

Site Review and Update

WASHINGTON COUNTY SANITARY LANDFILL
LAKE ELMO, WASHINGTON COUNTY, MINNESOTA
CERCLIS NO. MN980704738

NOVEMBER 30, 1995

Prepared by

Minnesota Department of Health
Under Cooperative Agreement With The
Agency for Toxic Substances and Disease Registry

FORWARD

This document summarizes potential public health concerns at a mixed waste landfill 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), 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
Minnesota Department of Health
625 Robert St. N.
Box 64975
St. Paul, MN 55164-0975

OR call us at: (651) 201-4897 or 1-800-657-3908
(toll free call—press "4" on your touch tone phone)

INTRODUCTION

The Minnesota Department of Health (MDH) completed this Site Review and Update (SRU) on the Washington County Sanitary Landfill (the Site). This report was prepared to evaluate the potential for human health hazards from the Site and to make recommendations to protect public health. This SRU is independent of quarterly reports completed for the Methane/Radon Project associated with the Site. MDH obtained the information for this report by reviewing Minnesota Pollution Control Agency (MPCA) site files, consulting with Washington and Ramsey Counties (the Counties), and conducting site visits on May 11 and October 6, 1995. For additional background information, refer to other health reports on the Site (ATSDR 1989, MDH 1993).

SUMMARY OF BACKGROUND AND HISTORY

Site Description

The Washington County Sanitary Landfill is located on Jamaca Avenue in Lake Elmo, Minnesota, approximately 3/4 mile north of Highway 5 and two miles east of Interstate 694 (Figure 1). The Site is a closed, publicly owned, and permitted landfill that operated from 1969 to 1975. It received 2.57 million cubic yards of waste from Washington and Ramsey Counties, which consisted of approximately 73% municipal wastes, 26% commercial/industrial wastes, and 1% demolition wastes.

While the Site met permit regulations at the time of operation, it is located on a former gravel and sand pit that does not meet current landfill engineering requirements. For example, there is no protective liner and no leachate collection system to prevent hazardous chemicals from migrating to the groundwater. Investigations at the Site have shown that the groundwater is contaminated with several volatile organic compounds (VOCs). In addition, wastes in the landfill are generating methane gas that is migrating in the direction of residences (see below). As a result of these factors, the Site was placed on the U.S. Environmental Protection Agency's (EPA) National Priority List (Federal Superfund).

The land near the Site primarily consists of residential property, cultivated fields, and park property. Residences are located across Jamaca Avenue west and southwest of the Site. To the east of the Site is city park land, and to the south is farmland. In addition, the Lake Elmo Fire Station (Station #2) borders the fill area to the west, and two maintenance buildings border the Site to the northwest. The nearest residential property south of the Site was acquired by the Counties, and all buildings on this property have been demolished.

Unsaturated soil in the vicinity of the Site consists of unconsolidated till which is a mixture of clay, silt, sand, gravel and cobbles. Three primary aquifers are located in the area - the shallow and basal drift aquifer, the St. Peter aquifer and the Prairie du Chien/Jordan aquifer. The regional groundwater flow is generally towards the St. Croix River east of the Site, however, local influence from Lake Jane north of the Site causes groundwater to flow in a southerly direction.

Currently, regulatory control of the Site is being transferred to the Minnesota Landfill Cleanup Program. This Program will remove the Site from Superfund and place it under state authority. The MPCA has outlined remedial plans for the Site in the Closed Landfill Assessment Report (MPCA 1995b), including: (1) placing a new cover over the Site, (2) installing a new active gas extraction system, and (3) continuing groundwater monitoring and pumping at the Site. The new cover and the proposed active gas extraction system are expected to be installed by 1996. These recommendations are presented in the five-year review completed by MPCA for U.S. EPA (MPCA 1994). MDH has reviewed the MPCA report, and has integrated the relevant information throughout the text of this document.

Environmental Investigations

In 1981 investigations at the Site indicated that shallow groundwater beneath the Site was contaminated with several VOCs (listed in groundwater section below). Subsequent investigations indicated that the contaminants had migrated off-site and impacted residential wells at levels exceeding MDH Health Risk Limits for drinking water.

