

Health Consultation

**REVIEW OF PRIVATE WELL DATA:
FORMER WASHINGTON COUNTY SANITARY LANDFILL
WASHINGTON COUNTY, MINNESOTA**

EPA Facility ID: MND980704738

**Prepared by the
Minnesota Department of Health**

July 6, 2009

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

A health consultation is a verbal or written response from ATSDR or ATSDR's Cooperative Agreement Partners 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 or ATSDR's Cooperative Agreement Partner which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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FOREWORD

This document summarizes public health concerns at a groundwater contamination 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 is 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 individual 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
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OR call us at: (651) 201-4897 or 1-800-657-3908
(toll free call—press "4" on your touch tone phone)

On the web: <http://www.health.state.mn.us/divs/eh/hazardous/index.html>

I. Summary of Background and History

The purpose of this Health Consultation is to respond to a request from the Minnesota Pollution Control Agency (MPCA) for Minnesota Department of Health (MDH) staff to review water quality data for a private well located southeast of the former Washington County Sanitary Landfill in Lake Elmo, Minnesota. The location of the former Washington County Sanitary Landfill and monitoring wells installed to monitor groundwater at and near it are shown in Figure 1.

The former Washington County Sanitary Landfill is a 35-acre site that was used for a gravel pit in the 1960s. After gravel mining ceased, it was operated by Ramsey and Washington counties as a sanitary landfill from 1969 to 1975, and accepted residential, commercial, and industrial wastes (MPCA 2008). Figure 2 is a photograph from the early 1970s that shows trucks dumping solid waste in the former gravel pit. The site closed in 1975, and at that time a clean soil cap was placed on the landfill. In 1981, groundwater monitoring indicated the presence of volatile organic compounds (VOCs) and some heavy metals in on-site monitoring wells and off-site residential drinking water wells. In 1983, Ramsey and Washington counties (as responsible parties for the site) installed a remediation system to reduce or eliminate VOCs in groundwater migrating away from the landfill. The system involved groundwater extraction wells to pump the contaminated groundwater from beneath the landfill and spray it back over the ground surface, allowing the VOCs to evaporate (where they would degrade in the atmosphere) and the water to infiltrate back into the aquifer. This type of treatment effectively removes and treats VOCs in groundwater. In the mid-1980s, private wells were sealed at 121 homes west and south of the landfill and the homes connected to the adjacent City of Oakdale municipal water supply (later switched to the Lake Elmo municipal water supply when it became available) due to groundwater contamination with VOCs. Responsibility for investigation, remediation, and ongoing maintenance of the former Washington County Sanitary Landfill was assumed by the MPCA in 1996 after the creation of the Closed Landfill Program.

In 2004, 3M reported to the MPCA that sludge and ash from 3M's Cottage Grove facility that contained a family of chemicals known as perfluorochemicals (PFCs) were disposed of in the early 1970s at the former Washington County Sanitary Landfill. Soon thereafter, PFCs were detected by the MPCA in groundwater monitoring wells at the landfill, and were ultimately detected in hundreds of private wells located to the south, beyond the area where municipal water was extended in the 1980s. In 2006 and 2007 the City of Lake Elmo, using grant funds from 3M, extended city water to over 200 of these homes and sealed the private wells. PFC contamination at the landfill, a nearby disposal site in the City of Oakdale, and surrounding areas was described by MDH in a Public Health Assessment (PHA; MDH 2008) dated August 29, 2008, available on the MDH website at <http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/pha/lakeelmooakdale/index.html>.

The private well for which MDH was requested to review data is located downgradient of the landfill and has been monitored regularly by the MPCA. Monitoring was originally done for VOCs alone, but has included PFCs since their discovery at the landfill in 2004. The 126 foot deep private well, completed in the Prairie du Chien aquifer, is used for domestic purposes and to provide water for a small number of farm animals. In 2004, the MDH Public Health Laboratory

had the capability to analyze for two PFCs, perfluorooctane sulfonate (PFOS) and perfluorooctanoic acid (PFOA). Neither PFOS nor PFOA were detected in the 2004 water sample; however the method detection limits at that time were higher than those achievable today.

