Nos. 1,4, and 7) were in or immediately adjacent to Zone I, and ten municipal wells in Zone II, most of which were

TABLE I. CONTAMINANTS OF CONCERN — ON-SITE

	Maximum Contaminant Concentrations	
	SUBSURFACE SOILS[a] (ug/kg or ppb)	GROUND WATER[b] (ug/L or ppb)
Organic Compounds		
Bis(2-ethylhexyl)phthalate (BEHP)	742,064	ND[c]
N-Nitrosodiphenylamine	83	ND
Tetrachloroethene (PCE)	13,907	7
Trichloroethene (TCE)	1	9
Inorganic Compounds		
Aluminum	4,960,000	799
Cadmium	2,400	ND
Chromium (total)	46,000	98
Lead	61,000	ND

a Data for surface soils not shown. The surface soils which were backfilled in 1974 did not contain appreciable levels of contamination when sampled in 1986.

b Data for organic compounds are from monitoring wells 5, 13, 14 and 15 which sampled in the upper aquifer Data for inorganic compounds are based only on samples taken from monitoring well #5 since other on-site wells were not sampled for inorganic chemicals.

c ND = Not detected

TABLE 2. CONTAMINANTS OF CONCERN — OFF-SITE

CONTAMINANTS	Maximum Contaminant Concentrations		
	PRIVATE/MUNICIPAL WELLS[a]	GROUND WATER MONITORING WELLS[b]	
		UPPER	LOWER
	(ug/L or ppb)	(ug/L or ppb)	
Organic Compounds			
Bis(2-ethylhexyl)phthalate (BEHP)	ND[c]	29	28
N-Nitrosodiphenylamine	8[d]	6[d]	ND
Tetrachloroethene (PCE)	5	19	ND
Trichloroethene (TCE)	14	15	ND
Inorganic Compounds			
Aluminum	783	2620[e]	7
Cadmium	273[d]	6[e]	ND
Chromium (total)	ND	615	ND
Lead	58	56[e]	33[d]

a Eighteen municipal and residential wells in Zone II were sampled for organic and inorganic contaminants. Data for residential well #3 are not included in Table 2. because of probable non-site-related contamination during sampling. The latter is discussed further in the text.

b Twenty wells were monitored off-site for organic compounds. Of these, monitoring wells 1, 7, 18 and 23 monitored the lower aquifer. Monitoring wells 12-23 were not monitored for inorganic compounds.

c ND = Not detected

d Contaminant estimated or detected in only one sample or in only one well.

e Found in highest concentration in a Toms River Water Company (TRWC) monitoring well, specifically, TRWC-MWD.

south-southeast of the Reich Farm site. Surface water or sediment sampling from the intermittent stream (dry during the supplementary investigation) and the Toms River was not performed.

C. PHYSICAL HAZARDS

All drums, surface wastes and disposal trenches at the Reich Farm have been removed. Currently, the former on-site disposal areas are used for various activities associated with present commercial operations. No physical hazards are present from the previous disposal practices or wastes.

DEMOGRAPHICS OF POPULATION NEAR SITE

Land use in the general vicinity of the site is predominately commercial, residential and agricultural. Two businesses, the Le-Ed Concrete Construction Company and RDB Excavating, currently occupy a one-story building just west of the site. Heavy traffic from large commercial vehicles from these businesses occurs on and around the site. The Le-Ed Company uses some of the site for the storage of fill, stone, and sand. Within one-half mile to the east and south of the site, land use is 60 percent wooded and commercial. To the north, west, and southwest, residences occupy about 50 percent of the land use, with wooded areas and commercial buildings occupying the remaining 50 percent. Approximately 563 persons work or live within a one-quarter mile radius of the site. The population served by ground water in a three-mile radius of the site is about 106,500 persons. The nearest residence is about 1,500 feet southwest of the site.

EVALUATION

A. SITE CHARACTERIZATION (DATA NEEDS AND EVALUATION)

1. Environmental Media

The conclusions and recommendations made in this Health Assessment are based on the information and monitoring data provided. The following information and monitoring data, as detailed in this section, are needed to characterize the site and to evaluate the public health concerns completely. Additional information and monitoring data, as it becomes available, may necessitate a reevaluation by ATSDR of the public health concerns associated with the Reich Farm NPL site.

A potential exists for the migration of contaminants from subsurface soils on-site and ground water in Zone I areas to downgradient private wells located in Zone II and beyond. Hence, additional monitoring of the wells in those areas is needed to characterize completely the potential for oral and inhalation exposure to site-related contamination.

