

HEALTH CONSULTATION

Landfill-Gas-Recovery Condensate Off-Gassing in a Residential Area

Northville Township, Wayne County, Michigan

Prepared by

Michigan Department of Community Health
Under a Cooperative Agreement With the
Agency for Toxic Substances and Disease Registry

SUMMARY

In November 2002, intense odors from a sewer line were reported to be entering the ambient air of a yard of a residence on Reservoir Road in Northville Township, Wayne County, Michigan. The odors were making enjoyment of the area impossible and were causing potential exposure of the residents to high concentrations of volatile organic compounds. Investigative efforts by local and state government agencies revealed that landfill-gas-recovery condensate released to the sewer system from a gas-recovery plant was the cause of the odors. High concentrations of total volatile organic compounds were detected in the condensate and residential ambient air. Local and state agencies convened with the operators of the landfill and gas-recovery plant to correct the situation. The odors now have subsided, and total volatile organic compounds in ambient air have decreased to near-normal background levels for the area. *No apparent public health hazard* exists in the Reservoir Road neighborhood since corrective actions were completed.

BACKGROUND

In November 2002, the Michigan Department of Community Health (MDCH) received a call from a homeowner on Reservoir Road in Northville Township, Wayne County, Michigan, who complained of a distinct, sometimes overpowering, petroleum-like odor at a residence on Reservoir Road. MDCH staff advised the homeowner to contact the local fire department to request a check for a combustible gas hazard. The fire department tested the residence and found no hazard to exist.

The homeowner first became aware of the odors in December 2001, when roofing contractors alerted the homeowner to the odor coming from the vent stacks on the roof. Over the next several months these odors intensified, becoming noticeable both indoors and outdoors. The odor was traced to the sewer line that serves Reservoir Road. The houses on Reservoir Road are situated on hill, approximately 50 feet above the main road (Northville Road) and the sewer line. An 8-inch (state-mandated-minimum diameter) sewer pipe extends from the main sewer line and continues up the hillside to service all three residences. Gas from the sewer is drawn up the Reservoir Road pipe and vented into the ambient air through the vent stacks on the roofs and through openings in manhole covers. A similar phenomenon occurs in many sewers; however, in this specific case the volume of wastewater input from only three residences was insufficient to minimize the “chimney effect” that draws odors from the sewer.

In October 2002, the homeowner contacted the Northville Township Department of Public Services, which identified the likely source of the odors as either landfill leachate or gas-recovery condensate that is discharged into the sewer from the Arbor Hills Landfill, 5 miles west of Reservoir Road (Figures 1 and 2). The landfill has discharge permits with Northville Township, the City of Detroit, and the Ypsilanti Community Utilities Authority (YCUA) to discharge effluent into the sewer system. At the time of the complaints, the effluent was comprised of landfill leachate from the Arbor Hills Landfill (operated by the Onyx Corporation [Onyx]) and a gas-recovery condensate, a byproduct of a methane-recovery plant operated by Gas Recovery Systems, Inc. (GRS).

YCUA issued a cease-and-desist order to CRS, which mitigated the situation until the landfill was allowed to release its discharge again, at which point the odors returned. MDCH staff visited the site to determine the public health implications, if any, of these odor events.

RESPONSE

Environmental Testing and Characterization

MDCH staff visited the Reservoir Road residence on November 13, 2002, with a photo-ionization detector (PID). A PID is a real-time instrument that measures and records total VOCs; however, is not capable of identifying the specific VOCs being detected. MDCH staff took readings of total VOCs from 1) the perforated manhole cover nearest the main sewer line (at the bottom of the hill), 2) a manhole cover in the homeowner's backyard (at the top of the hill), 3) vent stacks on the main house and a guest house, and 4) from the indoor air of the homeowner's residence (Table 1). A strong and distinct odor redolent of diesel fuel could be smelled coming from the manhole coverings and from the rooftop vent stacks. A weaker odor pervaded the residence's entire backyard. The odor was slight-to-nonexistent indoors, and VOC readings inside the home were inconclusive. Other readings indicated that significant concentrations of VOCs were present in the sewer.

Table 1. Photo-Ionization Detector (PID) Readings Near Reservoir Road Residence, Northville Township, Wayne County, Michigan, November 13, 2002

Location	Reading Range
Manhole, bottom of hill	176-354 ppm*
Manhole, top of hill	268-533 ppm
Vent stack, main house	64-468 ppm
Vent stack, guest house	191-494 ppm
Ambient air, away from openings	0.3-4.5 ppm

* ppm = parts per million

MDCH notified local and state agencies of the reading results. YCUA subsequently issued a cease-and-desist order to GRS on November 16, 2002. The odor dissipated over the following 36-hour period. MDCH returned to the Reservoir Road residence for follow-up sampling on the morning of November 18, 2002. PID readings ranged from 0.1 to 27.5 parts per million (ppm). The GRS plant was allowed to release effluent later that afternoon. By late evening, the homeowner detected strong odors again and reported the odors to the agencies the next day. YCUA issued another cease-and-desist order for the agencies to meet and determine appropriate actions.

