Health Consultation

AAF – MCQUAY INCORPORATED SITE
(aliases – SNYDER GENERAL AND MCQUAY INTERNATIONAL)

FARIBAULT, RICE COUNTY, MINNESOTA

EPA FACILITY ID: MND006151344

FEBRUARY 5, 2003

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation 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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Prepared by:

Minnesota Department of Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

FOREWORD

This document summarizes public health concerns at a hazardous waste site in Minnesota. It is based on a formal site evaluation prepared by the Minnesota Department of Health (MDH). A number of steps are necessary to do such an evaluation:

- Evaluating exposure: MDH scientists begin by reviewing available information about environmental conditions at the site. The first task is to find out how much contamination is present, where it's found on the site, and how people might be exposed to it. Usually, MDH does not collect its own environmental sampling data. We rely on information provided by the Minnesota Pollution Control Agency (MPCA), the U.S. Environmental Protection Agency (EPA), and other government agencies, businesses, and the general public.

- Evaluating health effects: If there is evidence that people are being exposed - or could be exposed - to hazardous substances, MDH scientists will take steps to determine whether that exposure could be harmful to human health. The report focuses on public health - the health impact on the community as a whole - and is based on existing scientific information.

- Developing recommendations: In the evaluation report, MDH outlines its conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. The role of MDH in dealing with hazardous waste sites is primarily advisory. For that reason, the evaluation report will typically recommend actions to be taken by other agencies including EPA and MPCA. However, if there is an immediate health threat, MDH will issue a public health advisory warning people of the danger, and will work to resolve the problem.

- Soliciting community input: The evaluation process is interactive. MDH starts by soliciting and evaluating information from various government agencies, the organizations responsible for cleaning up the site, and the community surrounding the site. Any conclusions about the site are shared with the groups and organizations that provided the information. Once an evaluation report has been prepared, MDH seeks feedback from the public. *If you have questions or comments about this report, we encourage you to contact us.*

Please write to: Community Relations Coordinator
Site Assessment and Consultation Unit
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(toll free call - press "4" on your touch tone phone)

I. Summary of Background and History

The AAF - McQuay Inc. site (the site) is located at 300 24th Street NW in Faribault, Minnesota. The site occupies approximately 37 acres and consists of a single 240,000 square foot manufacturing building and associated parking and landscaped areas. AAF - McQuay Inc. manufactures heating and air conditioning units for commercial and industrial applications. The site is located in an area of mixed property use including agricultural, commercial, industrial, and residential properties. The site is located approximately 1,000 feet west of the Cannon River. A map showing the location of the site is presented in Figure 1.

A release of 1,1,2-trichloroethylene (TCE) at the site was first identified in 1994 when six soil borings were advanced, and four of the borings converted to groundwater monitoring wells as part of a due diligence investigation conducted for a pending ownership change (ENSR 1994). TCE contamination was found in groundwater beneath the site at relatively high levels in three of the four monitoring wells. Due to the discovery of the TCE contamination at the site in 1994, it was entered into the Minnesota Pollution Control Agency's (MPCA) Voluntary Investigation and Cleanup (VIC) Program under the name "Snyder General" (MPCA Project Number 4840). MDH has reviewed site documents prepared to date along with the results of recent groundwater monitoring in order to develop conclusions and recommendations regarding the site and its potential public health impacts. MDH has been involved for some time with groundwater quality issues in Faribault due to the presence of TCE contamination in the municipal water supply wells (itself a state Superfund site; MDH 1997 and 1998), as well as another solvent release site in the city, the Nutting Truck and Caster Company (MDH 2000). The AAF - McQuay Inc. site was briefly mentioned in the 1997 MDH Health Consultation on the Faribault Municipal Well Field.

The AAF - McQuay Inc. facility was originally constructed on undeveloped land in 1966. The company already was operating at another facility in Faribault, located at 1701 NW 4th Street, and consolidated its operations at the current location in 1969. The site has been served by municipal water and sewer service since its construction. No underground storage tanks were ever located at the property. Eight above ground storage tanks (ASTs) have served the facility, however. The eight ASTs were as follows (MPCA 1990):

Table 1: Above Ground Storage Tanks

Tank	Product Stored	Capacity (gallons)	Throughput Per Month (gal)	Dates in Operation
1	Trichloroethylene	4,000	683	1970-1993
2	Trichloroethylene	2,750	454	1966-1993
3	Trichloroethylene	1,000	229	1972-1993
4	Propane	30,000	1,100	1968-
5	Propane	30,000	1,100	1970-
6	Propane	30,000	1,100	1974-
7	Freon 22	5,500	1,375	1966-
8	Gasoline	300	75	1967-

TCE tanks two and three were located inside of the building on a cement surface, while TCE tank number one was located outside of the building, on the east side. This tank was the only tank located within a concrete secondary containment structure. An underground piping system (reportedly "double contained") was used to transfer the TCE to the inside of the plant, where it was distributed to vapor degreasers via overhead pipes (ENSR 1994).

As a part of its expanded operation, the company had installed two vapor degreasers inside the plant. A large conveyor-fed fin degreaser was installed in March 1969, and was located near the eastern wall of the building in the assembly area. A batch operated vapor degreaser was installed in June of 1970 in the tubing area, and was located near the center of the "ell" of the building. A site plan with the locations of the vapor degreasers as well as the outdoor TCE tank are shown in Figure 2. The two TCE tanks located inside the building may have been located near the vapor degreasers. Vapor degreasing using TCE occurred at the site from March of 1969 until December of 1993 when it was discontinued. AAF - McQuay Inc. reported using 19,950 pounds of TCE in 1993 (ENSR 1994). Data from the MPCA AST reporting form for 1990 stated a monthly throughput of 1,366 gallons of TCE per month for the three TCE tanks (MPCA 1990).

Data from the U.S. Environmental Protection Agency's (EPA) Toxic Release Inventory database indicates that the AAF - McQuay Inc. facility released much higher quantities of TCE into the air from 1988 (when TRI data was first reported) until 1992 (EPA 2002a):

Table 2: TRI Data for TCE, 1988-1993

Year	Total Air Emissions of TCE, in pounds
1988	133,632
1989	88,632
1990	88,632
1991	88,768
1992	82,980
1993	6,611

The TRI data for 1993 indicates that of a reported 19,950 pounds of TCE used at the facility (presumably in the vapor degreasers), 6,611 pounds (33%) were released to the air. The TRI data also implies that significantly higher quantities of TCE may have been used in the vapor degreasers over the period of 1969 – 1992 than was reported for 1993, and that a larger quantity of TCE may have been released into the air on an annual basis. There were no reported releases to other media (soil, water) in the TRI database.

In 1992, the MPCA received a citizen complaint alleging that AAF - McQuay Inc. had suffered a spill from one of its vapor degreasers that was not reported to authorities or evaluated (MPCA 1992). It was not reported which of the two vapor degreasers suffered the spill. The company's response to the MPCA's enforcement letter on the subject was that the "alleged spill was actually water, from a hose connected to city water, that was being used to wash the degreaser" (ENSR

1994). There was no further explanation provided in the ENSR document as to whether or not the water was contaminated with solvent residues or sludge from the degreaser, where the water went, or how it was managed.

Geology/Hydrogeology

There are four aquifers beneath the site. The uppermost layer (known as glacial till) is composed of intermixed sand and silty sand that was deposited during the last glacial period. The glacial till is approximately 25 to 35 feet thick at the site, and water is typically encountered at eight to ten feet below the ground surface (CORR 1997). Below this is the St. Peter sandstone aquifer, which is composed of a fine to medium grained sandstone. Near the base of the St. Peter sandstone there is often a clay zone that, when present, can impede (but does not prevent) vertical movement of groundwater. This clay zone has not been encountered at the site, and in fact the St. Peter sandstone has not been observed consistently across the site (ENSR 1995a). Where it has been observed, it is up to 20 feet thick (CORR 1997). Below the St. Peter are the Prairie du Chien dolomite (limestone) and the Jordan sandstone, which together make up the important regional aquifer. Based on the static water level results from monitoring wells at the site, groundwater flow in the glacial till is generally east, towards the Cannon River.

Groundwater flow in the St. Peter formation is towards the east-southeast, towards the Cannon River. According to the consultant for the site owner, flow direction in the St. Peter may be influenced by local geologic features or by the Cannon River (CORR 2002A). The flow direction in the Prairie du Chien at the site is not definitively known due to the fact that only one (possibly two) monitoring well has been installed in the Prairie du Chien, but is likely to also be toward the Cannon River. Because the St. Peter and Prairie du Chien / Jordan formations are interconnected, groundwater flow may be influenced by nearby pumping wells. Groundwater flow on a more localized scale may also vary significantly due to the karstic nature (defined by small cave like openings) and fracture systems of the Prairie du Chien aquifer. These fractures and karstic openings tend to concentrate groundwater flow into narrow openings that can be both vertically and horizontally extensive. As a result the groundwater flow can be concentrated in narrow openings at unknown locations causing unpredictable flow rates and directions. The concentrated groundwater flow in these narrow openings can make it extremely difficult to identify contaminant sources and plume directions based on monitoring well data. Unless the monitoring well is fortuitously placed, the contaminant plume may side-step an otherwise well-placed monitoring well network through a narrow flow channel.

Several investigations have been conducted in and around the site to identify the extent of the TCE contamination in soil and groundwater. A summary of the data collected during the various investigations follows below.