Several contaminants of public health concern were found in various TRWC drinking water wells (may not be site-related); however, since the TRWC has other wells in use, it is assumed that they blend their raw water supplies before distribution. Therefore, monitoring of the TRWC finished water quality (for the TCL compounds) is needed to determine the exact human exposure to these contaminants found in the TRWC raw water supplies. Although the monitoring data for the finished water from the TRWC water supplies were not reviewed by ATSDR, it has been determined that this monitoring is performed and that the water meets the NJDEP Maximum Contaminant Levels (MCLs) [Personal Communication, Ramona Pezzella, EPA-Remedial Project Manager (RPM), December 1, 1988].

2. Land Use and Demographics

Adequate information was available to evaluate the land use and demographics of the Reich Farm NPL site.

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

QA/QC was performed by the Environmental Protection Agency (EPA) on all of the data reviewed for this Health Assessment. Conclusions contained in this Health Assessment are based on the information received by ATSDR. The accuracy of these conclusions is dependent on the availability and reliability of the data provided.

B. ENVIRONMENTAL PATHWAYS

As a result of past disposal practices, current monitoring data, and removal actions, the only current source of on-site contamination is from subsurface soils. Elevated concentrations of VOCs, bis(2-ethylhexyl) phthalate (BEHP), N-nitrosodiphenylamine (NNDPA), and heavy metals were found in the on-site subsurface soils. As noted earlier, on-site contaminated surface soils were removed in 1974 and backfilled with "clean" soil. Surface soil monitoring data in 1986 did not indicate any appreciable concentrations of the contaminants of concern.

GROUND WATER

A hydraulicaly connected sand aquifer system (Kirkwood-Cohansey Aquifer) underlies the Reich Farm site and the hydraulically downgradient areas. The ground water flow direction in the Kirkwood-Cohansey Aquifers is towards the south-southwest, and increases from north to south, possibly because of the influence of TRWC and private wells. These wells may influence flow to other directions in localized areas. The average ground water flow velocity in the upper sand aquifer is 1.6 feet/day (Ebasco, 1988).

Because of the closure of wells in Zone I and the existence of municipal well supplies, the nearest drinking water well is located about 2,400 feet south-southwest of the site. The TRWC-MWD on Dugan Lane is about 4,100 feet south-southeast of the site. The TRWC's Parkway Station Well Field is located between 4,700 and 5,700 feet southeast of the site and it has wells screened in the Kirkwood-Cohansey aquifer system (Appendix I).

Table 2 lists the various organic contaminants and heavy metals of concern that were found in downgradient off-site ground water in the upper and lower sand aquifers. Although aluminum was detected in on-site surface soils and on-site and off-site ground water, it cannot be determined if this contaminant is related to the past disposal practices at the site. Also detected (data not shown) were elevated levels of acetone and methylene chloride in samples from wells both upgradient and downgradient from the site. It should be noted, however, that these two chemical compounds were also commonly found in sampling blanks, and may thus indicate field and/or laboratory contamination. Samples from off-site upgradient RW-7 indicated elevated concentrations of carbon tetrachloride (7 ppb) and PCE (5 ppb) suggesting the existence of an additional source of contamination located upgradient of the Reich Farm NPL Site. All of the contaminants of concern found in the downgradient off-site ground water samples were also found in on-site subsurface soils (i.e., the current source of on-site contamination).

The potential exists for additional leaching of contaminants from subsurface soil to the ground water. The on-site soils have a low organic carbon content, which could indicate greater hydrophilicity and thus increased leaching potential of BEHP and n-Nitrosdiphenylamine. Under the current hydrogeological conditions, contaminants could be transported further downgradient in both the upper and lower aquifers.

SURFACE SOIL (SURFACE RUNOFF)

Because of the removal of 12-15 feet of contaminated soil and the backfilling with "clean" soil in 1974, site-related contamination has been confined to the subsurface soils and ground water. Hence, the surface runoff environmental pathway is not likely to be a current pathway of concern. Before the 1974 removal action, surface runoff was possible, but was probably minimal because of existing surface conditions (i.e., dense forests and buildings surround the site) which are still present. These are: (1) the nearest stream or runoff channel (an intermittent stream) is 1,000 feet from the site; (2) the site is fairly level with a minimal surface gradient; and (3) the soil at the site is predominantly sand and is highly permeable. Furthermore, no evidence was found of surface runoff from the site to the wooded areas around the former disposal areas during the RIs.

AIR

The transport of site-related contamination off-site via air is not likely to be of current concern at the Reich Farm site. As previously indicated, the contamination is confined to the subsurface zones. Although some

volatilization and transport of VOCs through undisturbed soil may reach the surface zone, the levels are not likely to be appreciable. The relatively non-volatile nature of the other contaminants of concern would suggest that transport from undisturbed soil would not likely be through the air pathway.