On December 11, 2002, only leachate from the landfill was released to the sewer system. The effluent contained no condensate. MDCH staff took 16 PID readings along the entire route of the sewer system from the landfill to Reservoir Road. The readings ranged from 0.4 to 0.8 ppm VOCs, indicating that the leachate was not the cause of the odors.

Protective Actions

Representatives from MDCH, YCUA, Western Townships Utilities Authority (WTUA), and Northville Township discussed the situation with engineers from GRS and Onyx. Testing of wastewater samples indicated that oil and grease from the compressors in the condensing operation and phenol in the condensate wastestream were the primary contributors to the odor problems (ASci Corporation 2001, Merit Laboratories 2002). The phenols, combined with the “chimney” action of the connecting sewer pipe, were causing the odor problems the residents were experiencing. To correct these problems, GRS installed an ozonation system, repaired a faulty oil/water separator, added a second oil/water separator, and added operational alarms its wastewater treatment system. As well, the company agreed to install a monitoring/alarm system for combustibles and hydrogen sulfide (the gas responsible for the typical, “rotten egg” landfill odor) along the discharge line, before the connection with the main sewer line. WTUA began discussions with the Michigan Department of Environmental Quality regarding venting the sewer line into ambient air at a county park as a protective action. YCUA drafted a consent order to regulate wastewater discharge from GRS into the public sewer system (YCUA 2003).

The cease-and-desist order remained in effect until its stipulated conditions could be met. GRS diverted compressor condensate to an 8,000-gallon storage tank while the corrections and additions were being made. When the conditions of the consent order were accomplished, condensate would be released on a day-by-day basis until YCUA determined the trial period to be satisfactory.

Verification of Results

Subsequent to making the corrections stipulated in the consent order, GRS tested the raw wastewater and the treated wastewater. Analytical results indicated that treatment had been effective (Merit Laboratories 2003).

On February 26, 2004, “pre-release” air samples were taken along the sewer line from the landfill to Reservoir Road by staff from MDCH, WTUA, Northville Township, and GRS (Figure 2). A photo-ionization detector (PID) and a flame-ionization detector (FID), were used to detect total organic compounds, volatile organic compounds (VOCs), and non-volatile organic compounds. The purpose of these “pre-release” readings was to determine background levels of VOCs and other organic compounds emanating from the sewer during periods when no unacceptable odors were present. Samples were taken from the breathing zone (BZ, about 4 feet above ground) around manhole openings and from within the manholes themselves.

On April 6, 2004, GRS initiated a trial release of treated effluent, which had been stored on-site for several months, at a rate of 3 gallons per minute (gpm) to the sewer system. MDCH monitored the air in the manholes (12–18 inches below the opening) and breathing-zone air at the same geographic points previously sampled. On May 13, GRS conducted another trial release at a rate of 6 gpm, using more recently collected condensate. MDCH monitored the air at the manholes during this release as well. The results for the sampling events are compared in Table 2.

Table 2. Results of Air-Sampling Events Using a Photo-Ionization Detector (PID), Arbor Hills Landfill/Gas Recovery Systems, Inc. (GRS), Northville Township, Wayne County, Michigan, 2004