Soil Investigations

Six soil borings were advanced at the site in 1994 as a part of the original due diligence investigation (ENSR 1994). Four of the soil borings became monitoring wells one through four (MW-1 to MW-4). The remaining two borings were drilled between the location of the TCE storage tank (shown in Figure 2) and the east side of the building where the underground TCE pipeline was located. Soil samples collected from the six soil borings were analyzed for volatile organic compounds (VOCs). No VOCs were detected in any of the soil samples, although the laboratory detection limits were slightly elevated.

In 1995, eight soil probes were drilled using push-probe technology to depths of 13 to 21 feet on the east side of the building in an attempt to identify the source of the TCE contamination (ENSR 1995a). Soil samples were collected and screened at 2-foot intervals; typical sample depths were 3 to 5 feet, 8 to 10 feet, and 13 to 15 feet below ground. A total of 23 soil samples from the eight borings were analyzed on-site for VOCs using field laboratory equipment. Three samples were also sent off-site to a fixed laboratory for quality control purposes. The locations of the soil borings are shown in Figure 3. No VOCs were detected in any of the soil samples analyzed. Based on the findings of the soil investigation, the 1995 ENSR report stated that the source of the TCE contamination had not been identified but was "believed to exist beneath the McQuay building" (ENSR 1995a).

Groundwater Investigations
In 1995, ten push probes (MT-15 through MT-24) were advanced in a north-south line to the east of the site, between 2nd Avenue Northwest and the Cannon River. Groundwater samples were collected from the glacial till aquifer, and analyzed for the presence of VOCs. VOCs (primarily TCE) were detected in seven of the ten groundwater samples, with the highest concentrations of TCE being found in probes MT-17 and MT-18 (ENSR 1995a). No VOCs were detected in probes MT-22, MT-23, and MT-24, at the south and north ends of the line of probes. One other VOC, cis-1,2-dichloroethylene (cis-1,2-DCE), was also detected in several of the groundwater samples. Cis-1,2-DCE is a common breakdown product of TCE. Data from the groundwater probe analysis was as follows:

Table 3: Groundwater Probe Sample Data

Probe Number	**Concentration in micrograms per liter (µg/L)**	
	TCE	**Cis-1,2-DCE**
MT-15	*9.6*	<1.0
MT-16	22	9.8
MT-17	*36*	3.4
MT-18	*37*	4.2
MT-19	2.9	5.1
MT-20	3.6	<1.0
MT-21	2.4	<1.0
MT-22	<1.0	<1.0
MT-23	<1.0	<1.0
MT-24	<1.0	<1.0
MDH HRL*	30**	70

* Minnesota Department of Health, Health Risk Limit

** The interim recommended exposure limit for TCE is 5 µg/L.

Result in *italics* indicates exceeds the interim exposure limit for TCE.

Bold italics indicates exceeds both the Health Risk Limit (HRL) and the interim exposure limit for TCE. The results of the push probe investigation indicated that a plume of TCE and its associated breakdown products was present within the glacial till aquifer and extended to the east and southeast of the site. The concentration of TCE in groundwater in the glacial till aquifer exceeded the MDH HRL for TCE of 30 micrograms per liter (µg/L) in probes MT-17 and MT-18, and exceeded the MDH interim recommended exposure limit for TCE of 5 µg/L in probes MT-15 through MT-18. A description of groundwater quality standards and criteria for TCE is presented in the Discussion section below.

Since 1994, a total of 20 monitoring wells have been installed at and around the site to evaluate groundwater quality. The monitoring wells are completed in the glacial till, St. Peter, and Prairie du Chien aquifers. Some of the monitoring wells have been sealed and are no longer in operation. The monitoring well locations are shown in Figure 5. Historical groundwater monitoring data for the monitoring well network is presented in Appendix 1. The monitoring well identifications, Minnesota unique well numbers, depth, geologic formation completed in, and status are as follows:

Table 4: Monitoring Wells

Well Number	Unique Well No.	Date Installed	Total Depth (feet)	Geologic Formation	Status
MW-1	540860	1994	24	Glacial Till	Sealed
MW-2	540861	1994	26	Glacial Till	Active
MW-3	540862	1994	26	Glacial Till	Inactive
MW-4	540863	1994	18	Glacial Till	Sealed
MW-5	541384	1995	14	Glacial Till	Sealed
MW-6	541385	1995	23	Glacial Till	Sealed
MW-7	543237	1995	25	Glacial Till	Active
MW-8	558180	1995	20	Glacial Till	Sealed
MW-9	558191	1995	44	St. Peter	Active
MW-10	558179	1995	14	Glacial Till	Active
MW-11	552368	1995	71	Prairie du Chien	Active
MW-12	578653	1996	32	Glacial Till	Active
MW-13	578651	1996	30	Glacial Till	Active
MW-14	578652	1996	21	Glacial Till	Inactive
MW-15	575887	1996	21	Glacial Till	Sealed
MW-16	598540	1997	40	St. Peter	Active
MW-17	598541	1997	50	St. Peter	Active
MW-18	617214	1998	63	St. Peter*	Active
MW-19	617215	1998	53	St. Peter	Active
MW-20	617216	1998	53	St. Peter	Active

* MW-18 may be completed in the upper Prairie du Chien formation.

The most common VOCs detected in the monitoring well network include TCE, 1,1-dichloroethylene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), 1,1,1-trichloroethane (1,1,1-TCA), cis-1,2,-DCE, and vinyl chloride. The other VOCs are either breakdown products of TCE, or common solvents that may be present along with TCE in commercial solvent mixtures. Low levels of other VOCs were also detected at various times and locations as described in the notes at the end of Appendix 1.

The highest concentrations TCE found historically were in monitoring wells MW-1 (250 µg/L in 1994), MW-2 (710 µg/L in 1994), MW-9 (130 µg/L in 1996), and MW-13 (168 µg/L in 1997). Concentrations of TCE have declined in most wells since 1994. Concentrations of TCE continue to exceed the MDH recommended exposure limit (as of July 2002; CORR 2002a) in MW-2 (7.8 µg/L), MW-7 (13.9 µg/L), MW-11 (8.8 µg/L), and MW-12 (20.4 µg/L). The only historical detections of vinyl chloride, the most toxic breakdown product of TCE, occurred in MW-9, with the highest concentration, 1.7 ppb, detected in 1995. The laboratory detection limits for vinyl chloride have in all cases exceeded the HRL of 0.2 µg/L, however.

The groundwater monitoring results confirm that a release of TCE and perhaps other VOCs occurred at the site at some time in the past. Levels of TCE continue to exceed the MDH recommended exposure limit in four monitoring wells. Contamination is present in the glacial till, St. Peter, and Prairie du Chien aquifers, and in the case of the glacial till and St. Peter aquifers extends to the east and southeast towards the Cannon River. Levels of TCE in the Prairie du Chien well (MW-11) have fluctuated since 1995, but overall appear to be slowly rising and now exceed the MDH recommended exposure limit.

In 1995, ENSR conducted a residential well survey in the vicinity of the site (ENSR 1995a). Personal interviews were conducted at 16 residences to determine if private wells existed in the area. The survey identified three private wells that were in use as potable water supplies, and three that were not being used. One of the six wells was identified as a domestic well that was not in use, but the residence was reportedly not connected to city water so it is unclear what source of water this home was using. The remaining five wells were subsequently sampled by ENSR. The samples were collected directly from the well itself. VOCs were found in two of the five wells, at levels exceeding the HRLs, as follows (ENSR 1995a):

Table 5: 1995 Private Well Sample Results, µg/L

Well Name	Well Depth (feet)	Sample Date	1,1-DCE	1,1-DCA	1,1,1-TCA	TCE	Cis-1,2-DCE
Well A	19.5	5/4/95	<1.3	<0.5	<1.1	<0.4	<0.8
Well B	46.5	4/17/95	<1.3	<0.5	<1.1	<0.4	<0.8
		5/4/95	<1.3	<0.5	<1.1	<0.4	<0.8
Well C	48.5	4/15/95	<1.3	<0.5	<1.1	<0.4	<0.8
		4/29/95	<1.3	<0.5	<1.1	<0.4	<0.8
Well D	27.5	4/17/95	1.9	4.2	1.3	**35**	7.4
		4/29/95	1.5	4.5	1.3	**30.3**	4.8
Well E	19.9	4/17/95	**16.9**	62	4.4	**130**	20.8
		4/29/95	<6.5	19	<5.5	**76**	<4.0
MDH HRL			6	70	600	30/5*	70

* The interim recommended exposure limit for TCE is 5 µg/L.
Bold indicates exceeds the MDH HRL / recommended exposure limit.

The locations of the private wells can be seen in Figure 4. As a result of the private well sampling, the residents at Well D were provided with bottled water and the residence was connected to city water approximately six weeks later. These activities were paid for by AAF - McQuay Inc. Well E, where TCE was found to significantly exceed the HRL, was reportedly not used for potable water or irrigation. The residence was already connected to city water, so no further actions were taken.

Site Visit

MDH staff visited the AAF - McQuay Inc. site on September 9, 2002. Surrounding land use is commercial and industrial (to the west and southwest), and residential to the east and southeast. To the north lie several homes, vacant land, two cemeteries, and farm fields beyond. The Cannon River is located approximately 1,000 east of the site. The commercial/industrial businesses located to the west and southwest of the site include an auto salvage yard (Harley's Auto), a construction company, a concrete products plant, a well driller, and an asphalt company. A Minnesota DOT maintenance garage and storage yard is located in this area as well. Historical topographical maps indicate several gravel pits may have been located in this area in the past. While no pits are currently visible, the types of businesses observed are consistent with past gravel mining operations.

The facility itself is quite large. The site consists of a large building, fenced storage lot, parking lots, and lawns. Monitoring wells associated with the investigation of the groundwater contamination can be seen on the property and off the site to the east, and are denoted by bright orange flags. There were no signs of contamination or emissions.