Soil gas samples indicated elevated concentrations of toluene, TCE, and PCE in an area located immediately east of the Le-Ed's Concrete Construction Company. This area was consistent with the former drum staging area. On-site workers from the two nearby commercial operations may be involved in digging of trenches for cement truck washings in these areas. Presently, the EPA has prohibited such digging and trenching activities (Personal Communication, Ramona Pezzella, EPA-RPM, December 1, 1989). However, based on the soil gas monitoring data, if these activities were to occur, prior to the proposed remediation of subsurface soil contamination, such activities could generate elevated concentrations of VOCs and contaminated dusts and dirt. Monitoring data are not available to quantify the concentrations of any contaminants that may be entrained by these activities.

CONSUMABLE BIOTA

While it was reported that several irrigation wells may still be used for watering gardens or for other non-potable domestic purposes, current monitoring data suggest that it is unlikely that appreciable levels of contaminants would reach or accumulate in plants or animals that might serve as a food source for humans. Likewise, the air medium is not a likely source to contaminate biota in the study area. Thus, biota in the area of the site is not expected to be contaminated and is not likely to be a source of human exposure to any site-related contaminants of concern.

B. HUMAN EXPOSURE PATHWAYS

The contamination of the environmental media previously identified in the Environmental Pathways Section, constitute the following potential human exposure pathways:

1. Ingestion of contaminated ground water from residential wells.

2. Inhalation of VOCs and dermal and oral exposure to contaminants from subsurface soils as a result of on-site remedial activities.
3. Dermal contact with and inhalation of contaminants present in ground water during domestic non-potable usage (bathing, showering, dishwashing, etc.).

PUBLIC HEALTH IMPLICATIONS

The public health implications resulting from exposure to contaminants found on-site and off-site during the two RIs are discussed below according to the human exposure pathways outlined above.

1. Ingestion of contaminated ground water from off-site residential wells.

The contaminants discussed below were identified in residential (and municipal monitoring wells) at levels that are considered to be of potential public health concern.

a. Lead

Maximum reported lead concentrations of 58 and 56 ppm were reported in downgradient off-site TRWC wells No. 20 and TRWC-MWD, respectively. Furthermore, of the sixteen municipal and residential wells sampled for inorganic contaminants, seven contained lead (range 8.4-58 ppb). The concentrations of lead in these wells exceeded EPA's proposed Maximum Contaminant Level (PMCL) of 5 ppb for drinking water, at the point where the water enters the municipal distribution system (EPA, 1988).

Although lead was not detected in the on-site MW-5 sampled for inorganic compounds, elevated levels were found in one or more samples of subsurface soils, being detected in 26 of 99 on-site soil borings at concentrations ranging from 3-61 ppm. The 61 ppm level is twofold greater than the typical median concentration of lead (29 ppm) in soils (Bowen, 1979) and fourfold higher than reported mean ambient levels (14 ppm) in eastern soils (Geological Survey Study, 1975).

Recent data and reports (ATSDR, 1988 a,b) indicate that chronic low level lead exposure, such as might occur from contaminated drinking water, may result in toxicities manifested by subtle neurological effects (deficiencies in learning ability and decreased intelligence quotients (IQ)), renal effects, increased blood pressure, and hematological effects (altered heme synthesis). The developing fetus, neonates, and young children appear to be particularly sensitive to the neurological effects of lead. Other potential effects from lead exposure include reduced growth in young children, reduced birth weights and delivery of preterm infants. Encephalopathy, frank anemias and renal toxicity (interstitial nephropathy) could occur following exposures to lead but are usually associated with lead levels which are greater than those likely to be present in municipally supplied drinking water. Presently, evidence is not sufficient to evaluate lead as a human carcinogen. Any health implications from lead exposure at this site would of course depend on many factors including nutrition, health status and actual exposure conditions.b.

Carcinogens

Several carcinogenic substances were identified in ground water on-site and off-site. Although the substances discussed below have characteristic toxicities in addition to cancer, the exposure concentrations needed to produce such effects are generally considered, based on results from

animal experiments and human exposure histories, to be many orders-of-magnitude higher than presently detected in ground water on and in the vicinity of the site. Similarly, doses of the detected carcinogens that produce cancer in animals and from which federal water guidelines and standards are developed (i.e., risk estimates) are generally very much higher than the levels present in site-related ground water. However, because of the prevailing non-threshold concept for cancer, the fact that present animal testing protocols may not be able to discern subtle noncarcinogenic effects, and because of the large uncertainties and inadequacies of the current toxicological information on many of these substances, monitoring for these compounds is recommended. The discussions below will focus primarily on the cancer potential of the compounds of concern.