Sampling Location	2/26/04 PID* Results (maximum ppm [†])	4/6/04 PID Results (maximum ppm)	5/13/04 PID Results (maximum ppm)
GRS, condensate manhole (raw effluent), BZ [‡]	4.6	NT [§]	1.3
GRS, condensate manhole (raw effluent)	41.4	84.4	47.9
GRS, storage tank headspace (treated effluent)	NA [¶]	51.6	398.0
GRS, mixing manhole (treated effluent), BZ	NA	35.7 ^{**}	7.1
GRS, mixing manhole (treated effluent)	NA	8.7	10.1
GRS, manhole #6, BZ	0.2	6.7	5.0
GRS, manhole #6	4.5	11.0	2.6
GRS, manhole #7, BZ	0.9	4.9	3.3
GRS, manhole #7	1.6	5.9	1.9
Onyx Pond manhole, BZ	0.8	1.8	3.8
Onyx Pond manhole	2.0	4.3	7.4
Ridge Road manhole, BZ	1.5	5.4	NT
Ridge Road manhole	2.0	4.7	NT
MRP21 manhole, BZ	0.5	3.3	2.7
MRP21 manhole	11.3	5.2	2.6
WTUA46 manhole, BZ	1.3	2.3	2.3
WTUA46 manhole	2.3	3.6	13.5
WTUA101, BZ	0.7	2.4	1.8
WTUA101 manhole	1.2	4.0	2.7
Hines Park, #74, BZ	0.6	1.6	2.0
Hines Park, #74	1.7	3.2	3.1
Hines Park, make-up supply vent intake, BZ	0.5	NT	NT
Northville Rd, manhole at bottom of hill from Reservoir Rd, BZ	0.6	3.1	1.6
Northville Rd, manhole at bottom of hill from Reservoir Rd	1.9	5.0	3.6
Reservoir Rd, main house manhole, BZ	0.5	3.1	1.8
Reservoir Rd, main house manhole	1.7	5.0	2.0
Reservoir Rd, backyard ambient air	NT	1.8	1.5
Reservoir Rd, roof vent, main house	1.7	3.9	NT

* PID = photo-ionization detector

[†] ppm = parts per million

[‡] BZ = breathing zone (about 4 feet above ground)

[§] NT = Not tested

[¶] NA = Not available (tank was frozen)

^{**} The mixing hole was downwind of the open manhole containing the raw effluent

Although the sampling results indicated that VOCs were present in the breathing zone, the homeowner and field staff noticed no strong odors in the ambient air in the homeowner's yard during any of the events. Occasional whiffs of odor were detected near the roof vent; however, because the occupants would not normally be on the roof (except during maintenance), this is not a significant exposure pathway.

It is possible that other sources may account for the presence of VOCs in the sewer line or ambient air. "Feeder" lines connecting to the main sewer system could be carrying wastewater containing volatile chemicals. Also, vehicle exhaust from nearby roadways or emissions from commercial or light industrial businesses in the area could cause the PID to indicate detections. Nonetheless, investigational efforts concluded that GRS was the main source of the odor that prompted the residents to complain.

Addressing the Unique Vulnerabilities of Children

Children may be at greater risk than an adult from certain kinds of exposure to hazardous substances at sites of environmental contamination. Children engage in activities, such as playing outdoors and hand-to-mouth behaviors, which increase their exposure to hazardous substances. Moreover, children are shorter than an adult, which means children breathe dust, soil, and vapors that are close to the ground. Children's low body weight and high air-intake rate result in a greater dose of hazardous substance per unit of body weight. The developing body systems of children can sustain permanent damage if toxic exposures are high enough during critical growth stages (ATSDR 1998).

Children would have been at a greater risk of exposure to gases from the sewer line because of their height and, therefore, closer to the source. The homeowner found the odors to be noxious, causing headache and nausea. At the very least, children would have experienced similar symptoms, and, likely, in a shorter time frame. Because initial exposure was short term and has since stopped, any risk of long-term adverse health effects is minimal.

CONCLUSIONS

This site poses *no apparent public health hazard, because exposure to high concentrations of total VOCs has stopped*. Although VOCs are present in the treated condensate released from the GRS methane-recovery site, the corrective actions taken sufficiently dilute the condensate in the sewer system so that no significant odor events are being experienced. The specific organic compounds which caused the odors have not been identified; however, it is possible that the types of compounds present in the condensate could change because of 1) variations in the composition of the condensate and 2) interactions with other releases into the sewer.

RECOMMENDATIONS

It is no longer necessary for MDCH to continue to monitor ambient air and sewer gas during subsequent releases. However, MDCH will remain available should further investigation be necessary.

To lessen the likelihood of sewer effluent off-gassing to the neighborhood again, WTUA and Northville Township Public Services should consider the feasibility of venting the sewer line upstream, in a non-residential area.

PUBLIC HEALTH ACTION PLAN

1. GRS and WTUA will notify Northville Township, YCUA, MDCH, and the Reservoir Road residents if an alarm situation occurs at the plant or in the sewer system.
2. The Reservoir Road residents will notify GRS, which will notify the other agencies involved, if an unacceptable odor is experienced.
3. WTUA and Northville Township will confer with the state Department of Environmental Quality regarding placing a vent along the system. (This action was completed the summer of 2004.)