The area around the plant appears to be on city water and sewer as evidenced by the many fire hydrants. While no wells were observed in yards, the presence of a well in a basement or other structure cannot be ruled out. Faribault city wells number five and six are located about one-quarter to one-half mile southwest of the site within the Rice County fairgrounds and a city park. No other large pumping wells were observed, or are thought to exist between the site and the Cannon River to the east or the south.

II. Discussion

The main contaminant found at the site is 1,1,2-trichloroethylene (TCE). TCE is commonly used for metal cleaning and degreasing, and was also sometimes used as a dry cleaning solvent. It can be found in wood stains, varnishes, lubricants, adhesives, cleaners, and typewriter correction fluid, although its use in consumer products is declining (EPA 2001a). It is one of the most common contaminants found at U.S. Superfund sites (ATSDR 1997). TCE is a non-flammable, colorless liquid at room temperature with a slightly sweet odor and taste.

The scientific information about the health effects of exposure to TCE generally comes from studies of people exposed to high levels in the workplace and from studies of animals exposed to high levels in air or water. Long-term exposure to TCE in drinking water can damage the liver, kidney, immune system, and the nervous system. TCE may also harm a developing fetus if the mother drinks water containing high levels of TCE. Some studies suggest that exposure to lower levels of TCE over many years may be linked to an increased risk of several types of cancer. It is likely that the adverse health effects from exposure to TCE are due to the compounds that are produced when the body breaks down TCE. Because TCE evaporates easily from water, people can also be exposed to it by inhaling the vapor. TCE may evaporate from water during such activities as bathing, doing dishes, or flushing a toilet. As the TCE evaporates into the air, it can be inhaled. TCE vapors from underground sources such as contaminated soil or groundwater can also migrate through soil and into overlying structures.

<u>Groundwater Quality Standards and Criteria for TCE</u>
The Federal Safe Drinking Water Act enacted Maximum Contaminant Limits (MCLs) for public water supplies for many pollutants, including TCE. The MCLs are based on protecting human health as well as the economic and technical feasibility of detection and treatment of the contaminant. The MCL for TCE is 5 $\mu g/l$, reportedly because many laboratories in 1985 were not able to detect TCE at concentrations below 5 $\mu g/l$.

The MDH groundwater drinking water standard for private wells, known as a Health Risk Limit (HRL), for TCE is 30 $\mu g/l$. The HRL for TCE was established in the early 1990s. A HRL is a concentration of a groundwater contaminant that is safe for people if they drink two liters (about two quarts) of water daily for a lifetime. MDH considers HRLs to be safe concentrations, even for sensitive groups of people such as children, the elderly, and pregnant women. HRLs are also typically used by the MPCA as groundwater evaluation and cleanup criteria at contaminated sites. Unlike the Federal MCL, HRLs are based solely on human health effects and do not consider technical or economic factors in contaminant removal or detection. Like the federal standard, the HRL is based on the potential for cancer to occur as a health effect of exposure. The HRL is based on a U.S. EPA cancer potency slope and is higher than the MCL because the Federal government has a goal of zero for carcinogens and sometimes considers excess lifetime cancers risks down to 1 in 1,000,000 for regulatory standards. Minnesota considers a negligible risk to be any total dose that results in an excess lifetime cancer risk less than or equal to 1 in 100,000 over a 70 year lifetime.

The U.S. Environmental Protection Agency (EPA) recently re-evaluated existing research on TCE, and also assessed the most current scientific information on TCE. EPA concluded that TCE may be more toxic than previously thought and issued a revised draft health risk assessment (EPA 2001b). The EPA document indicates that the risk of non-cancer effects (such as birth defects) may be as or more critical than the cancer risk from exposure to TCE. While the EPA document is in draft form, MDH considers it to represent the best available scientific information on the toxicity of TCE. In response to the draft EPA health risk assessment for TCE, in January of 2002 MDH recommended that an exposure limit of five micrograms of TCE per liter of water (5 µg/L) be used in place of the existing MDH HRL of 30 µg/L for drinking water from private wells (MDH 2002). The interim recommended exposure limit of 5 µg/L is at the lower end of the range of toxicity values proposed in the EPA document, and is consistent with the federal MCL for public water supplies. MDH is in the process of revising the HRLs for all contaminants; a new HRL for TCE (which may be different than 5 µg/L) will be adopted as a part of that process.

Soil Contamination

The soil investigations conducted along the eastern wall of the site building, near the location of the former TCE tank and associated piping, found no VOC contamination and therefore did not locate the source of the TCE contamination. The source presumably lies beneath the approximately five and one-half acre site building, perhaps near the former locations of the vapor degreasers, TCE storage tanks, nearby floor drains or drain lines, or cracks in the floor. Another possible location is near or at a roof vent or other vent location for the vapor degreasers. The TRI data indicates that significant quantities of TCE were released to the air from the vapor degreasers (EPA 2002a). In cold weather, TCE vapors can condense back to the liquid phase. The liquid TCE can then flow down a wall or across a roof where it could eventually reach the ground.

Groundwater Contamination

The VOC contamination in the glacial till aquifer appears to be well characterized, with the possible exception of the southern (or side-gradient) edge. The direction of groundwater flow in the glacial till is from west to east, towards the Cannon River; the southern extent of the plume in the glacial till has not been defined. Levels of TCE exceed the MDH interim recommended exposure limit in monitoring wells MW-2, MW-7, and MW-12. Levels of TCE have generally been declining since 1994, when the first monitoring wells were installed. The highest levels of TCE (710 µg/L) were observed in MW-2 in 1994. For the most recent sampling event, levels of TCE ranged from non-detect to 20.4 µg/L in the glacial till wells.

The extent of the VOC contamination in the St. Peter aquifer has generally been defined. Based on recent groundwater elevations measured in the monitoring wells, the direction of groundwater flow in the St. Peter appears to be to the east-southeast (CORR 2002b). The gradient is relatively flat, however and may be influenced by local geologic conditions or the Cannon River. The level of TCE in monitoring well MW-9, which is near the east side of the building, has been as high as 130 µg/L. The TCE level in MW-9 has only recently declined to below the HRL of 30 µg/L; as of the most recent groundwater sampling event the concentration was 3.7 µg/L. The highest levels of other VOCs, including vinyl chloride, have also been found in MW-9. Levels of these VOCs have also been declining and are currently below their respective MDH HRLs. TCE has been consistently detected in monitoring well MW-11, which is completed in the Prairie du Chien aquifer. The concentration of TCE in MW-11, while fluctuating, appears to be slowly rising overall, and at 8.8 µg/L now exceeds the MDH interim recommended exposure limit of 5 µg/L.

TCE, while relatively insoluble, is denser than water, and, if directly discharged (as the result of a spill or other short-term release) to groundwater, may sink to form a pool at the base of the groundwater aquifer. This pool of dense, non-aqueous phase liquid (or DNAPL) can serve as a continuing source of groundwater contamination. DNAPL formation does not usually occur if the release occurs slowly over some period of time, but may occur if the release is from a spill or other short-term event where concentrations can exceed the solubility of TCE in water. Because the exact source or mechanism of the release of the TCE at the site has never been identified, it is possible that a DNAPL source is present in the deeper aquifer and contributing to the contamination found in the Prairie du Chien. The lack of a confining layer between the St. Peter and the Prairie du Chien indicates that contaminants may move downward. While a study of the flow characteristics of the St. Peter conducted by the consultant for the site owner indicated that the St. Peter formation was relatively tight (ENSR 1995b), it does not prohibit the downward movement of contaminants.

Vinyl chloride, perhaps the most toxic breakdown product of TCE, has been detected in MW-9 during past sampling events. The standard laboratory detection limit for vinyl chloride is typically above the MDH HRL of 0.2 µg/L, so the possibility that vinyl chloride remains above levels of health concern in the groundwater in MW-9, while small, cannot be ruled out. TCE typically dissolves into the groundwater as it moves downgradient from the source of the contamination. Dissolved TCE has been shown to be easily degraded under anaerobic conditions in the environment by microbes through a process known as reductive dehalogenation (ATSDR 1997). This process involves reactions where electrons are transferred between molecules, including contaminants and other molecules present in the aquifer. These are classified as oxidation/reduction (Redox) reactions.

Currently, direct exposure to TCE and its breakdown products in groundwater is unlikely. The discharge of contaminated water from the glacial till aquifer into the Cannon River is unlikely to represent a risk to human health or the environment. The MPCA set an acceptable water quality chronic standard for TCE of 120 µg/L in the monitoring wells closest to the Cannon River (MPCA 1997). If the concentration of TCE consistently exceeds this level, remedial action would be required to protect the river. The concentration of TCE in MW-13 has only exceeded this level on one occasion, in 1997.

In 1995, the consultant for the site owner had identified six private wells in the area of the site, three of which appeared to still be in use as a potable water supply. One of these homes had concentrations of TCE above the MDH HRL, and was provided with access to the municipal water supply. Levels of TCE contamination in the two wells with detections of TCE were as high as 130 µg/L, indicating that significant exposure to TCE in groundwater may have occurred for an unknown period of time when the wells were in use. These wells were typically screened at a depth of 20 to 50 feet below grade.

It is not known if a comprehensive well survey was conducted or if all the identified wells in the area of the site were properly abandoned. The status of one well was unclear. The well survey was focused to the east of the site, in the flow direction of the glacial till aquifer. However, the flow direction in the underlying aquifers may at times be more to the east-southeast, and there may be wells in this direction that were not located previously.