Trichloroethene (TCE)

Maximum ground water concentrations of TCE detected in monitoring wells on-site (MW-5, 9 ppb), and off-site (MW-6, 15 ppb) during the two site investigations exceed EPA's current MCL (5 ppb). TCE levels in off-site downgradient monitoring wells, including MW-6, ranged from 2-15 ppb. Levels detected in municipal wells (TRWC #26, 27 and 28), during the 1986 sampling, ranged from 1 to 2.3 ppb. However, recent sampling (1988) indicates maximum levels of 14 ppb have now been detected in TRWC #26 while levels ranging up to 3.4 ppb of TCE were found in TRWC wells #28 and 29.

TCE is carcinogenic in animals following long-term oral exposures. Hepatocellular carcinomas have been observed in mice, while in the rat, kidney adenocarcinomas, testicular Leydig cell tumors, and some evidence of leukemias have been reported (ATSDR, 1988c). Human epidemiologic data have largely failed to show a relationship between TCE exposures and cancer. On the basis of animal studies, EPA has classified TCE as a probable human carcinogen (Group B2). However, many uncertainties exist. These include uncertainties about any interactive effects of TCE with other carcinogens and toxicants, a number of which are present in ground water impacted by this site and uncertainties related to the effects of the differences in metabolism of TCE by humans and animals. Thus, while the available human data do not allow definite conclusions concerning the carcinogenic potential of TCE in humans, animal studies suggest that long-term oral exposure to TCE-contaminated ground water at this site could be a potential public health concern.

Bis(2-ethylhexyl)phthalate (BEHP)

BEHP was ubiquitous in subsurface soils and was detected in off-site upgradient and downgradient monitoring wells and in both the upper and lower aquifers. One sample indicated levels as high as 2,200 ug/L. Although this level exceeds by greater than 40-fold the water solubility limits of BEHP (50 ug/L, 20°C) (ATSDR, 1987a), the presence of organic solvents such as TCE and PCE can greatly increase the water solubility limits of phthalates, such as BEHP. Such an effect would tend to increase

the mobility of BEHP. Whether or not soil-adsorbed BEHP is leaching and migrating into ground water in appreciable amounts remains to be determined.

In laboratory studies, BEHP has caused cancer in rats and mice, liver toxicity, damage to the male reproductive system, birth defects and altered fertility (ATSDR, 1987a). The levels of BEHP to which humans might be exposed at this site are probably not a concern with regards to noncarcinogenic toxicities. However, these levels are of potential concern for increased risk of cancer following long-term exposure, particularly if consumed in combination with other potential carcinogens.

Cadmium

Cadmium was not detected in on-site surface soils or in the one ground water monitoring well on-site (MW-5) that was sampled for inorganic chemicals. However, the element was detected in five of 104 on-site soil boring samples at concentrations ranging from 1-2.4 ppm. Although soil levels of cadmium do vary, the 2.4 ppm concentration exceeds reported median and mean concentrations of 0.5 ppm and 1 ppm for eastern soils, respectively (Bowen, 1979; Geological Survey Report, 1975). Cadmium was also detected in two downgradient wells; one private well (RW-8, 273 ppb) and one off-site monitoring well (TRWC-MWD, 6 ppb). These levels of cadmium detected in these off-site downgradient wells exceed EPA's Proposed Maximum Contaminant Level Goal (PMCLG) of 5 ppb and as such are considered a potential public health concern if lifetime ingestion of cadmium occurs via drinking water. However, human exposure to cadmium at these levels is not likely. RW-8 was, in the past, used to fill a community center swimming pool and has not recently been used as a potable water source. Indeed, EPA has indicated that this well is no longer in service (REF).

Cadmium is relatively well absorbed orally, and is sequestered and concentrated in the body, primarily in the kidneys and liver (ATSDR, 1987b). Chronic oral exposure to cadmium is carcinogenic to animals and probably to humans by the inhalation route. EPA has classified cadmium as a probable human carcinogen (Group B1) following chronic inhalation. However, the data are not sufficient to consider cadmium carcinogenic to humans by the oral route. Chronic oral exposure to elevated cadmium levels may result in other toxicologic effects including, primary renal disease (decreased tubular resorption), renal changes prior to and concominant with tubular resorption (beta 2-microglobulinemia, altered calcium excretion, enzyme changes, and cellular alterations) and secondary skeletal defects (osteoporosis, osteomalacia, spontaneous fractures) as a result of prolonged renal calcium loss. Results of animal studies suggest that oral exposure to cadmium may also alter immune responses and produce hypertension. However, these latter effects of cadmium have not been confirmed in human populations exposed to elevated levels of cadmium (ATSDR, 1987b). Nonetheless, the potential long-term oral exposure to cadmium concentrations detected in ground water monitoring wells, if

present in residential wells, could be considered a potential public health concern.