As a result, in 1983 and in 1989 MDH issued drinking water advisories for several residences south and southwest of the Site. The Counties installed a groundwater pump-out and treatment system to reduce off-site migration of contaminated groundwater in 1983. Because of continued concern about the potential for exposure to contaminants in the groundwater, the Counties installed a municipal water system in 1991-92 for approximately 80 residents down gradient of the Site. The area serviced by municipal water extends to Highway 5, including the residences south and west of the Site, one of the maintenance buildings, and the fire station (Figure 2). MPCA has indicated that all affected water wells have been sealed (MPCA 1994).

In January and March of 1993 the Counties conducted a soil gas investigation which indicated that explosive levels of methane were being generated by the wastes at the Site. The results showed that methane was migrating in the direction of several residences and the fire station. In addition, the investigation indicated that several VOCs were present in monitoring vents along the Site's western boundary (MPCA 1994). In January 1993 an explosion occurred at an on-site valve house as a result of methane gas accumulation inside the structure. No injuries occurred from the explosion, and steps were taken to repair and modify the valve house to prevent another explosion (MPCA 1994).

To address concerns about possible methane accumulation in nearby residences, the Counties installed continuous methane monitors in six homes west of the Site in 1993. Methane monitors were also installed at the fire station, one maintenance building, and at the blower building located on-site. Contingency plans were established by the Counties in the event monitors actuate.

In 1993 the Counties installed an interim active gas extraction system along the western perimeter of the Site to block methane migration from the landfill (Figure 3). In addition, the Counties conducted a soil gas survey in the Summer of 1994. Twenty-four locations were

sampled for methane gas at multiple depths up to 42 feet below the surface. Methane concentrations above the lower explosive limit (LEL) (5% methane by volume) were identified near residences west of the Site. Additional monitoring probes (G12 and G13) were installed in this area as a result of this study (Figure 3). Figure 3 also shows the groundwater control system, labeled GC (gradient control well), and Treatment Areas 1 and 2. Continued monitoring at the Site has indicated that this interim system is only partially effective at reducing the levels of methane near residences. However, none of the methane monitors placed in residences closest to the Site have actuated, suggesting that methane has not accumulated to hazardous levels indoors.

CURRENT SITE CONDITIONS

Site Visits

To observe current site conditions, Chuck Stroebel (MDH) and Mark Staba (MDH) visited the Site on May 11, 1995. Chuck Stroebel and Eric Magee (Washington County) conducted a follow-up visit on October 6, 1995. The following site observations were noted:

- C Access to most of the Site is restricted by a fence; however, a gap was observed along Jamaca Avenue at the southwestern perimeter of the Site during both site visits. This gap is large enough to allow a person to enter the Site and appears to be a deer crossing. Access to spray irrigation Treatment Area 1 is restricted by another fence at the interior southeast portion of the Site.
- C The surface of the Site is relatively flat with slight inclines and depressions. Small to mid-sized trees (maximum of approximately 25 feet in height) are scattered over the fill area, and vegetation appears to be stressed in a few limited areas. A small wetland area is located at the southwest corner of the Site.
- C The blower extraction building for the interim extraction system is approximately 60 feet south of the fire station near the Site's western perimeter. Electrical power lines (approximately 50 feet in height) extend from the blower extraction building to a pole over the fill area (approximately 100 yards to the east). Power lines also extend across the mid-southern boundary of the Site.
- C Yard wastes, such as grass clippings and leaves, are composted on the north end of the fill area. Access to this area is restricted by a gate along Jamaca Avenue, south of the maintenance buildings operated by the City of Lake Elmo.
- C New residential development (i.e. house construction, road expansion) is occurring in the area near Highway 5, south and southwest of the Site. Washington County is developing and expanding, and is in transition from a primarily rural to suburban area.

Groundwater

The monitoring data indicate that the groundwater continues to be impacted by several VOCs from the Site (Wenck 1995). These data were obtained by sampling water from 33 monitoring wells, four gradient control wells, and one residential well.

The results show that vinyl chloride is present in shallow and basal drift wells (A, H, I, V, T, V2) at levels above the health-based standards for drinking water (0.2 micrograms per liter (F g/l)). These wells are located along the west and south boundaries of the Site. Several other VOCs were also detected above health guidelines in wells on-site or near the site boundary, including: benzene, tetrahydrofuran, 1,2 dichloroethane, cis-1,2 dichloroethylene, 1,2 dichloropropane, trichloroethylene, and tetrachloroethylene. These wells draw from the shallow drift and basal, and Prairie du Chien aquifers.