The possibility of contamination in the Prairie du Chien from the site serving as a potential source of contamination in the city wells was first discussed in the 1997 MDH Health Consultation on the Faribault Municipal Well Field. The city of Faribault has two municipal wells, #5 and #6, located approximately one-quarter to one-half mile to the southwest of the site. The wells are completed in the Prairie du Chien – Jordan aquifers, and are approximately 400 feet in depth. Low levels of VOCs, including TCE and cis-1,2-DCE, have repeatedly been detected in city well #5, which is located further from the site than well #6. No VOCs have been detected in city well #6. Due to the distance involved, information collected at the site since 1997, and the current understanding of groundwater flow directions, it is unlikely that the TCE contamination in groundwater at the site is related to the TCE contamination found in city well #5. The possible presence of DNAPL at the site indicates that the site cannot be completely ruled out as a future source of contamination in the Prairie du Chien or Jordan aquifers, however.

MDH staff have been assisting the City of Faribault in the development of a wellhead protection plan for the city's well field. As a part of this effort, groundwater flow models have been developed that project the long-term groundwater capture zone of the city wells. The 20-year capture zone of wells #5 and #6 in the underlying Jordan (or deeper) aquifer reaches the site. If contamination is present at the site in the form of DNAPL in the Prairie du Chien formation, which is interconnected with the Jordan aquifer, it could eventually pose a long-term risk to the current city wells. A new city well, or other large capacity pumping wells could also be installed in the vicinity of the site in the future according to the city of Faribault staff, affecting local groundwater flow (personal communication, 2002).

The groundwater plume likely extends under part of a residential neighborhood to the east of the site based on the TCE concentrations in MW-7. VOC concentrations at shallow depths (10 to 20 feet below grade), while less than 20 µg/L, exceed the screening levels developed by EPA in its recent draft guidance document on soil vapor intrusion (EPA 2002b). This indicates that the potential exists for TCE vapors from the contaminated groundwater to penetrate into homes above the plume at concentrations in excess of health-based screening criteria. Given the relatively shallow depth to groundwater and general permeability of the overlying sand and gravel deposits, the vapor migration pathway may be complete and should be investigated.

Agency for Toxic Substance and Disease Registry (ATSDR) Child Health Initiative

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children make them of special concern to communities faced with contamination of their water, soil, air, or food. Children are at greater risk than adults from certain kinds of exposures to hazardous substances at waste disposal sites. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which mean they breathe dust, soil, and heavy vapors close to the ground. Children also weigh less, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most importantly, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Children may have been exposed to TCE from the site through consumption of contaminated well water prior to the discovery of the contamination in the 1990s. Homes with contaminated private wells have since been hooked up to the municipal water supply, which also is contaminated with low levels of TCE. The potential for exposure through vapor migration into indoor air also exists.

III. Conclusions

Groundwater at the AAF - McQuay Inc. site is contaminated with TCE and its breakdown products from an as yet unidentified source, likely beneath the five and one-half acre building at the site. The facility used large quantities of TCE from 1969 until 1993. Concentrations of TCE in groundwater at the site slightly exceed the current interim recommended exposure limit for TCE of 5 µg/L in the glacial till, St. Peter, and Prairie du Chien aquifers. The extent of the groundwater contamination has not been fully defined in the Prairie du Chien aquifer. While the potential for current exposure to the TCE contamination is low, several private wells were impacted by the contamination until the mid-1990's and vapor migration into indoor air could remain a possibility in the future. While TCE contamination has also been found in a nearby city well, it is unlikely that it is related to the TCE contamination at the site. Based on these findings, the site currently represents no apparent public health hazard, but may be an indeterminate public health hazard in the future.

IV. Recommendations

1. A comprehensive private well survey should be conducted to the south and east of the site to determine if any other private wells are present. The status of the well at 18515 Faribault Boulevard should be determined. Any wells identified should be sampled. Private wells that are not in use should be sealed according to MDH requirements.
2. Soil probe gas samples and/or indoor air samples should be collected at homes located above the groundwater plume and nearest to the site to evaluate whether a completed pathway for soil vapor intrusion into the homes exists.
3. Additional documentation should be submitted or investigation conducted at the site to try to identify the original source of the TCE contamination and to rule out the presence of DNAPL.
4. If the source of the contamination cannot be identified, the lateral and vertical extent of the groundwater contamination in the Prairie du Chien aquifer should be determined.
5. At least one more comprehensive round of samples should be collected from the existing monitoring well network and analyzed for VOCs. The sample from MW-9 should be analyzed using the lowest possible detection limits to check for the presence of low levels of vinyl chloride.
6. Monitoring well MW-11 should not be sealed, but should be maintained and remain available for future monitoring of the Prairie du Chien aquifer.

V. Public Health Action Plan

MDH's Public Health Action Plan for the site consists of continued consultation with MPCA staff on groundwater monitoring and site investigation activities, review of any new data, assisting in an updated private well survey, and participation in any planned public outreach activities.

VI. References

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CERTIFICATION

This AAF - McQuay Inc. Site Health Consultation was prepared by the Minnesota Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Alan W. Yarbrough
Technical Project Officer, SPS, SSAB, DHAC
ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.