Tetrachloroethene (PCE)

The maximum ground water levels of PCE (19 ug/L) detected in a downgradient off-site monitoring well (MW-4) exceeds EPA's guidance level of 10 ug/L (ATSDR, 1988c). Although the available human data do not allow definite conclusions concerning the carcinogenic potential of PCE in humans, results of animal studies suggest an increased carcinogenic risk to humans following long-term (lifetime exposures) oral exposure to PCE-contaminated ground water.

PCE has produced hepatocellular cancer in animals following chronic oral administration and is, therefore presumed to be a human carcinogen. EPA currently has classified PCE as a Probable Human Carcinogen (Group B2) although the overall weight of evidence is currently under review. With respect to noncarcinogenic toxic properties, PCE can, at levels much higher than expected to be encountered at this site, produce a variety of acute and chronic effects. However, in general, PCE is considered relatively nontoxic to humans when given orally, and in the past, was used clinically as an antihelmenthic (a drug to remove intestinal, parasitic roundworms). The doses usually ranged from 2.8 -4 ml of undiluted PCE (60-86 mg PCE/Kg body weight, assuming 70 Kg average human body weight). At these relatively high, acute exposure levels, some central nervous system effects similar to alcohol inebriation have been reported. Signs and symptoms of liver and kidney dysfunction have also been observed in humans following inhalation exposures to elevated levels of PCE (ATSDR, 1987c).

N-Nitrosodiphenylamine (NNDPA)

N-nitrosodiphenylamine levels were detected in the off-site ground water at concentrations of 6 to 8 ug/l (8 ug/l in TRWC #23 and 6 ug/l in MW-6). These levels are of public health concern with respect to potential carcinogenic effects following chronic oral exposure.

One study in rats, in which an increased incidence of bladder transitional cell carcinomas was detected in female rats following chronic exposure to NNDPA, suggests that this compound may be a bladder carcinogen in humans. Results from other rat bioassays and all mouse bioassays conducted to date have been negative. Concern about this compound arises from the fact that it is structurally similar to other carcinogenic nitrosamines (ATSDR, 1987d).

Chromium

Levels of chromium in subsurface soils ranged from 1-46 ppm. The maximum detected level (46 ppm) exceeds the mean value for eastern soils (36 ppm). Chromium was detected in ground water on-site (MW-5, 98 ppb), and off-site in one upgradient well (MW-2, 236 ppb) and two downgradient wells

(MW-3, 445 ppb and MW-4, 615 ppb). The levels of chromium detected in these wells exceed the EPA's MCL of 50 ppb. Several chromium compounds are carcinogenic by the inhalation route, and workers in chromate production have developed lung cancers. To date however, there is no evidence that chromium (hexavalent) is carcinogenic by the oral route. Chromium (III) is considered to be an essential nutrient in the diet and ingestion of chromium (total) up to 500 ug/day has been estimated to be safe and adequate (ATSDR, 1987e). Chronic oral studies of chromium compounds in animals have not identified toxicological endpoints despite rather high administration levels (ppm range). Presently, there does not appear to be any health concern with respect to the levels of chromium detected in ground water in the study area.

c. Aluminum

Levels of aluminum in on-site and off-site ground water sampled in monitoring and other wells in the study area ranged from 23-2,620 ug/L which are within normal background ranges (DWH, 1982). Currently, there is no Federal guidance regarding aluminum concentrations in water supplies, although guidelines are to be established in August 1989, with a standard scheduled for promulgation by 1991.

In general, aluminum is relatively nontoxic and at the concentrations found at this site is not likely to be a public health concern. However, for individuals on kidney dialysis, the levels of aluminum detected in ground water at this site could pose a problem unless certain precautions are taken. Some nephrologists believe that levels of aluminum above 50 ug/L may lead to dialysis dementia, osteomalacia fractures and myopathy. There is some evidence to support this association. Therefore, nephrologists have recommended that water being used for dialysis be prepared by softening, followed by treatment with reverse osmosis and then deionization. (DWH, 1982).

d. Other Contaminants

A number of pesticides and SVOCs were initially reported in ground water samples obtained from RW-3. Examples of some compounds in the sample were: pentachlorophenol (54 ppb), n-NNDPA (120 ppb), isophorone (58 ppb), and heptachlor epoxide (22 ppb). A duplicate sample, taken at the same time, failed to confirm the presence of those contaminants. A recent sample (taken in 1988) of the well also failed to detect any contamination (Ebasco, 1988). Contamination of the original sample is suspected; hence, there will be no further discussion of the compounds found in RW-3. Similarly, acetone was detected in several samples at rather elevated concentrations including one sample from an off-site downgradient monitoring well (MW-10) that showed a concentration of 74,000 ppb. It should be noted, however, that acetone was also present in several blanks at concentrations as high as 3,500 ppb, thus indicating possible laboratory and/or field contamination. In general, acetone is not overly toxic, and anyone using water with such elevated levels of acetone would likely detect odor or taste changes, and thus be reluctant to use the water.

