Public Health Assessment

Initial/Public Comment Release

Evaluation of Municipal and Residential Drinking Water around Torch Lake

Houghton County, Michigan

EPA FACILITY ID: MID980901946

Prepared by
Michigan Department of Community Health

COMMENT PERIOD ENDS: August 10, 2012

Send comments to:
Dr. Jennifer Gray
Michigan Department of Community Health
Division of Environmental Health
201 Townsend Street
Lansing, MI 48913

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

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment-Public Comment Release was prepared by ATSDR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate. This document represents the agency's best efforts, based on currently available information, to fulfill the statutory criteria set out in CERCLA section 104 (i)(6) within a limited time frame. To the extent possible, it presents an assessment of potential risks to human health. Actions authorized by CERCLA section 104 (i)(11), or otherwise authorized by CERCLA, may be undertaken to prevent or mitigate human exposure or risks to human health. In addition, ATSDR's Cooperative Agreement Partner will utilize this document to determine if follow-up health actions are appropriate at this time.

This document has previously been provided to EPA and the affected state in an initial release, as required by CERCLA section 104 (i) (6) (H) for their information and review. Where necessary, it has been revised in response to comments or additional relevant information provided by them to ATSDR's Cooperative Agreement Partner. This revised document has now been released for a 60-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner will address all public comments and revise or append the document as appropriate. The public health assessment will then be reissued. This will conclude the public health assessment process for this site, unless additional information is obtained by ATSDR's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

Use of trade names is for identification only and does not constitute endorsement by the U.S. Department of Health and Human Services.

Please address comments regarding this report to:

Agency for Toxic Substances and Disease Registry
Attn: Records Center
1600 Clifton Road, N.E., MS F-09
Atlanta, Georgia 30333

You May Contact ATSDR Toll Free at
1-800-CDC-INFO or
Visit our Home Page at: http://www.atsdr.cdc.gov

PUBLIC HEALTH ASSESSMENT

Evaluation of Municipal and Residential Drinking Water around Torch Lake

Houghton County, Michigan

EPA FACILITY ID: MID980901946

Prepared by:

Michigan Department of Community Health

Under a Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

Foreword

The Michigan Department of Community Health (MDCH) conducted this evaluation for the federal Agency for Toxic Substances and Disease Registry (ATSDR) under a cooperative agreement. ATSDR conducts public health activities (assessments/consultations, advisories, education) at sites of environmental contamination. The purpose of this document is to identify potentially harmful chemical exposures and actions that would minimize those exposures. This is not a regulatory document and does not evaluate or confirm compliance with laws. This is a publicly available document and is provided to the appropriate regulatory agencies for their consideration.

The following steps are necessary to conduct public health assessments/consultations:

- Evaluating exposure: MDCH toxicologists begin by reviewing available information about environmental conditions at the site: how much contamination is present, where it is found on the site, and how people might be exposed to it. This process requires the measurement of chemicals in air, water, soil, or animals. Usually, MDCH does not collect its own environmental sampling data. We rely on information provided by the Michigan Department of Environmental Quality (MDEQ), 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, MDCH toxicologists then determine whether that exposure could be harmful to human health, using existing scientific information. The report focuses on public health – the health impact on the community as a whole.

- Developing recommendations: In its report, MDCH outlines conclusions regarding any potential health threat posed by a site, and offers recommendations for reducing or eliminating human exposure to contaminants. If there is an immediate health threat, MDCH will issue a public health advisory warning people of the danger, and will work with the appropriate agencies to resolve the problem.

- Soliciting community input: The evaluation process is interactive. MDCH solicits and considers information from various government agencies, parties responsible for the site, and the community. If you have any questions or comments about this report, we encourage you to contact us.

Please write to: Toxicology and Response Section
Division of Environmental Health
Michigan Department of Community Health
PO Box 30195
Lansing, MI 48909
Or call us at: 1-800-648-6942 (toll free)
For more information, please visit:
www.michigan.gov/mdch-toxics

Table of Contents

List of Tables

List of Figures

List of Appendices

Acronyms and Abbreviations

µg	micrograms
ATSDR	Agency for Toxic Substances and Disease Registry
EPA	U.S. Environmental Protection Agency
kg	kilograms
L	liter
MCL	Maximum Contaminant Level
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
MDNRE	Michigan Department of Natural Resources and Environment
MRL	Minimal Risk Level
NA	not available
NAS	National Academy of Sciences
ND	not detected
NPL	National Priorities List
OU	Operable Unit
PHA	Public Health Assessment
RDWC	Residential Drinking Water Criteria
WUPHD	Western Upper Peninsula Health Department

Torch Lake Superfund Site Public Health Assessment Documents: An Introduction

The federal Agency for Toxic Substances and Disease Registry (ATSDR) is mandated to provide public health activities (assessments, advisories, education) at National Priorities List (NPL, or "Superfund") sites. The Michigan Department of Community Health (MDCH) conducts these activities for ATSDR in Michigan, under a cooperative agreement.