Roberta Erlwein
Chief, State Program Section, SSAB, DHAC, ATSDR

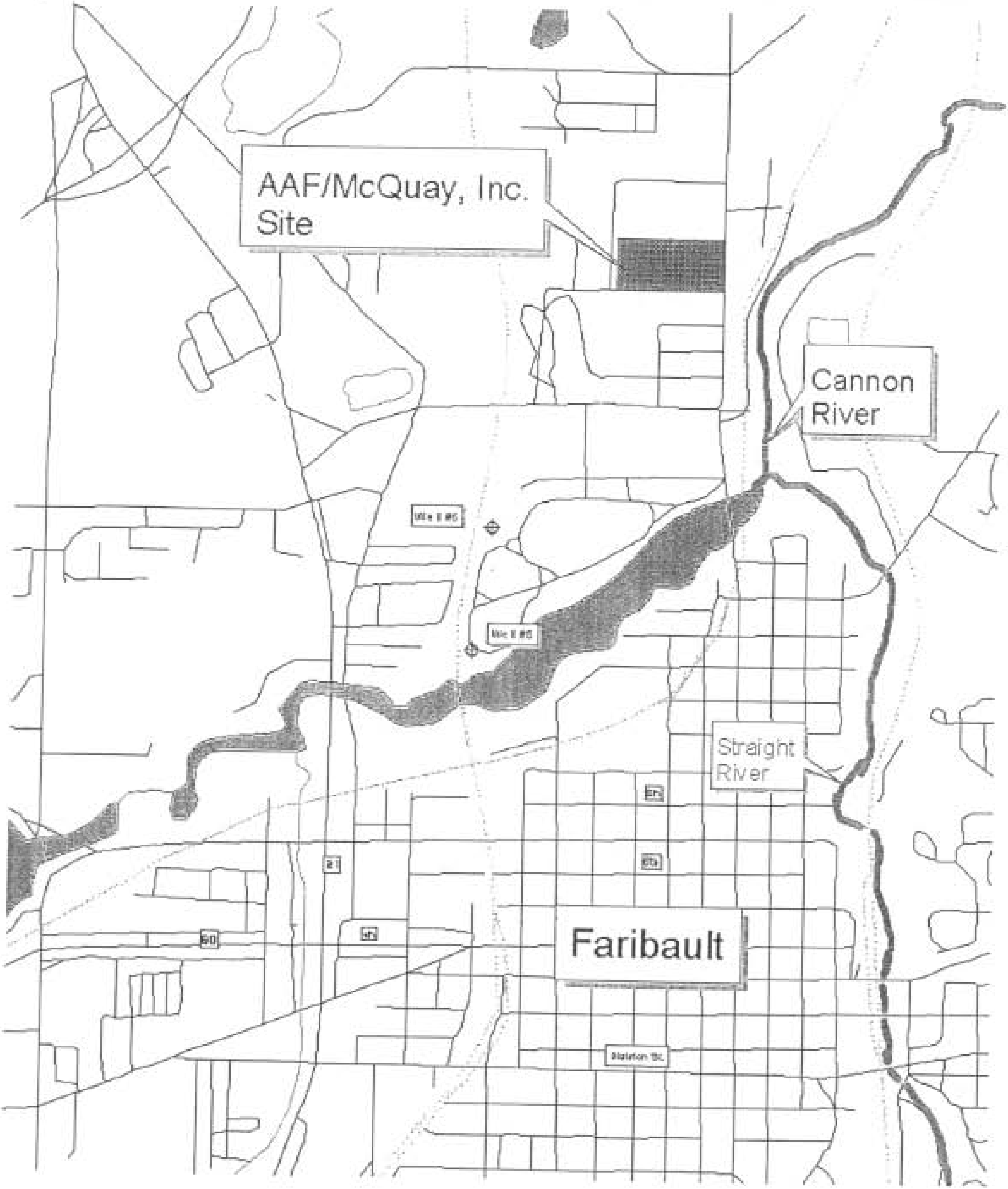

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Figure 1: Site Location

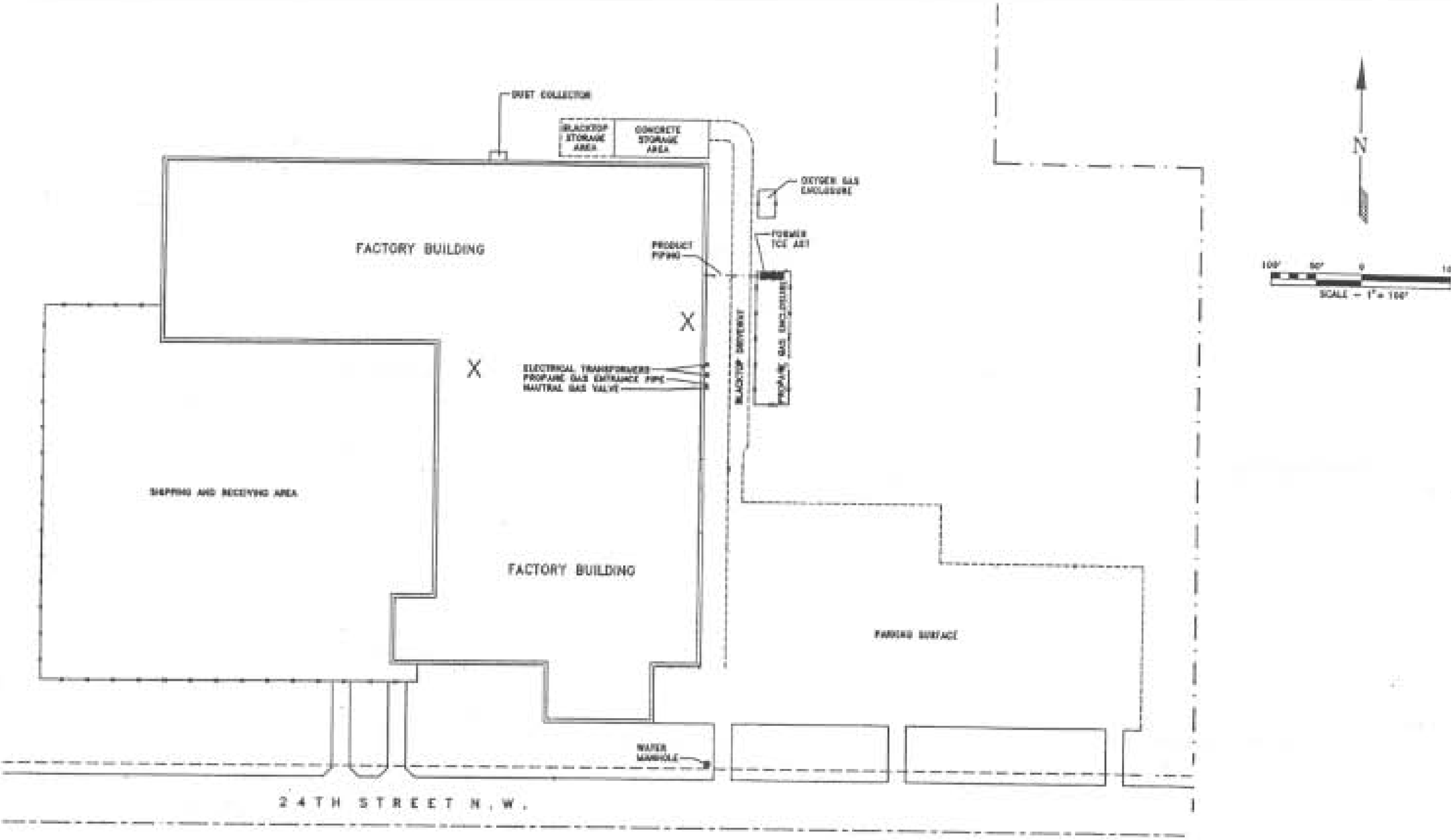

Figure 2: Site Plan

X = Approximate Location of Vapor Degreasers

Source: ENSR 1994

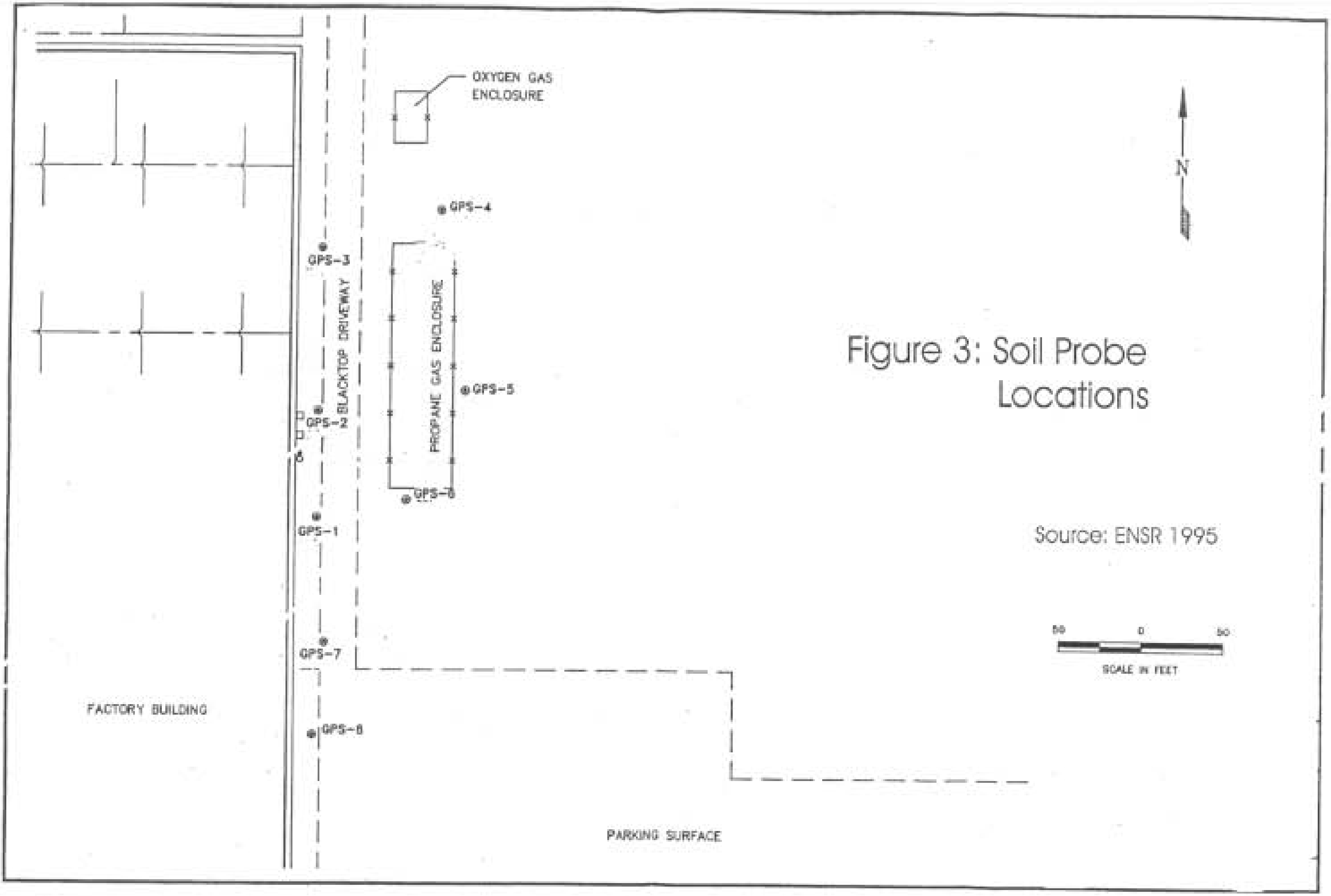

Figure 3: Soil Probe Locations

Source: ENSR 1995

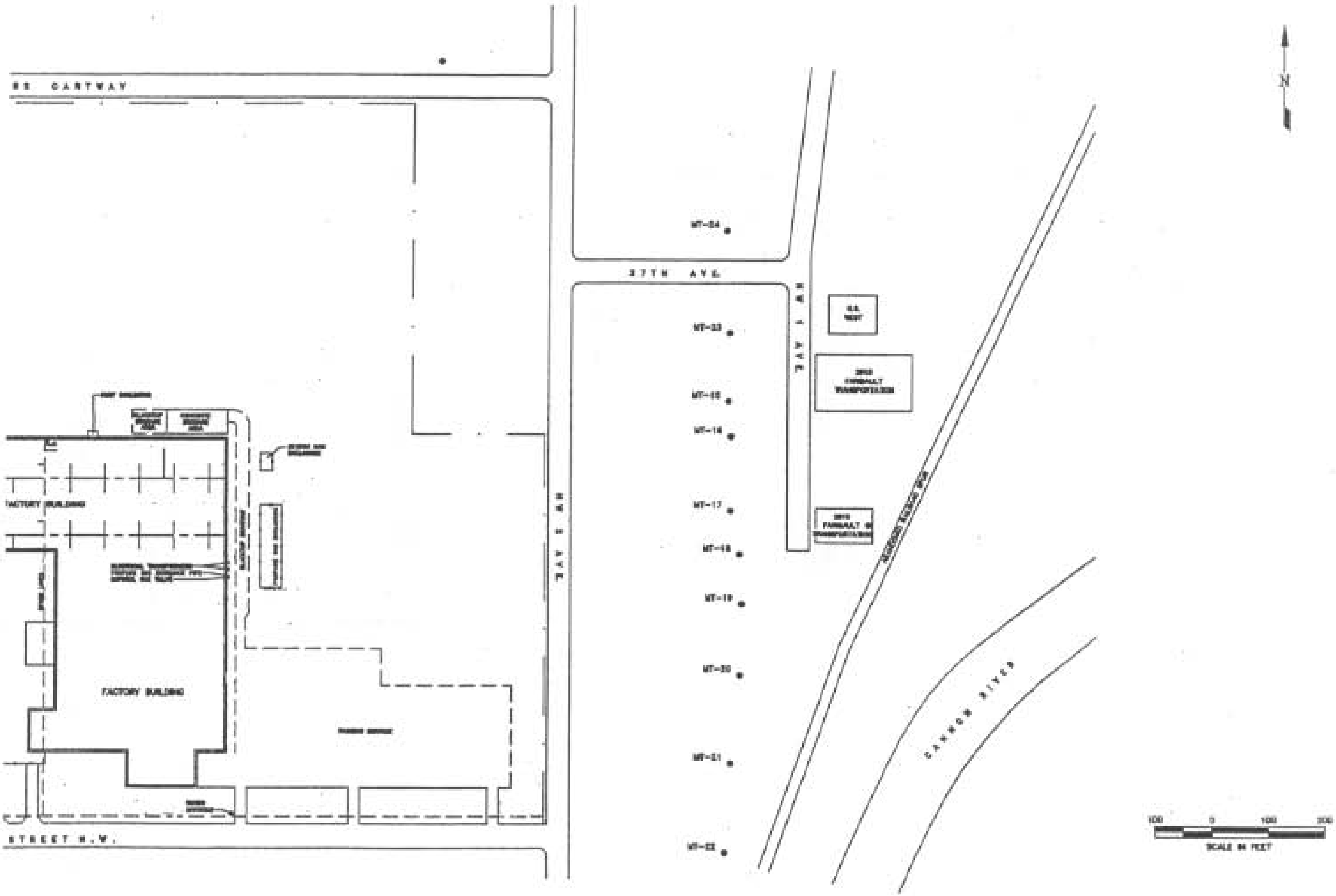

Figure 4: Off-Site Probe and Residential Well Locations

Source: ENSTR 1995

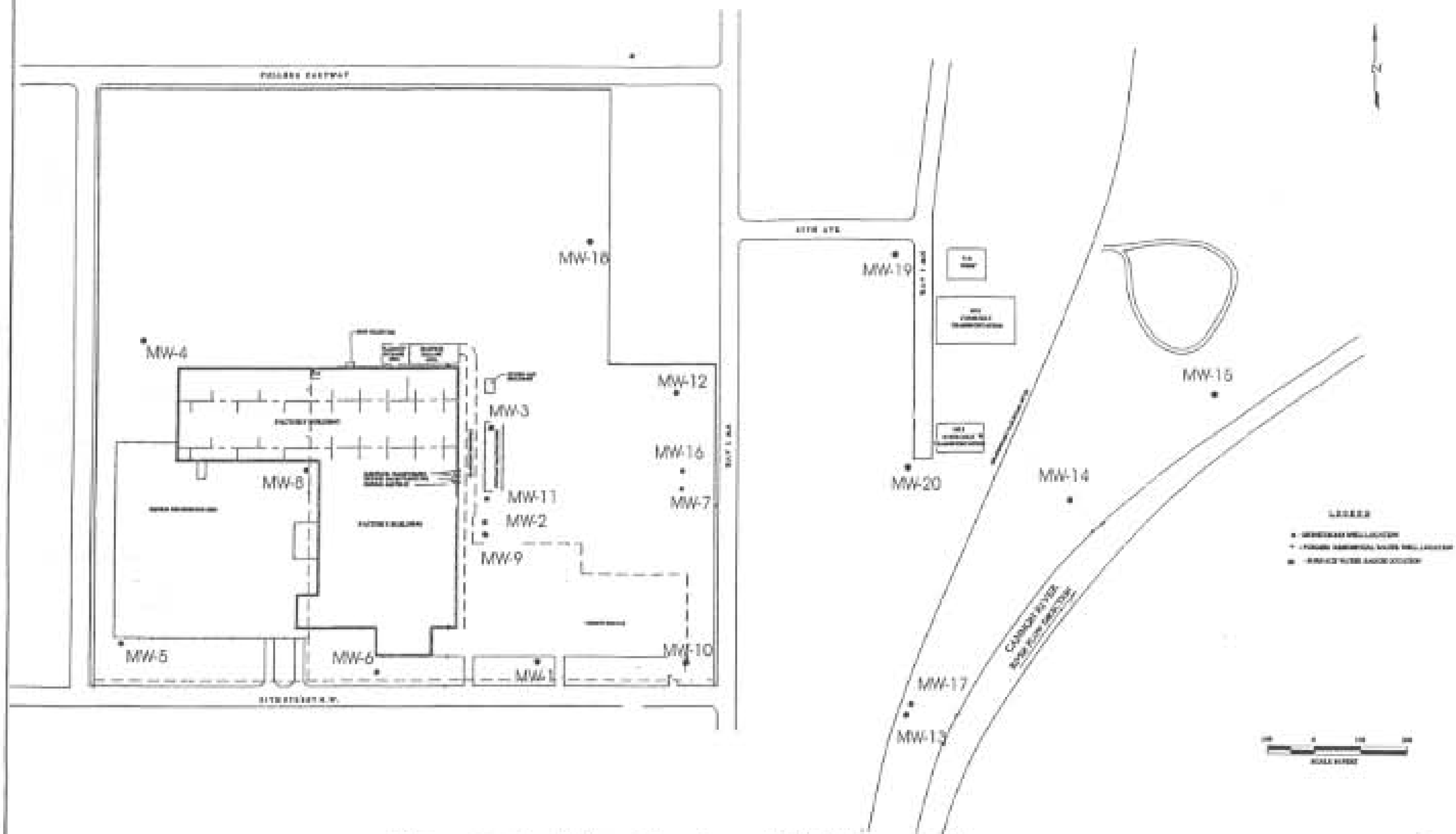

Figure 5: Monitoring Well Locations

Source: CORR 2000

Appendix 1
Historical Groundwater Analytical Results
AAF-McQuay Inc. Site
Faribault, Minnesota

	Sample Dates	1,1-DCE ug/l	1,1-DCA ug/l	1,1,1-TCA ug/l	1,1,2-TCE ug/l	cis-1,2-DCE ug/l	Vinyl Chloride ug/l
HRLs		6	70	600	30/5*	70	0.2
MW-1	3/3/1994	4.0	17.0	9.5	**250.0**	24.0	<1.5
	3/30/1994	<5.0	14.0	14.0	**240.0**	19.0	<1.5
	1/18/1995	5.1	18.0	1.9	**64.0**	15.0	<1.5
	4/30/1995	3.9	10.1	1.5	**32.0**	7.9	<0.5
	7/28/1995	4.7	15.0	1.2	**31.2**	8.4	<0.3
	10/24/1995	<1.0	7.4	<0.8	*24.0*	4.6	<0.3
	3/21/1996	2.3	7.6	<0.9	*23.3*	3.8	<0.5
	6/20/1996	2.6	9.2	<0.9	*24.0*	4.2	<0.5
	9/20/96	2.4	7.9	<0.9	*19.0*	4.1	<0.5
	12/18/96	<0.9	2.8	<0.9	*15.7*	2.2	<0.5
	3/26/97[18]	<0.9	4.1	<0.9	*18.3*	2.3	<0.5
	10/30/1997	<0.5	<0.5	<0.5	*11.9*	<0.5	<1.0
	4/22/1998	<0.5	4.9	<0.5	*8.9*	<0.5	<0.5
MW-2	3/3/1994		15.0	17.0	**600.0**	24.0	<1.5