Low levels of VOCs have also been detected in several more distant wells south of the Site (R1, R2, R3, AA, BB2, BB3, EE). These wells draw from the shallow drift and basal, and Prairie du Chien aquifers. No contaminants have been detected in the one residential well which is regularly sampled near the Site.

The groundwater treatment system is currently operating to prevent contaminants from migrating down gradient of the Site. This system consists of four gradient control wells (GC1, GC2R, GC3, GC4) which are located along the mid to southern portion of the Site. This system has operated continuously since 1983 with the exception of maintenance and repairs. Captured groundwater from three of these wells is pumped to the surface and spray irrigated on Treatment Area 1, southeast of the fill limits. The groundwater from the fourth well (GC 1) is monitored and then discharged off-site (see below).

A 1995 report on the Site (Wenck 1995) states that the levels of vinyl chloride and other VOCs in wells V and V2 are high because they are close to a stagnation point between the two most southern gradient control wells. However, it is also possible that these higher levels are caused by a gap in the gradient control system which is not completely capturing the plume of contaminants migrating south of the Site. Monitoring data show low levels of VOCs in nearby well nest R, at the southeast boundary of the Site. Additional data are needed to evaluate the effectiveness of the pumpouts system and to determine if contaminants are migrating south of the V and V2 wells.

Surface Water

Gradient control well 1 (GC1) discharges effluent into the Valley Branch Watershed District's Tri-Lakes Outlet via manhole 36, approximately 2000 feet upstream from the culvert under Highway 5 (Figure 1). The effluent passes through a wetland area and ultimately enters Eagle Point Lake, approximately one mile southeast of the Highway 5 outfall. This water is monitored

by the Counties based on National Pollutant Discharge Elimination System (NPDES) permit requirements. The permit, issued by MPCA in May 1989, establishes a parameter list, discharge limitations and monitoring requirements for surface water quality standards at this Site. This discharge is sampled monthly for VOCs, total phenols, metals and pH.

The monitoring data indicate that the GC1 effluent has been within NPDES compliance and standards set by the City of Lake Elmo, except for two sampling events in March 1990 and January 1991. During these times the concentrations of total phenols exceeded permit guidelines (7 Fg/l) by 1 and 2 Fg/l, respectively (MPCA 1994). However, follow-up sampling required by the NPDES permit showed no exceedances of the permit guidelines.

In November 1991 spray irrigation at Treatment Area 2 (Figure 3) was closed because it was located directly over the fill area and because of concerns about contaminated soil and water runoff (metal loading) into the pond northeast of the Site. In June 1991 the Counties submitted an investigative report to MPCA, which concluded that the past metal loading did not pose a threat to the environment. In October 1992 additional testing was done to confirm this conclusion, and the measured metal levels met established surface water standards for this Site.

Landfill Gas

Monitoring data from the Site suggest that methane levels in soil along the western border have declined dramatically since the installation of the interim gas extraction system in 1993. However, methane continues to migrate in the vicinity of residences west of the Site. During the first quarter of 1995, the data show that methane concentrations were up to 17.0% methane in monitoring vent G12, and 0.1 % at monitoring vent G10 (Wenck 1995). No methane was detected in other vents at the Site during the first quarter of 1995.

Six residences west of the Site have continuous methane monitors that alarm at levels exceeding 10% of the LEL. None of these monitors have actuated since their installation in 1993. In addition, monitors in the fire station and the maintenance building adjacent to the Site indicate that methane concentrations have been maintained below 25% of the LEL, as required by the First Amended Unilateral Administrative Order (EPA 1993).

In addition to methane, other landfill gases have been identified in soil at the Site (MPCA 1994). A limited soil gas survey was conducted in 1993. The results showed that there were several VOCs in the soil along the western perimeter of the Site. However, only limited conclusions can be made from these results because they were obtained prior to installation of the interim extraction system and were determined from only one sampling event.