The well was routinely re-sampled for PFCs in April 2006. By this time, the MDH Public Health Laboratory had developed the ability to analyze for a total of seven PFCs: PFOS, PFOA, perfluorobutanoic acid (PFBA), perfluoropentanoic acid (PFPeA), perfluorohexanoic acid (PFHxA), perfluorobutane sulfonate (PFBS), and perfluorohexane sulfonate (PFHxS). The method detection limits were also much lower. PFBA was detected in this sample at a concentration of nearly twelve micrograms per liter (ug/L); PFOA was also detected at a low level (0.21 ug/L). Because the level of PFBA exceeded a well advisory guideline of 1 ug/L established by MDH for PFBA at that time, on June 13, 2006 MDH issued a drinking water well advisory to the residents recommending that they not use the water for drinking and cooking purposes. The issuance of the drinking water well advisory triggered the delivery of bottled water by the MPCA to be used as an alternate water supply until a more permanent solution could be implemented. Unfortunately, the detection of PFBA and the issuance of the drinking water well advisory were made after design and initial construction of the city water extension began, and provisions could not be made in time to include it in the construction project. Delivery of bottled water has continued to this day.

The well has been re-sampled two more times for PFCs, in May and December of 2008. PFC data since 2004 for the well are presented in Table 1:

Table 1: PFC Monitoring Data

Sample Date	PFOS	PFOA	PFBA	PFPeA	PFHxA	PFBS	PFHxS
6/21/2004	0	0	---	---	---	---	---
4/27/2006	0	0.21	11.77	0	0	0	0
5/30/2008	0	0.6	17	0.28	0.3	0	0
12/4/2008	0	0.7	19	0.26	0.36	0	0

--- = not analyzed.

PFC levels appear to be rising in the well. It is not clear if this is related to adjustments made by the MPCA to the groundwater extraction and treatment system at the landfill (which involved moving the infiltration area further south), changes in PFC levels in the aquifer, or other unknown factors.

The well has also been periodically sampled for VOCs by the MPCA due to their presence in groundwater at the landfill. Very low levels of two VOCs, dichlorodifluoromethane and dichlorofluoromethane, were also detected in the December 2008 sample. These two VOCs are common groundwater contaminants near landfills, and their levels were well below MDH drinking water standards.

To address the long-term impact on public health and the environment from PFC contamination at the landfill, the MPCA plans to conduct further remediation beginning in 2009. This work will consist of complete excavation of the wastes (in phases) and reburial in a lined disposal cell to be

constructed on site. A leachate collection system will also be installed. This work will necessitate the temporary shutdown of the groundwater extraction system and removal of other safeguards in place designed to limit the migration of contaminants from the waste. The work is expected to take several years to complete.

Site Visits

MDH Site Assessment & Consultation Unit staff have participated in the collection of private well samples at and near the former Washington County Sanitary Landfill, attended community and local government meetings, and discussed sample results with private well owners. Access to the former Washington County Landfill is restricted by fencing and gates, and the area is regularly patrolled. There are no exposed wastes on the former landfill, although exposure to PFCs (and other contaminants) could occur from contact with or ingestion of the extracted contaminated groundwater as it infiltrates back into the ground.

II. Discussion

Evaluation of Toxicity and Exposure to Site Contaminants

Perfluorochemicals are a class of organic chemicals in which fluorine atoms completely replace the hydrogen atoms that are typically attached to the carbon ‘backbone’ of organic hydrocarbon molecules. Because of the very high strength of the carbon-fluorine bond, PFCs are inherently stable, nonreactive, and resistant to degradation (3M 1999). PFCs were made by 3M at its Cottage Grove, Minnesota facility and were used in the manufacture of a variety of commercial and industrial products by 3M and other companies, including fabric coatings (such as Scotchgard™), surfactants, non-stick products (including Teflon™), fire-fighting foams, film coatings, and other products.