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REFERENCES

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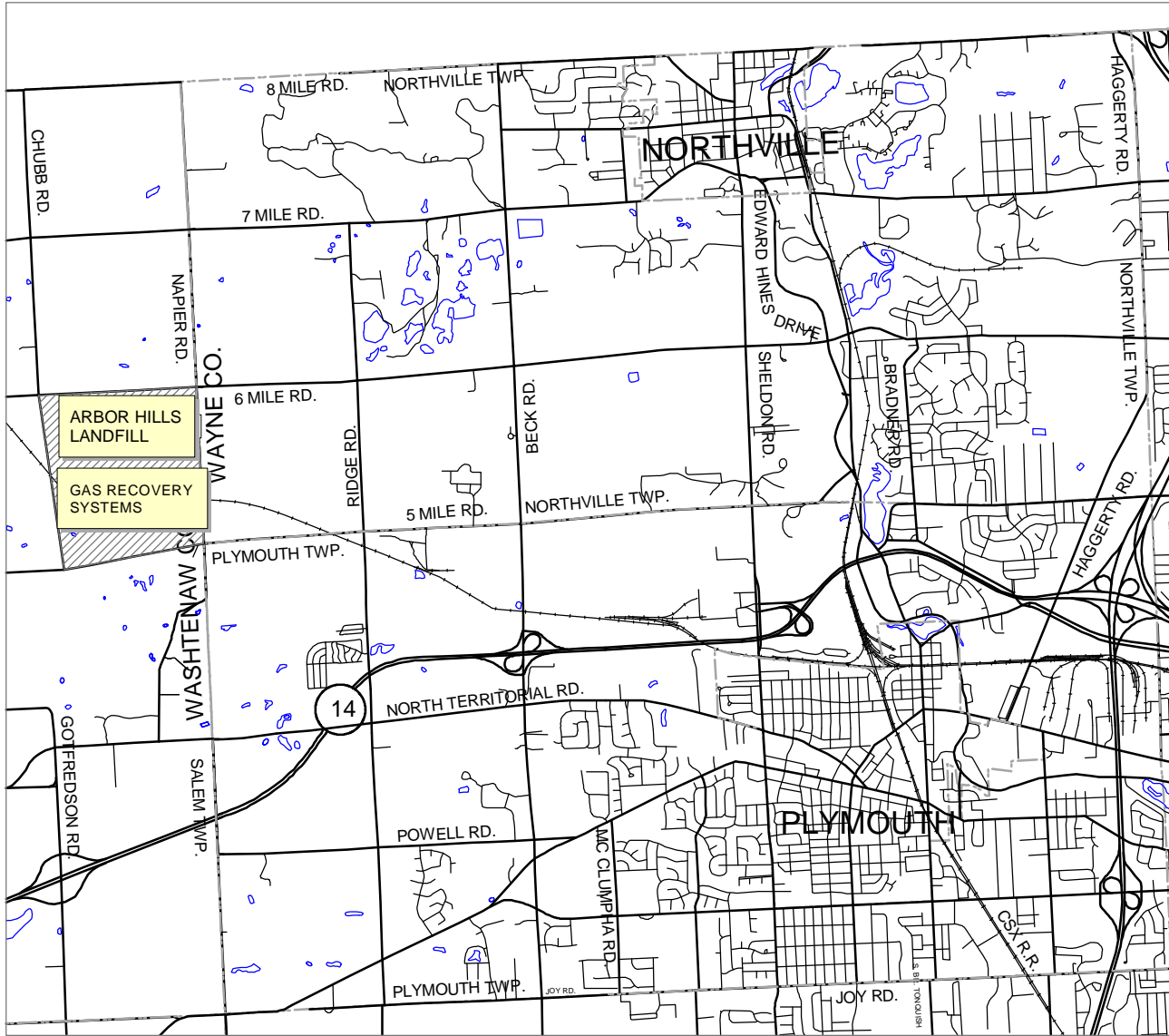
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












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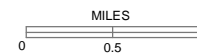
Figure 1.