Air

Air emissions from the vent stack of the interim gas extraction system have been sampled, modeled and analyzed for VOCs quarterly since the system's activation in December 1993. Vinyl chloride exceeded the former allowable emission rate (AER) of 460 micrograms per

second (Fg/second), which is the health-based guideline established by MPCA for this Site at the vent stack. These emissions were sampled eight times from December 1993 to January 1995. For three of these sampling periods vinyl chloride exceeded the AER, initially by over 7 times the health guideline. Vinyl chloride emissions have fluctuated since then with emissions last exceeding the AER in April 1994. The vinyl chloride AER was recently revised and lowered to 384 Fg/second (MPCA 1995). Other VOCs sampled at the vent stack since the system's activation have not exceeded the AER.

CURRENT ISSUES

The primary health concern at this Site is the potential for methane gas from the landfill to accumulate to explosive levels in nearby homes and buildings. Although the interim gas extraction system has significantly reduced methane concentrations along the western border of the Site, this system is only partially effective (MPCA 1994). Elevated levels of methane continue to be detected in monitoring vent G12 which is near residences west of the Site. In addition, methane has been detected in soil near the fire station, which is immediately adjacent to the fill limits. However, none of the methane monitors placed in homes or buildings at this Site have actuated, suggesting that methane has not accumulated to hazardous levels indoors.

To address methane-related concerns at this Site, MPCA is expected to install a new active gas extraction system in 1996. This system is anticipated to prevent landfill gases from being forced laterally out of the Site when a new cover is installed and to prevent methane migration near residences and buildings. MPCA also has proposed to remove the fire station from the Site to eliminate the potential for methane accumulation and to make way for new construction at the Site (MDH 1995b). The maintenance buildings northwest of the Site will remain in place because methane is unlikely to migrate to and accumulate in these structures given the current understanding of the soil profile, and the type of construction and building use. As a precautionary measure, the nearest maintenance building has a continuous methane monitor and MPCA has proposed placing monitoring probes between this building and the fill. In addition, MPCA is anticipated to continue monitoring after installation of the proposed gas extraction system and recapping the Site to evaluate the effectiveness of these remedial actions (MDH 1995b).

Since methane has been detected in the soil near residences, it is likely that VOCs are present in the soil as well. These gases share similar properties with methane, and therefore are expected to migrate in a similar way through the soil. Only limited data are available from 1993 which indicated the presence of VOCs, including vinyl chloride, along the western perimeter of the Site. If these gases were to accumulate inside residences, even at low levels relative to methane, they may be a health concern. The proposed gas extraction system is likely to prevent off-site migration of these gases; however, additional monitoring data are needed to evaluate the potential for exposure to VOCs prior to its installation.

MDH has also evaluated the potential for exposure to contaminated groundwater at this Site. As mentioned, municipal water is supplied to residents living down gradient from the Site extending

approximately 3/4 mile to Highway 5. Exposure to site contaminants to these residents is unlikely because the municipal water is tested regularly and is obtained by the City of Oakdale. People using residential wells down gradient from the Site (south of Highway 5) may be exposed, if contaminants were to migrate to potable water wells in this area. Current monitoring data indicate that there are low levels of VOCs in monitoring wells south of the Site; however, these levels are below health-based standards for drinking water. The groundwater pump-out system is operating to prevent contaminants from migrating from the Site. Regular monitoring of groundwater is being conducted to evaluate the effectiveness of the current pump-out system, and to evaluate the potential for any impact to potable water wells.

Residents near the Site have also expressed concerns about possible health impacts from contaminants in the surface water discharge from GC1. Although contaminants are present in this water, they occur at extremely low concentrations that are below levels of health concern. Regular monitoring of this effluent indicates that the discharge meets surface water standards established by the MPCA and the City of Lake Elmo.

Vinyl chloride emissions from the interim gas extraction system have exceeded the health guideline at the vent stack on several occasions since 1993. These emissions may be a health concern if residents have been exposed regularly to vinyl chloride. Data from the first quarter of 1995 indicate that the vinyl chloride emission rate was 230 Fg/second, which is approximately 2/3 of the current health guideline (384 Fg/second) (Wenck 1995). Emissions of other VOCs at the vent stack are also below the health guidelines. Due to possible fluctuations in the emission rate, continued monitoring is necessary to determine if vinyl chloride emissions exceed the guideline and to determine if modifications are needed to reduce emissions from the interim system.