Because of their unique physical and chemical properties, PFCs appear to move easily through the environment, and have been found globally at low levels. Some PFCs are bio-accumulative, i.e., build up in living organisms; PFOS has been detected in the blood and tissues of humans and animals from virtually all parts of the world. Published toxicological studies in animals exposed to PFCs at high concentrations show adverse effects on the liver and other organs. The mechanisms of toxicity are not entirely clear; one likely major mechanism involves effects on certain enzymes regulating metabolic pathways in the liver. Exposure to high concentrations of PFOA over long durations has been shown to cause tumors in some test animals, although the specific mechanisms are not clear and the relevance to humans may be low. Developmental effects have also been observed in the offspring of pregnant rats and mice exposed to high doses of PFOA and PFOS.

PFOA has a very low volatility and vapor pressure (EPA 2002). PFOA salts are very soluble and completely disassociate in water; in aqueous solution it may loosely collect at the air/water interface and partition between them (3M 2003). The vapor pressure and water solubility of PFBA are similar to PFOA (Kwan 2001). Animal studies have shown that PFOA (in pure form) is easily absorbed through ingestion, inhalation, and dermal contact, as are other PFCs (EPA 2002).

In 2007, MDH established chronic Health-Risk Limits (HRLs) of 0.3 ug/L for PFOS and 0.5 ug/L for PFOA (Note: MDH has proposed to lower the HRL for PFOA to 0.3 ug/L). In early 2008, MDH established a chronic health-based value (HBV) for PFBA of 7 ug/L. The HBV is similar to a HRL but has not been established through a formal rule-making process. MDH also established an acute HBV for PFBA of 8 ug/L, based on a one day exposure. HRLs and HBVs represent levels of a contaminant in drinking water that are safe to consume over a specified exposure period, typically a lifetime unless otherwise specified.

For PFOA, the key study was used to derive a reference dose (RfD) of 0.00014 mg/kg-d. The RfD for PFOA included a ‘dose metric adjustment’ of 70 to account for the even larger relative difference in half-life between Cynomolgus monkeys (20 days) and humans (3.8 years), as well as a total uncertainty factor of 300. The critical effect used to determine the RfD was an increase in relative liver weight. Additional information on the derivation of the PFOA HRL can be found at: <http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/healthlinks.html>

The 2008 HBVs for PFBA are based on toxicological studies conducted on rats. HBVs were developed for different exposure periods (acute, short-term, sub-chronic, and chronic) and were derived based on more recent MDH practices. The lowest non-acute value, which in the case of PFBA is the short-term (up to 30 days) value, became the final HBV. For this value, a reference dose of 0.0038 mg/kg-d was derived from the key study, which included a much smaller ‘dose metric adjustment’ of eight due to the much shorter half-life of PFBA in humans (3 days) versus rats (9.22 hours). The total uncertainty factor was 100. Additional information on the derivation of the PFBA HBV can be found at:

<http://www.health.state.mn.us/divs/eh/hazardous/topics/pfcs/healthlinks.html>

Sample results from the well since 2006 show that the level of PFBA exceeds both the chronic and acute HBVs, and more recently, the chronic HRL for PFOA. The level of PFBA in the well is more than double both the chronic and acute HBVs, and is in fact the highest level of PFBA detected in a drinking water well in Minnesota. The residents were provided the results by letter and have continued to be advised by MDH not to use the water for drinking and cooking purposes.

PFBA (and other PFCs) are considered essentially “non-volatile” in comparison to other chemicals such as VOCs. Nonetheless, there is the potential for some limited exposure to PFBA during showering or bathing. It is difficult to quantify these exposures given the number of variables involved. Ingestion of the contaminated water is by far the predominant exposure pathway. Use of PFC contaminated water for canning or cooking purposes may also contribute to exposure, as reported by Emmett et al. (2006) and Holzer et al (2008).