As noted previously, contaminants of potential public health concern are present in the on-site and off-site ground water and at levels that on long-term exposure are considered a potential health concern. However, based on current monitoring data and information, no documented exposure appears to be occurring. The contaminants cadmium, lead, NNDPA, and TCE that were found in the TRWC municipal drinking water wells were at concentrations of potential public health concern; however, since the TRWC has additional wells used for potable water supplies it is assumed that water is blended before distribution, hence, the exact contaminant exposure concentrations could not be determined. Likewise, since complete monitoring data from off-site downgradient private drinking water wells located in Zone II were not available, the extent of exposure to the contaminants of concern in the ground water by these residents could not be determined.

2. Inhalation of volatile organic compounds and dermal and oral exposure of contaminants from subsurface soils as a result of on-site trenching and digging operations.

Approximately six subsurface locations were found in which total VOCs exceeded 1,000 ppb. Furthermore, soil gas samples taken at 4-6 feet indicated elevated levels of toluene (340 ppm) and the carcinogenic substances PCE (3.4 ppm = 23.4 mg/m^3) and TCE (5.5 ppm = 30.0 mg/m^3). The latter concentrations of PCE and TCE are a health concern because of their theoretical potential to cause cancer in humans. The maximum concentration of toluene is less than the Occupational Safety and Health Administration's (OSHA) standard for a 10 minute peak exposure (500 ppm) but is greater than OSHA's 8-hour time-weighted-average (TWA) of 200 ppm and its 300 ppm Ceiling Limit. These toluene standards are intended to prevent short-term and long-term central nervous system (CNS) effects and long-term liver and kidney effects following inhalation. It should be reemphasized that actual ambient air levels over the site were not measured. Based on the fact that elevated levels of potentially carcinogenic compounds were detected in subsurface soils and in soil gases, a potential exists that on-site remedial and current on-site workers could be exposed to air concentrations of contaminants or to contaminated dusts at levels of public health concern. However, following EPA's proposed remediation of the on-site surface soils, human exposure to contaminants via this pathway should not occur and therefore will not be a public health concern. In the interim, EPA has prohibited any non-remedial digging and trenching activities on-site. Use of proper protective gear and adherence to appropriate work-related safety standards should reduce or eliminate any potential health concerns during the future remediation of this site.

3. Dermal contact and inhalation of contaminants present in ground water during non-potable domestic (eg., bathing, showering, dishwashing, toilet flushing, cleaning, swimming) and agricultural (crop irrigation) uses.

Dermal absorption or contact with the levels of contaminants identified in ground water samples on-site and in the vicinity of the site does not appear to pose a public health concern.

Significantly elevated indoor air levels of PCE and TCE can occur as a result of volatilization in homes that use water supplies contaminated with these compounds For example, experiments conducted in two homes using water contaminated with 40 ppm (40,000 ug/L) of TCE, a running shower was found to elevate TCE levels in the bathroom from less than 0.5 mg/m^3 to 81 mg/m^3 (14.8 ppm) within 30 minutes (ATSDR, 1988c), a level which was less than the National Institute for Occupational Safety and Health's (NIOSH) recommended workplace standard of 25 ppm (136.5 mg/m^3) but above EPA's 10^{-6} excess cancer risk level which assumes lifetime 24 hour exposures. Similar results have been observed with PCE (1987c). With regards to the present site, the maximum ground water concentrations of TCE and PCE are in the low ppb range, and are not likely to be of human health concern during indoor, non-potable domestic use nor during outdoor use for agricultural or other uses (eg., swimming, car washing).

CONCLUSIONS AND RECOMMENDATIONS

Based on the data needs in the Site Evaluation Section and the public health concerns associated with the Reich Farm NPL site, the following conclusions and recommendations are made:

1. This site is of potential public health concern because of potential exposure to hazardous substances at levels that may result in adverse health effects over time. As noted above in Human Exposure Pathways Section, human exposure to various VOCs, SVOCs and heavy metals may be occurring via oral or dermal exposure to contaminated ground water, inhalation exposure to VOC-contaminated air or contaminants entrained in dusts during various activities by on-site workers. However, the likelihood of this exposure is minimal because the EPA has prohibited any trenching or digging activities by the current on-site workers. Cadmium, lead, TCE, and NNDPA are present in the TRWC municipal drinking water wells (may not be site-related) at concentrations of public health concern. However, the finished water (that is, blended water) from the TRWC is monitored and does meet the NJDEP MCLs. Various contaminants of public health concern are present in the on-site and off-site ground water; however, because of the lack of complete monitoring data from the Zone II private drinking water wells, this potential human exposure pathway and public health implications cannot be defined completely.