The new gas extraction system proposed for the Site is a closed flare which is estimated to eliminate 98%, or more, of the VOC emissions at the vent stack. This contrasts with the interim system which vents directly to the ambient air without flare or combustion.

While the flare will significantly reduce VOC emissions, this system is expected to extract a much larger volume of VOCs from the landfill (compared to the interim system). These emissions may be a concern if they regularly exceed health guidelines after flaring. Monitoring will be necessary to determine if the flare and equipment are working properly and to evaluate any hazards associated with the emissions to residents near the Site.

Based on the information presented above, MDH does not currently consider this Site to be a health hazard. This conclusion should be reviewed when additional data are obtained.

CONCLUSIONS

- C The Washington County Sanitary Landfill (the Site) is a publicly owned and permitted landfill, which operated from 1969 to 1975. Municipal wastes, commercial/industrial

wastes, and demolition wastes were disposed at the Site by Washington and Ramsey Counties.

- C The interim gas extraction system has significantly reduced methane concentrations in soil west of the Site. However, elevated levels of methane continue to be detected near residences across Jamaca Avenue. Methane monitors placed in homes near the Site have not actuated, suggesting that methane has not accumulated to hazardous levels indoors.
- C Only limited data are available regarding VOC gas concentrations in off-site soil. If VOC gases were to accumulate inside residences, even at low levels relative to methane, they would be a health concern. The proposed gas extraction system is likely to prevent off-site migration of these gases; however, additional monitoring data are needed to evaluate the potential for exposure prior to its installation.
- C VOCs are present in groundwater monitoring wells at levels above the MDH health guidelines at the Site's west and south boundaries. VOCs also have been detected at levels below health guidelines for drinking water in monitoring wells down gradient of the Site.
- C Municipal water is supplied to residents living down gradient from the Site extending approximately 3/4 mile to Highway 5. Exposure to site contaminants by these residents is unlikely because the municipal water is tested regularly and is obtained by the City of Oakdale. People using residential wells down gradient from the Site (south of Highway 5) may be exposed, if contaminants were to migrate to potable water wells in this area. Regular monitoring of groundwater is being conducted to evaluate the effectiveness of the current pump-out system, and to evaluate the potential for any impact to potable water wells.
- C Vinyl chloride emissions from the interim gas extraction system have exceeded the health guideline at the vent stack on several occasions since 1993. These emissions may pose a health concern if residents have been exposed regularly to vinyl chloride. Emissions of other VOCs at the vent stack are below the health guidelines.
- C The new gas extraction system proposed for the Site is a closed flare which is estimated to eliminate 98%, or more, of the VOC emissions at the vent stack. While the flare will significantly reduce VOC emissions, this system is expected to extract a much larger volume of VOCs from the landfill (compared to the interim system). These emissions may be a concern if they exceed health guidelines.
- C Residents near the Site expressed concern about the off-site surface water discharge from the existing groundwater and pump-out system. Regular monitoring of the effluent indicates that the discharge is currently meeting surface water standards established by the MPCA and the City of Lake Elmo, and that the water is not likely to be a health hazard.

- C Regulatory control of the Site is being transferred to the Minnesota Landfill Cleanup Program, which will remove the Site from Superfund and place it under state authority. The MPCA has outlined remedial plans for the Site, including: (1) placing a new cover over the Site, (2) installing a new active gas extraction system, and (3) continuing groundwater monitoring and pumping at the Site. The new cover and the proposed active gas extraction system are expected to be installed in 1996.

RECOMMENDATIONS

1. As proposed by the MPCA, a new active gas extraction system should be installed to prevent landfill gas migration from the Site. Methane monitoring should be continued to evaluate the impact of the proposed extraction system and landfill cover on gas migration, and to ensure the methane is not a hazard to nearby residents. Additional monitoring of VOCs is needed to determine if they are present at levels of health concern in soil near residences west of the Site.
2. Air emissions from the interim gas extraction system should continue to be monitored. If these emissions exceed the health guidelines, modifications should be made to ensure that they remain below levels of health concern. Monitoring of the emissions from the proposed venting system will need to be conducted to determine if there are any hazards associated with the emissions. The appropriate frequency of this sampling should be based on the emissions from the proposed venting system.
3. Groundwater monitoring should be continued to evaluate the effectiveness of the current pump-out system, and to evaluate the potential for down gradient wells to be impacted by contaminants from the Site. After installation of a cover and the active gas extraction system, these data should be evaluated to determine if additional wells are needed to characterize the plume south of the Site.
5. Access to the Site should be restricted to prevent exposure to physical hazards on the Site.
6. Workers involved in activities at the Site, such as digging or drilling, should be properly trained and informed of hazards (i.e. electrical, chemical) at the Site.
7. Efforts to distribute information to the surrounding community regarding site activities and plans should continue. This may involve the use of fact sheets, public meetings, development of site mailing lists, or other community relations tools.
8. The Site should be reviewed as part of the MDH work plan in 1997 to evaluate remedial actions and any changes in site conditions that may impact public health.