	3/30/1994	<12	<12	39.0	**710.0**	15.0	<1.5
	1/18/1995	4.7	22.0	15.0	**250.0**	41.0	<1.5
	4/30/1995	4.8	15.2	7.8	**55.0**	15.2	<0.5
	7/28/1995	2.9	10.0	6.1	**68.0**	13.1	<0.3
	10/24/1995	<1.0	8.6	3.6	**52.0**	6.5	<0.3
	3/21/1996	1.4	6.6	4.7	**45.0**	5.7	<0.5
	6/20/1996	3.1	12.0	2.4	**52.0**	10.0	<0.5
	9/20/1996	0.9	2.9	1.7	*28.0*	4.4	<0.5
	12/19/1996	<0.9	1.1	<0.9	*8.8*	1.5	<0.5
	3/27/97[18]	<0.9	2.2	<0.9	*8.3*	1.1	<0.5
	10/30/1997	<0.5	<0.5	<0.5	**51.4**	11.6	<1.0
	4/22/98 [24]	<0.5	4.4	2.4	**34.0**	4.0	<0.5
	6/22/1999	<2	5.3	<2	**55.5**	9.1	<2
	8/9/2000	<2	<2	<2	*14.0*	3.0	<2
	7/17/2001	<5	<5	<5	*27.0*	<5	<5
	7/31/2002	<2	<2	<2	*7.8*	<2	<2
MW-3	3/3/1994	1.2	4.0	13.0	**32.0**	15.0	<1.5
	3/30/1994	1.2	4.3	13.0	**32.0**	12.0	<1.5
	1/18/1995	0.6	4.0	8.1	**46.0**	37.0	<1.5
	4/30/1995	<1.3	1.6	2.9	*9.9*	3.0	<0.5
	7/28/1995	<1.0	3.1	4.2	*18.7*	18.3	<0.3
	10/24/1995	<1.0	3.3	4.6	*14.0*	6.0	<0.3
	3/21/1996	<0.9	1.0	2.0	*22.0*	5.8	<0.5
	6/20/1996	<0.9	1.9	2.4	*12.0*	4.5	<0.5
	9/19/96[1]	<0.9	2.8	3.3	*18.0*	9.0	<0.5
	12/18/96[12]	<0.9	1.9	3.8	**61.0**	7.3	<0.5
	3/26/97	<0.9	1.9	3.1	**68.0**	8.7	<0.5
	10/30/1997	<0.5	<0.5	3.3	*22.2*	16.1	<1.0
	1/22/1998	<5.0	<5.0	2.5	*19.0*	8.4	<5.0
	4/22/1998	<0.5	<0.5	<0.5	*14.0*	2.1	<0.5
	7/1/1998	1.6	2.6	10	*13*	7.3	< .9
MW-4	3/3/1994	<0.3	<0.2	<0.5	<0.5	<0.5	-
	3/30/1994	<0.5	<0.5	<0.5	<0.5	<0.5	-
	1/18/1995	<0.5	<0.5	<0.5	<0.5	<0.5	-
MW-5	3/30/1994	<0.5	<0.5	<0.5	<0.5	<0.5	-
	1/18/1995	<0.5	<0.5	<0.5	<0.5	<0.5	-