GAS RECOVERY SYSTEMS/ARBOR HILLS LANDFILL AND SURROUNDING AREA

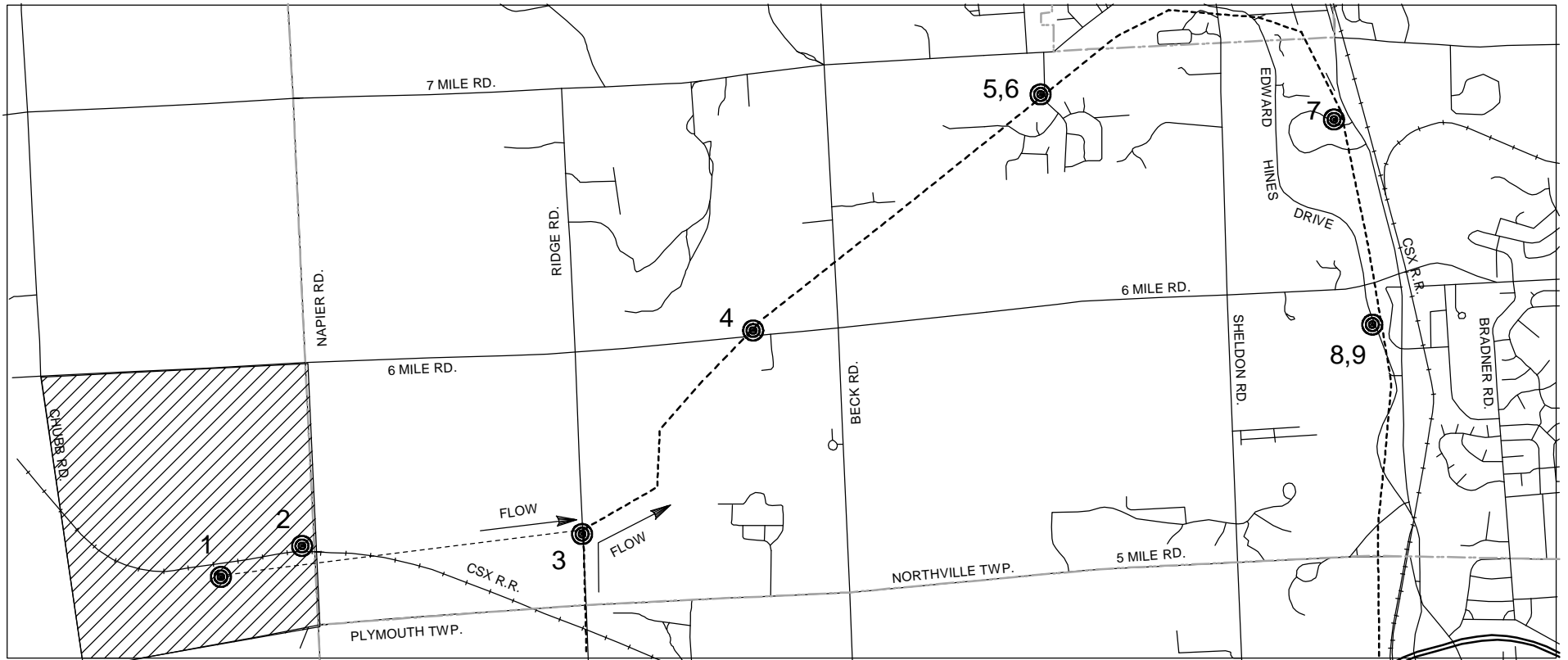
WAYNE AND WASHTENAW COUNTIES, MICHIGAN



-  INTERSTATE HIGHWAYS
-  U.S. HIGHWAYS
-  STATE HIGHWAYS
-  OTHER MAJOR ROADS
-  MINOR ROADS
-  TWO-TRACK ROADS
-  AIRPORTS
-  GRASS AIRSTRIPS
-  RAILROADS
-  ABANDONED RAILROADS
-  RIVERS AND STREAMS
-  INTERMITTENT STREAMS
-  POLITICAL BOUNDARIES



SEWER SYSTEM AND AIR SAMPLING LOCATIONS BETWEEN GRS AND PRIVATE RESIDENCE
 WAYNE AND WASHTENAW COUNTIES, MICHIGAN

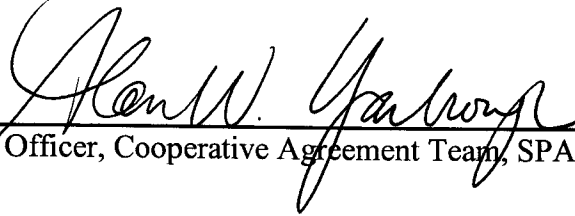


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|---|------------|---|---------|---|-----------------|
| 1 | GRS | 4 | MRP21 | 7 | Hines Park, #74 |
| 2 | Onyx Pond | 5 | UTUA46 | 8 | Northville Road |
| 3 | Ridge Road | 6 | UTUA101 | 9 | Reservoir Road |

Figure 2.

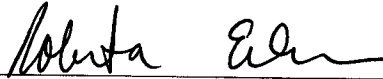
CERTIFICATION

This health consultation, **Landfill-Gas-Recovery Condensate Off-Gassing in a Residential Area**, was prepared by the Michigan Department of Community Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). The health consultation is in accordance with ATSDR-approved methodology and procedures existing when the health consultation was begun.



Technical Project Officer, Cooperative Agreement Team, SPAB, DHAC, ATSDR

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



Team Leader, Cooperative Agreement Team, SPAB, DHAC, ATSDR