2. The planned remedial actions delineated in the ROD appear to be protective of public health.

3. Additional monitoring (for the TCL compounds) is needed for the private wells located in Zone II, and other potentially affected areas, on

a periodic basis (at least quarterly) to determine the extent of contamination migration and to evaluate this potential human exposure pathway.

4. Personnel involved in on-site construction or remediation activities should be informed of the public health concerns, wear appropriate protective gear and adhere to all relevant worker-safety standards and regulations.

5. In accordance with the Comprehensive Environmental Response, Compensation, Liability Act of 1980 (CERCLA), as amended, the Reich Farm NPL site has been evaluated for appropriate follow-up with respect to health effects studies. Since there is insufficient information to evaluate the potential pathways of human exposure, no health study recommendation can be made at this time. If data become available suggesting that human exposure to significant levels of hazardous substances is currently occurring, ATSDR will re-evaluate this site for any indicated follow-up.

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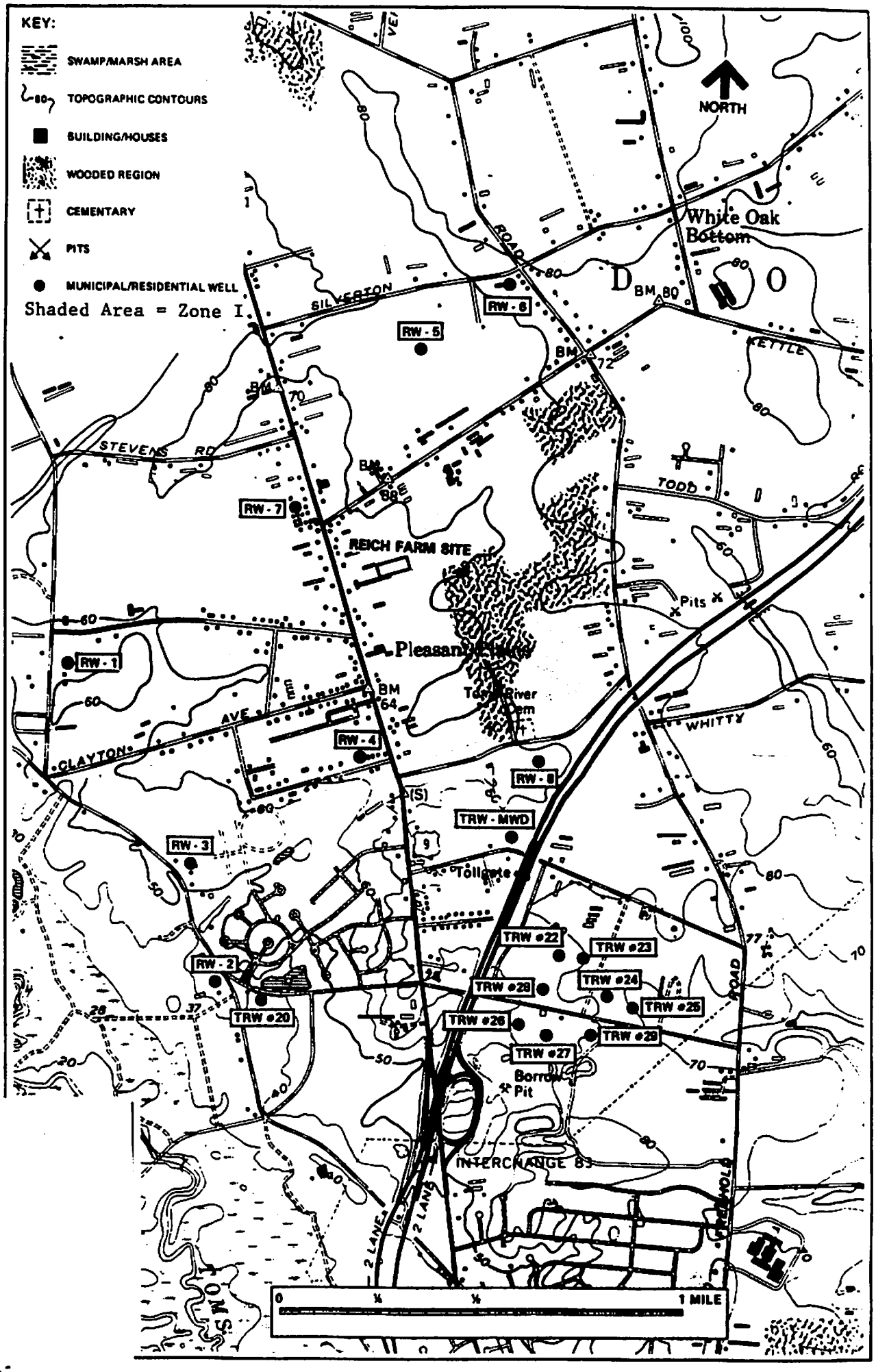
APPENDICES