Appendix 1
Historical Groundwater Analytical Results
AAF-McQuay Inc. Site
Faribault, Minnesota

	Sample Dates	1,1-DCE ug/l	1,1-DCA ug/l	1,1,1-TCA ug/l	1,1,2-TCE ug/l	cis-1,2-DCE ug/l	Vinyl Chloride ug/l
HRLs		6	70	600	30/5*	70	0.2
MW-6	3/30/1994	0.25	1.40	0.80	*10.00*	1.20	-
	1/18/1995	0.70	6.30	0.60	*54.00*	8.70	-
	4/30/1995	0.65	1.10	0.55	*7.50*	1.50	-
	7/27/1995	0.50	1.60	0.40	*7.20*	1.60	
	10/24/1995	0.50	0.70	0.40	*5.50*	1.50	-
	3/21/1996	0.50	0.40	0.50	*10.00*	1.40	-
	6/20/1996	0.50	0.40	0.90	*12.00*	3.00	-
	9/19/1996	0.50	0.40	0.90	*6.10*	2.10	-
	12/18/1996	0.50	0.40	0.50	*10.30*	1.90	-
	3/21/1997	0.50	0.40	0.50	*10.40*	1.20	-
MW-7	3/30/1994	<0.5	1.1	1.0	4.5	<0.5	<1.5
	1/18/1995	<0.5	1.6	0.7	*5.1*	<0.5	<1.5
	4/30/1995	<1.3	1.8	1.5	4.4	<0.8	<0.5
	7/27/1995	<1.0	2.2	1.0	*5.6*	<0.5	<0.3
	10/24/1995	<1.0	2.1	1.2	4.8	0.7	<0.3
	3/21/1996	1.0	4.2	1.1	*11.0*	0.8	<0.5
	6/20/96[3]	1.0	5.6	1.4	*14.0*	1.2	<0.5
	9/19/96[5]	1.8	7.4	2.0	*19.0*	2.4	<0.5
	12/18/96[13]	2.7	11.4	2.8	**31.0**	3.2	<0.5
	3/26/97[19]	3.3	19.0	3.1	**38.0**	5.2	<0.5
	10/30/1997	<0.5	<0.5	<0.5	**31.5**	<0.5	<1.0
	1/22/1998	<5.0	8.7	<5.0	*22.0*	<5.0	<5.0
	4/22/1998	<0.5	4.8	<0.5	*13.0*	<0.5	<0.5
	7/1/1998	2.3	12	< 1.1	*28*	4.2	< .9
	6/22/1999	<2	<2	<2	4.7	<2	<2
	8/9/2000	<2	5.0	<2	*5.0*	<2	<2
	7/17/2002	<5	12.7	<5	*17.4*	<5	<5
	7/31/2002	<2	8.1	<2	*13.9*	2.7	<2
MW-8	1/18/1995	0.25	0.25	0.60	0.50	0.25	-
	4/30/1995	0.65	0.25	1.50	0.20	0.40	-
	7/27/1995	0.50	0.15	1.30	0.35	0.25	-
	10/24/1995	0.50	0.15	0.90	0.35	0.25	-
	3/21/1996	0.50	0.20	0.90	0.40	0.30	-
MW-9	1/18/1995	**17.0**	**78.0**	<0.5	**70.0**	27.0	<1.5
	4/30/1995	**23.8**	61.0	<1.1	**79.0**	23.2	**1.1**
	7/28/1995	**39.2**	**75.0**	<0.8	**46.0**	38.3	**1.7**
	10/24/1995	**23.0**	**110.0**	<0.8	**105.0**	36.0	**1.3**
	3/21/1996	**36.0**	**110.0**	<0.9	**110.0**	38.0	**1.3**
	6/20/96[4]	**32.0**	**97.0**	<0.9	**130.0**	40.0	**1.1**
	9/20/96[6]	**35.0**	**99.0**	<0.9	**107.0**	41.0	**1.2**
	12/19/96[14]	**24.0**	**85.0**	<0.9	**110.0**	26.5	**0.8**
	3/27/97	**15.3**	**98.0**	<0.9	**87.7**	29.9	**0.7**
	10/30/1997	**19.9**	**91.1**	<0.5	**122.0**	40.3	<1.0
	1/22/1998	**27.0**	**100.0**	<5.0	**130.0**	42.0	<5.0
	4/22/98[23]	**22.0**	**92.0**	<0.5	**110.0**	37.0	<0.5
	7/1/1998	**31**	**100**	< 1.1	**120**	44	< .9
	6/22/1999	**23.1**	**67.4**	<2	**102**	38.6	<2
	8/9/2000	**17.0**	**80.0**	<2	**36.0**	**100.0**	<2
	7/17/2001	**10.4**	46.0	<5	*22.7*	**71.3**	<5
	7/31/2002	5.5	26.7	<2	3.7	46.8	<2

Appendix 1
Historical Groundwater Analytical Results
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Faribault, Minnesota

	Sample Dates	1,1-DCE ug/l	1,1-DCA ug/l	1,1,1-TCA ug/l	1,1,2-TCE ug/l	cis-1,2-DCE ug/l	Vinyl Chloride ug/l
HRLs		6	70	600	30/5*	70	0.2
MW-10	1/18/1995	1.1	5.9	<0.5	*19.0*	1.7	<1.5
	4/30/1995	<1.3	<0.5	<1.1	*6.7*	1.1	<0.5
	7/28/1995	1.0	4.7	<0.8	*7.2*	<0.5	<0.3
	10/24/1995	<1.0	7.1	<0.8	*16.0*	1.8	<0.3
	3/21/96[2]	1.7	9.5	<0.9	*20.0*	2.6	<0.5
	6/20/96[3]	<0.9	2.2	<0.9	*5.3*	<0.5	<0.5
	9/19/96[4]	<0.9	2.9	<0.9	*6.3*	1.0	<0.5
	12/18/96[13]	<0.9	2.8	<0.9	*7.1*	1.4	<0.5
	3/26/97[13]	<0.9	4.0	<0.9	*12.6*	1.5	<0.5
	10/30/1997	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
	1/22/1998	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	4/22/1998	<0.5	2.6	<0.5	*7.3*	<0.5	<0.5
	7/1/98 [25]	< 1.4	< .8	< 1.1	3.2	< .6	< .9
	6/22/1999	<2	2.8	<2	*9.2*	<2	<2
	8/9/2000	<2	<2	<2	<2	<2	<2
	7/17/2001	<5	6.0	<5	*12.9*	<5	<5
	7/30/2002	<2	<2	<2	4.5	<2	<2
MW-11	5/5/1995	<1.3	1.4	<1.1	3.1	0.9	<0.5
	7/28/1995	<1.0	0.7	<0.8	1.1	<0.5	<0.3
	10/24/1995	<1.0	0.5	<0.8	1.0	<0.5	<0.3
	3/21/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	6/20/1996	<0.9	2.0	<0.9	3.1	<0.5	<0.5
	9/19/1996	<0.9	1.9	<0.9	2.3	<0.5	<0.5
	12/18/96[13]	<0.9	1.8	<0.9	1.6	0.9	<0.5
	3/27/97	<0.9	1.6	<0.9	<1.0	<0.5	<0.5
	10/30/1997	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
	4/22/1998	<0.5	3.0	<0.5	3.9	1.5	<0.5
	7/1/1998	< 1.4	3.4	< 1.1	4.3	1.8	< .9
	6/22/1999	<2	3.2	<2	*5.8*	2.2	<2
	8/9/2000	<2	3.0	<2	3.0	<2	<2
	7/17/2001	<5	<5	<5	*6.6*	<5	<5
	7/31/2002	<2	5.2	<2	*8.8*	2.9	<2
	7/31/02 (dup)	<2	5.1	<2	*8.2*	2.9	<2
MW-12	3/21/1996	4.3	24.0	2.7	**32.0**	13.0	<0.5
	6/20/1996	4.3	19.0	2.7	**81.0**	11.0	<0.5
	9/20/1996	5.0	20.0	2.9	**83.0**	12.0	<0.5
	12/19/1996	2.3	12.7	2.0	**49.0**	6.8	<0.5
	3/27/97	3.9	22.2	1.9	**72.0**	10.9	<0.5
	10/30/97	<0.5	<0.5	<0.5	**48.2**	8.8	<1.0
	1/22/1998	<3.8	15.0	<0.5	**61.0**	8.9	<5.0
	4/22/1998	<0.5	9.1	<0.5	**39.0**	<0.5	<0.5
	7/1/1998	4.0	18	< 1.1	**71.0**	9.8	< .9
	6/22/1999	2.9	10.5	<2	**56.0**	8.5	<2
	8/9/2000	<2	7.0	<2	*27.0*	5.0	<2
	7/17/2001	<5	7.8	<5	**31.0**	5.8	<5
	7/30/2002	<2	6.1	<2	*20.4*	3.8	<2