The MPCA is considering options for providing a permanent, clean source of drinking water to the residents of the home where the well is located (note that MDH does not consider bottled water a permanent solution). These options include:

1. Installing a whole-house granular activated carbon (GAC) system to filter the well water;
2. Drilling a new well that would draw water from a deeper, uncontaminated aquifer; or

3. Connecting the home to the Lake Elmo municipal water supply.

GAC has proven to be an effective treatment to remove PFCs (and VOCs) from drinking water. The MPCA has installed over 70 whole-house GAC filter units to remove PFCs from private well water where drinking water well advisories have been issued by MDH. The filter units consist of two, 90-pound GAC filter tanks connected in series. Using data generated from existing GAC systems, MDH staff estimate that based on the current level found in the well, PFBA would break through the standard GAC filter used by the MPCA in approximately 76 days. Given the upward trend in PFBA levels in the well and the uncertainty over the potential effect on groundwater contaminant migration from the upcoming remediation of the site, PFBA levels are likely to increase, perhaps rapidly. Breakthrough of PFBA could therefore occur at a faster rate and with little or no warning, resulting in exposure to PFBA at levels well above the acute HBV. Levels of VOCs could also rise rapidly, further reducing the capacity of the GAC system to remove PFCs. While other types of treatment such as reverse osmosis may also be effective at removing PFCs, it may not be effective at removing other contaminants.

Construction of a new private well to an uncontaminated aquifer in this instance is also not advisable. Under the provisions of the Special Well Construction Area (SWCA) enacted for this area by MDH, the well would likely need to be constructed to the Franconia aquifer, which lies below the St. Lawrence formation. The St. Lawrence formation is a regional shale layer that acts to protect the Franconia from surface contamination. Drilling through the St. Lawrence could increase the risk that highly PFC contaminated water in the overlying aquifers could contaminate the Franconia aquifer, which is being relied upon as the sole option for PFC-free drinking water within the SWCA. The SWCA was enacted to provide additional control over the construction of water supply wells in the area of contamination, to protect public health and prevent the further spread of contamination.

The most health-protective option for a long-term supply of clean drinking water is the connection of the home to the Lake Elmo municipal water supply. This would eliminate the potential exposure to PFCs at levels above MDH HRLs and HBVs, and would not require regular maintenance of GAC filters or testing of the well. While the initial cost for installation is higher, the ongoing cost is minimal and would be borne by the residents. It would also not result in a risk of spreading the PFC contamination through drilling a new well, or from the failure of the existing well. While some engineering work is required, there is a municipal water line located on the property adjacent to the property where the contaminated well is located.

Child Health Considerations

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 smaller than adults, which means 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 be exposed to PFCs in water from this well during incidental water use such as brushing teeth, or perhaps during showering or bathing. The exposures are expected to be minimal and of short duration.

V. Conclusions

Exposure to levels of PFBA above the HBV in the water from this private well may have occurred for some time prior to the first detection of PFBA in 2006. Currently, exposures are being minimized by the use of bottled water by the residents for drinking and cooking purposes. MDH concludes that exposure to PFCs in the water from this private well is currently not expected to harm the residents health. However, a more permanent solution is needed given the rising level of PFCs, uncertainty over the effectiveness of water treatment, and potential incidental exposure above the acute HBV. MDH concludes that the connection of the home to the Lake Elmo municipal water supply is the most prudent, public health protective option under consideration.

VI. Recommendations

1. To prevent further exposures, the home should be connected to the Lake Elmo municipal water supply as soon as practical by the MPCA, in cooperation with the City of Lake Elmo.
2. The private well should be sealed according to MDH rules, or converted to a monitoring well.

VII. Public Health Action Plan

MDH's Public Health Action Plan for the site will consist of: A letter to the MPCA, city, and county authorities and the property owner advising them of these conclusions and recommendations; communication with local residents; and a review of any additional available data and participation in any meetings or other public outreach activities.

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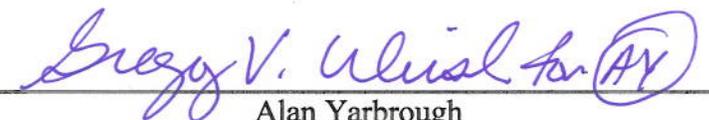
CERTIFICATION

This Washington County Sanitary Landfill 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. Editorial review was completed by the Cooperative Agreement partner.