I. Reich Farm NPL Site Area Map

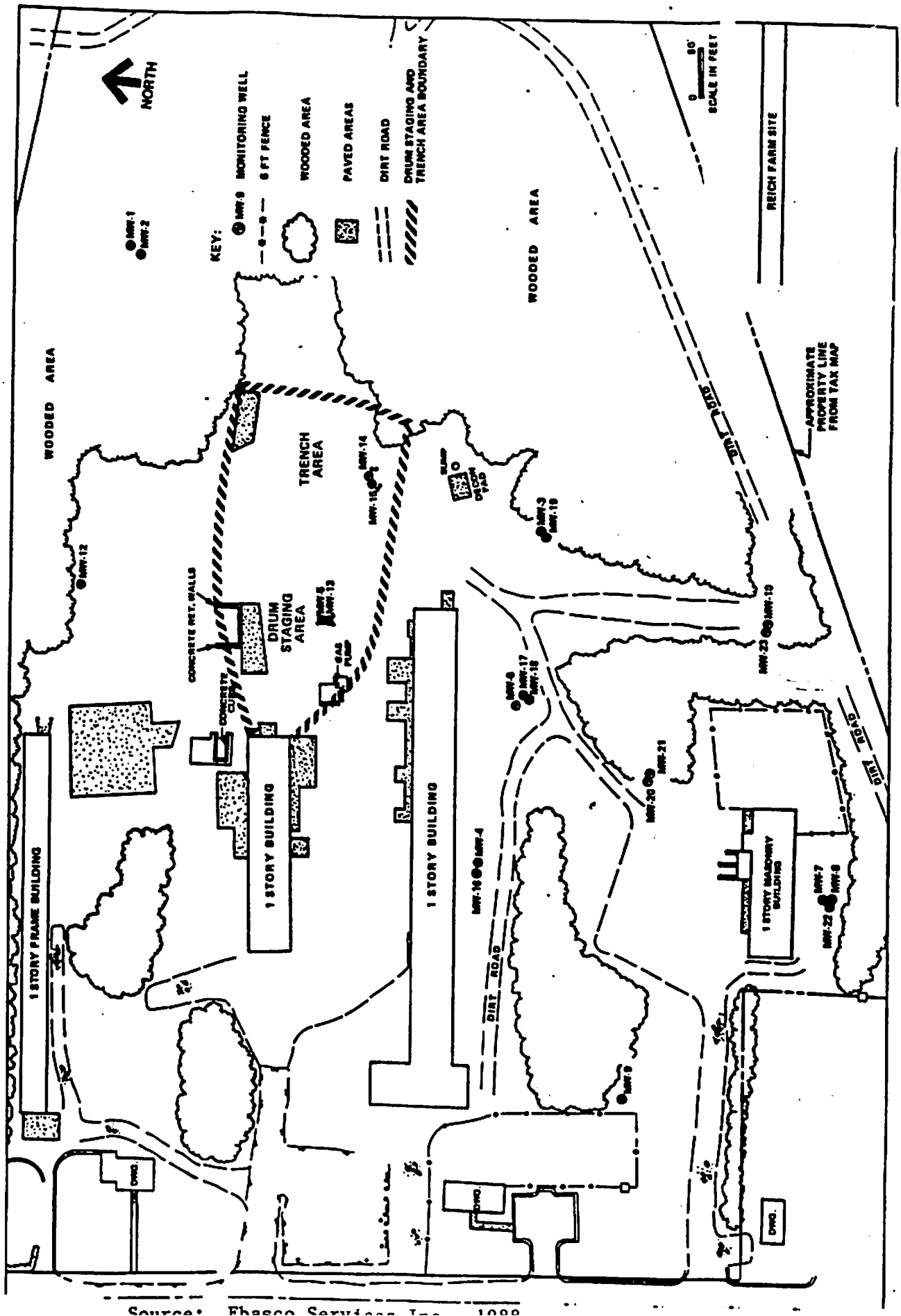
II. Reich Farm NPL Site Monitoring Well Map

Appendix I: Reich Farm NPL Site Area Map



Source: Ebasco Services Inc., 1988

Appendix II: Reich Farm NPL Site Monitoring Well Map



Source: Ebasco Services Inc., 1988