Appendix 1 Historical Groundwater Analytical Results AAF-McQuay Inc. Site Faribault, Minnesota							
	Sample Dates	1,1-DCE ug/l	1,1-DCA ug/l	1,1,1-TCA ug/l	1,1,2-TCE ug/l	cis-1,2-DCE ug/l	Vinyl Chloride ug/l
HRLs		6	70	600	30/5*	70	0.2
MW-13	3/21/96[7]	<0.9	<0.8	<0.9	**31.0**	1.1	<0.5
	6/20/1996	<0.9	<0.8	<0.9	4.6	<0.5	<0.5
	9/19/1996	<0.9	<0.8	<0.9	*23.0*	<0.5	<0.5
	12/18/1996	<0.9	<0.8	<0.9	**43.0**	1.0	<0.5
	3/26/97	<0.9	<0.8	<0.9	**85.0**	0.9	<0.5
	10/30/1997	<0.5	<0.5	<0.5	**168.0**	<0.5	<1.0
	1/22/1998	<0.5	<0.5	<0.5	*19.0*	<0.5	<0.5
	4/22/1998	<0.5	<0.5	<0.5	**36.0**	<0.5	<0.5
	7/1/98[20]	< 1.4	< .8	< 1.1	*22*	< .8	< .9
	6/22/1999	<2	<2	<2	*27*	<2	<2
	8/9/2000	<2	<2	<2	**40**	<2	<2
	7/17/2001	<5	<5	<5	*25.8*	<5	<5
	7/31/2002	<2	<2	<2	<2	<2	<2
MW-14	3/21/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	6/20/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	9/19/96[10&11]	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	12/18/96[12]	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	3/26/97[18, 21]	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	10/30/1997	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
	4/22/1998	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-15	3/21/96[7]	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	6/20/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	9/19/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	12/18/96[16]	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	3/26/97[18]	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	10/30/97[22]	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
	4/22/1998	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
MW-16	10/30/1997	**9.74**	<0.5	10.5	**75.3**	11.1	<1.0
	1/22/1998	9.6	35.0	13.0	**94.0**	11.0	<0.5
	4/22/1998	**7.5**	29.0	9.0	**77.0**	8.3	<0.5
	7/1/1998	**11**	39	12	**90**	11	< .9
	6/22/1999	**10**	30.4	8.4	**85**	10.5	<2
	8/9/2000	**25**	<2	<2	*5.0*	8.0	<2
	7/17/2001	<5	13.7	<5	<5	<5	<5
	7/30/2002	<2	6.8	<2	3.0	<2	<2
	7/30/02 (dup)	<5	6.7	<2	2.3	<2	<2
MW-17	10/30/1997	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
	4/22/1998	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	6/22/1999	<2	<2	<2	<2	<2	<2
	8/9/2000	<2	<2	<2	<2	<2	<2
	7/17/2001	<5	<5	<5	<5	<5	<5
	7/31/2002	<2	<2	<2	<2	<2	<2

Appendix 1
Historical Groundwater Analytical Results
AAF-McQuay Inc. Site
Faribault, Minnesota

	Sample Dates	1,1-DCE ug/l	1,1-DCA ug/l	1,1,1-TCA ug/l	1,1,2-TCE ug/l	cis-1,2-DCE ug/l	Vinyl Chloride ug/l
HRLs		6	70	600	30/5*	70	0.2
MW-18	10/1/1998	<2	<2	<2	<2	<2	<2
	6/22/1999	<2	<2	<2	<2	<2	<2
	12/21/1999	<2	<2	<2	<2	<2	<2
	8/9/2000	<2	<2	<2	<2	<2	<2
	7/17/2001	<5	<5	<5	<5	<5	<5
	7/30/2002	<2	<2	<2	<2	<2	<2
MW-19	10/1/1998	<2	<2	<2	<2	<2	<2
	6/22/1999	<2	<2	<2	<2	<2	<2
	12/21/1999	<2	<2	<2	<2	<2	<2
	8/9/2000	<2	<2	<2	<2	<2	<2
	7/17/2001	<5	<5	<5	<5	<5	<5
	7/30/2002	<2	<2	<2	<2	<2	<2
MW-20	10/1/1998	<2	<2	<2	<2	<2	<2
	6/22/1999	<2	<2	<2	<2	<2	<2
	12/21/1999	<2	<2	<2	<2	<2	<2
	8/9/2000	<2	<2	<2	<2	<2	<2
	7/17/2001	<5	<5	<5	<5	<5	<5
	7/30/2002	<2	<2	<2	<2	<2	<2
Trip Blank	4/30/1995	<1.3	<0.5	<1.1	<0.4	<0.8	<0.5
	7/28/95[8]	<1.0	<0.3	<0.8	<0.7	<0.5	<0.3
	10/24/1995	<1.0	<0.3	<0.8	<0.7	<0.5	<0.3
	3/21/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	6/20/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	9/19/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	12/18/1996	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
	3/26/97	<0.9	<0.8	<0.9	<1.0	<0.5	<0.5
Dup-MW-2	4/30/1995	3.5	14.5	8.0	**82.0**	13.8	<0.5
Dup-MW-7	7/27/1995	<1.0	2.3	1.1	*5.8*	<0.5	<0.3
Dup-MW-8	10/24/95	<1.0	<0.3	0.9	<0.7	<0.5	<0.3
Dup-MW-2	3/21/1996	1.3	6.6	4.8	**45.0**	5.5	<0.5
Dup-MW-9	6/20/96[9]	**33.0**	**99.0**	<0.9	**130.0**	40.0	1.1
Dup-MW-9	9/20/96[10]	**32.0**	**90.0**	<0.9	**82.0**	34.0	1.1
Dup-MW-9	12/19/96[14&15]	**24.0**	**83.0**	<0.9	**96.0**	26.7	0.9
Dup-MW-9	3/27/97	**31.0**	**99.0**	<0.9	**100.0**	34.0	1.2

Appendix 1 Historical Groundwater Analytical Results AAF-McQuay Inc. Site Faribault, Minnesota							
	Sample Dates	1,1-DCE ug/l	1,1-DCA ug/l	1,1,1-TCA ug/l	1,1,2-TCE ug/l	cis-1,2-DCE ug/l	Vinyl Chloride ug/l
HRLs		6	70	600	30/5*	70	0.2

[1]- o-xylene detected in MW-3 and MW-14 at 0.4 ug/l and 0.5 ug/l, respectively; HRL is 10,000 ug/l

[2]-Dichlorodifluoromethane detected in MW-10 at 9.7 ug/l; HRL is 1,000 ug/l

[3]-Dichlorodifluoromethane detected in MW-7 and MW-10 at 2.4 ug/l and 3.3 ug/l, respectively; HRL is 1,000 ug

[4]-trans-1,2-Dichloroethene detected in MW-9 at 1.2 ug/l; HRL is 100 ug/l

[5]- Dichlorodifluoromethane detected in MW-7 and MW-10 at 6.1 ug/l and 8.7 ug/l, respectively; HRL is 1,000 u

[6]-trans-1,2-Dichloroethene detected in MW-9 at 0.7 ug/l; HRL is 100 ug/l

[7]-1,2 DCA detected in MW-13 and MW-15 at 0.5 ug/l and 0.6 ug/l, respectively; HRL is 4.0 ug/l

[8] - Methylene chloride detected at 1.6 ug/l

[9] - trans-1,2-Dichloroethene detected in MW-9D at 1.3 ug/l; HRL is 100 ug/l

[10] - trans-1,2-Dichloroethene detected in MW-9D at 0.7 ug/l; HRL is 100 ug/l

[11] - 1,2,4-Trimethylbenzene detected in MW-4 at 1.2 ug/l; HRL is not established

[12] - t-Butylbenzene detected in MW-3, MW-6, and MW-14 at 1.5, 1.4, and 2.0 ug/l, respectively; HRL is not est

[13]-Dichlorodifluoromethane detected in MW-7, MW-10, and MW-11 at 11.5, 7.9, and 1.6 ug/l; HRL is 1,000 ug

[14] - trans-1,2-Dichloroethene detected in MW-9 and MW-9D at 0.6 ug/l; HRL is 100 ug/l

[15]-Benzene detected in MW-9 and MW-9D at 0.9 and 0.8 ug/l, respectively; HRL is 1,000 ug/l

[16] - Napthalene detected in MW-15 at 1.1 ug/l; HRL is not established

[17]-Dichlorodifluoromethane detected in MW-4 at 11.1 ug/l; HRL is 1,000 ug/l

[18] - t-Butylbenzene detected in MW-1, MW-2, MW-6, MW-14, and MW-15 at 3.0, 2.8, 1.4, 1.4, and 1.3 ug/l, re

[19]-Dichlorodifluoromethane detected in MW-7 and MW-10 at 8.4 and 8.6 ug/l; HRL is 1,000 ug/l

[20]- m,p-xylene detected in MW-6 at 1.2 ug/l; HRL is 10,000 ug/l

[21]-Benzene detected in MW-6 and MW-14 at 0.6 and 0.5 ug/l, respectively; HRL is 1,000 ug/l

[22] -tert-Butylbenzene in MW-12 at 46.2

[23] 2-Butanone in MW-9 at 58 ug/L

[24] MW-2 Toluene detected at 3.4 ug/L

[25] MW-10 detected 2-Butanone at 3.0 ug/L, 2-Hexanone at 1.9 ug/L, and 4-Methyl-2-Pentanone at 1.8 ug/l

[26] Mw-13 detected Carbon Disulfide at 2.2 ug/L

* The HRL for TCE is 30 ug/L; MDH's current recommended exposure limit is 5 ug/L

Bold data indicates values above MDH HRL

Italics indicates exceeds MDH recommended exposure limit (TCE only)

NS = Not Sampled

- = No data available

BDL=Below Detection Limits