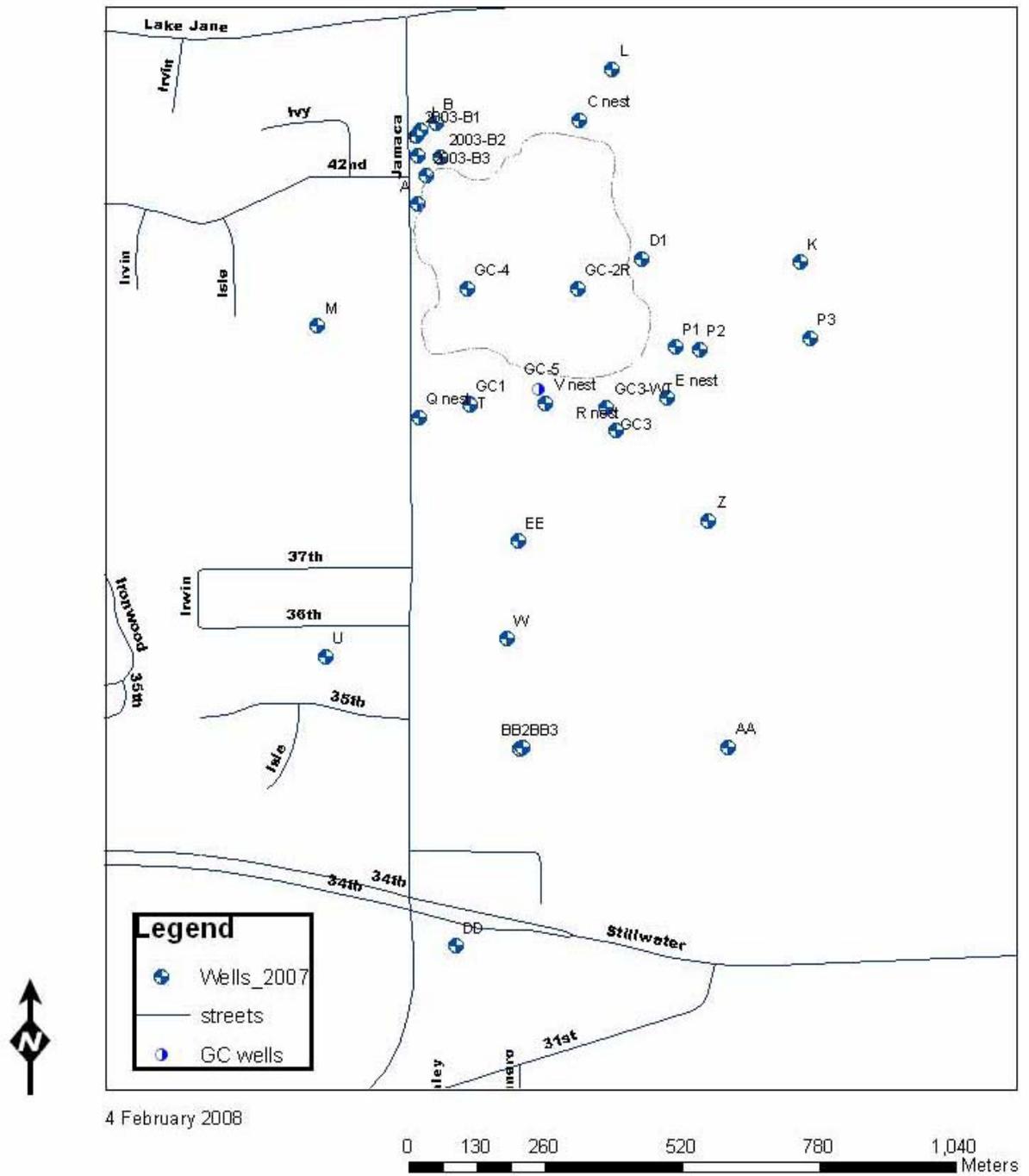
Trent LeCoulre
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The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health consultation and concurs with the findings.



Alan Yarbrough
Chief, State Program Section, SSAB, DHAC, ATSDR

Figure 1
Former Washington County Sanitary Landfill and Monitoring Well Locations



Source: MPCA 2008

Figure 2

Waste Disposal at the Washington County Sanitary Landfill, c. early 1970s



Photo provided by Washington County Dept. of Public Health & Environment