The data and information in this report have been collected to decide if follow-up actions may be indicated. No further public health actions are suggested at this time.

Preparers of the Report:

Mark Staba
Site Assessment and Consultation Unit
Minnesota Department of Health
Environmental Scientist
612/215-0913

Chuck Stroebel
Site Assessment and Consultation Unit
Minnesota Department of Health
Environmental Scientist
612/215-0919

CERTIFICATION

This Washington County Sanitary Landfill Site Site Review And Update 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 site review & update was begun.

Richard R. Kauffman, M.S.
Technical Project Officer
State Programs Section (SPS)
Superfund Site Assessment Branch (SSAB)
Division of Health Assessment and Consultation (DHAC)
ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this site review & update, and concurs with its findings.

Richard E. Gillig, M.C.P.
Chief, SPS, SSAB, DHAC, ATSDR

DOCUMENTS REVIEWED

ATSDR, Health Assessment for the Washington County Landfill National Priorities List (NPL) Site (April 19, 1989).

EPA, First Amended Unilateral Administrative Order (February 1993).

MDH, Site Review and Update of the Washington County Landfill (May 20, 1993).

MDH, Telephone Conversation with Eric Magee, Memo from Mark Staba to the Washington County Site File (May 10, 1995a).

MDH, Telephone Conversation with Peter Tiffany, Memo from Mark Staba to the Washington County Site File (May 4, June 8 and 9, 1995b).

MDH, Telephone Conversation with Gregg Rocheford, Memo from Mark Staba to the Washington County Site File (May 8, 1995c).

MDH, Telephone Conversation with Nile Fellows, Memo from Mark Staba to the Washington County Site File (May 2, 1995d).

MDH, Washington County Landfill Informational Meeting, Memo from Chuck Stroebel to Washington County Site File (April 6, 1995e).

MPCA, Comments on the ATSDR Health Assessment for Washington County Landfill, Memo to Gary Eddy from Dave Douglas (January 16, 1990).

MPCA, Five-Year Review Report Washington County Landfill Site - Lake Elmo, Minnesota (January, 1994).

MPCA, Fact Sheet - Work Planned for Washington County Landfill (March, 1995).

MPCA, Minnesota Closed Landfill Assessment Report 1994 (January, 1995).

Wenck Associates, Inc., 1993 Evaluation Report for the Washington County Landfill No.1 (February, 1994).

Wenck Associates, Inc., 1994 Evaluation Report for the Washington County Landfill No. 1 (February, 1995).

Wenck Associates, Inc., Quarterly Report January-March 1995 of the Washington County Landfill No. 1 (April, 1995).

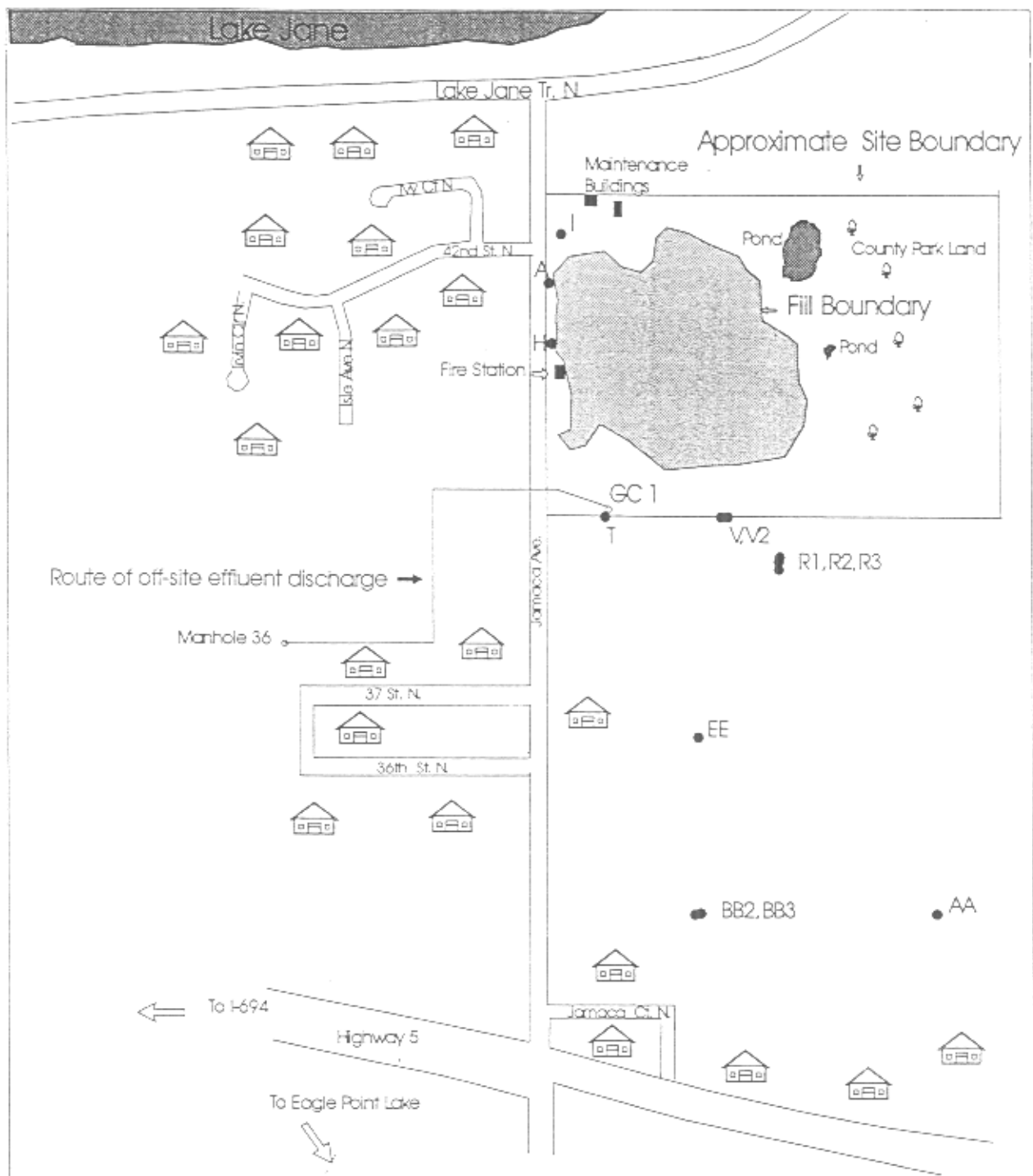


Figure 1: Washington County Landfill and Vicinity



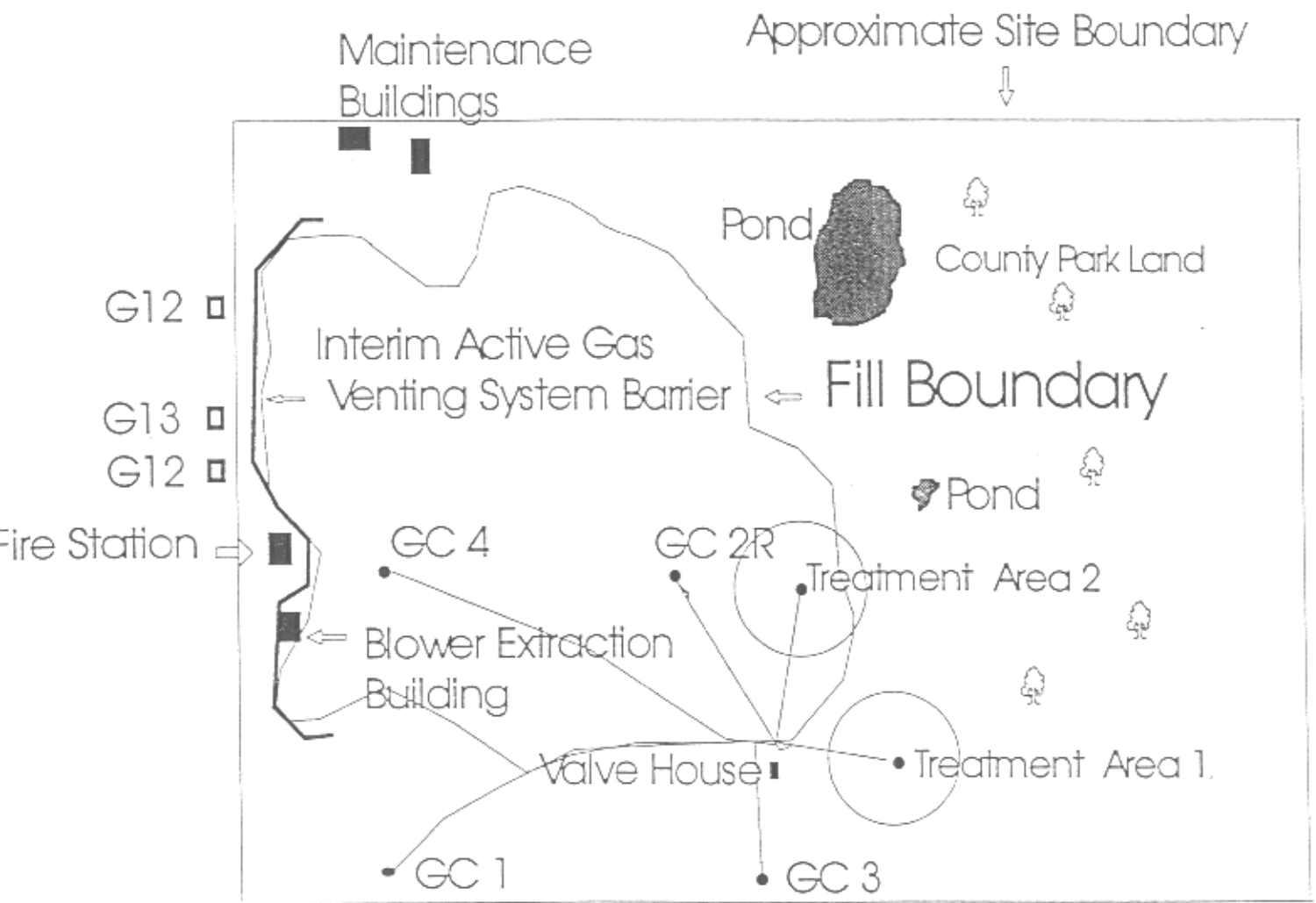


Figure 2: Site Area Map -- Washington County SLF

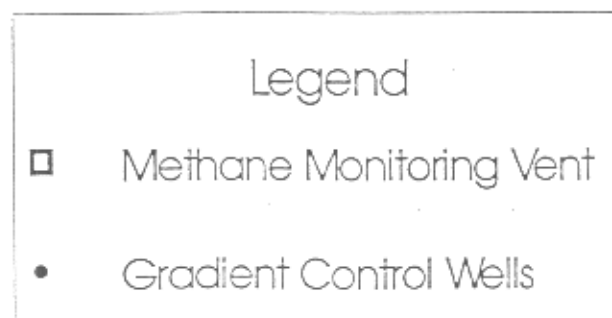


Table 1
Maximum VOC Concentrations from Limited Landfill Gas Sampling

Compound	Maximum Concentration (ppm)
Benzene	11
Chloroethane	0.7
Dichlorodifluoromethane	11
Dichloroflouromethane	30
1,2-Dichlorotetrafluoroethene	0.7
1,1-Dichloroethane	1.6
1,2- Dichloroethene	16
1,2-Dichloropropane	3.5
Ethylbenzene	36
Isopropyl Benzene	4.8
Methylene Chloride	3.7
Methyl Isobutyl Ketone	10
P-Isopropyl Toluene	1.1
1,1,2,2-Tetrachloroethene	2.5
Toluene	32
Trichloroflouromethane	0.1
1,1,2-Trichloroethylene (TCE)	2.9
Vinyl Chloride	16
Xylenes (total)	133

Source: MPCA 1994