Due to its size and complexity, the Torch Lake Superfund site in Michigan's Upper Peninsula was divided into three Operable Units (OUs), as stated in the United States Environmental Protection Agency (EPA)'s 1992 Record of Decision[1]:

- **OU1** includes surface tailings, drums, and slag pile/beach on the western shore of Torch Lake. These tailing piles include stampsands in Lake Linden, Hubbell/Tamarack City, and Mason, while a slag pile/beach is located in Hubbell.
- **OU2** includes groundwater, surface water, submerged tailings and sediments in Torch Lake, Portage Lake, the Portage Channel, and other water bodies at the site.
- **OU3** includes tailings and slag deposits located in the north entry of Lake Superior, Michigan Smelter, Quincy Smelter, Calumet Lake, Isle-Royale, Boston Pond, and Grosse-Point.

MDCH previously produced several documents for the Torch Lake Superfund site: a Preliminary Health Assessment in 1989; a Site Review and Update in 1995; and a Health Consultation in 1998, per a request by the Michigan Department of Environmental Quality (MDEQ), which was conducting a Brownfields assessment at various locations within the site.

In 2007, MDEQ requested that MDCH provide further public health input on exposure issues for which there was new environmental and toxicological information. MDCH visited the site in June 2008 to gain a better understanding of MDEQ's concerns. The Western Upper Peninsula Health Department (WUPHD) accompanied MDCH, MDEQ, and EPA on this site visit. Issues discussed included:

- ►physical hazards
- ►inhalation of resuspended stampsands
- ►the potential for drinking water to be contaminated
- ►recreational exposure at beaches
- ►exposure via local sport-caught fish consumption.

Following the site visit, WUPHD requested that MDCH determine public health implications of these various exposure pathways.

MDCH is addressing the issues listed above in separate Public Health Assessment (PHA) documents. Each document will be released for public review and comment, following which MDCH will respond in a final document. Comments should be addressed to the first MDCH author listed (see "Preparers of Report" page) and sent to the address in the foreword.

[1] United States Environmental Protection Agency (EPA).Superfund Record of Decision: Torch Lake, MI. Washington, D.C.: Office of Emergency and Remedial Response, United States Environmental Protection Agency; 1992 Sept. Report No.: EPA/ROD/R05-92/215.

Summary

The Torch Lake Superfund site is located in Houghton County in the Keweenaw Peninsula of the Michigan Upper Peninsula. Contamination at the areas included in the site and other locations is primarily from historical copper mining waste. Waste from the copper mining includes stampsands (a type of mine tailing), slag piles, and remains of industrial facilities. Stampsand piles are located throughout the area, and municipal or residential drinking water wells may be installed or screened in stampsand.

The Michigan Department of Community Health's (MDCH) conclusions regarding municipal or residential drinking water wells around the Torch Lake Superfund site:

1. *MDCH concludes that drinking municipal drinking water is not expected to harm people's health.* Dollar Bay (Osceola Township's), City of Houghton's, and Village of Lake Linden's municipal water wells, as tested in 2010, do not contain regulated chemicals at levels that would harm people's health. Several unregulated chemicals were also tested in the water. These chemicals were not detected in the municipal water samples.

   Next steps: MDCH will evaluate new data as necessary.

2. *MDCH is unable to determine if contaminants present in private residential wells installed or screened in stampsand may harm people's health.* Only a limited number of residential wells were sampled in 2010 and the sample results were not useful in evaluating people's potential exposure to chemicals.

   Next steps: MDCH will evaluate new data when it becomes available.

Purpose and Health Issues

In the past, the Michigan Department of Community Health (MDCH) produced several documents discussing public health issues at the Torch Lake Superfund site (ATSDR 1989; 1995; 1998). In 2007, the Michigan Department of Environmental Quality (MDEQ)[2] and the Western Upper Peninsula Health Department (WUPHD) requested that MDCH provide public health input for potential exposures based on new or updated information. This document addresses potential contaminant exposure from municipal or residential wells in the Torch Lake area. This document does not include any ecological assessments, such as discussion of impacts to wildlife or benthic communities.

Background

The Torch Lake Superfund site is located in Houghton County in the Keweenaw Peninsula of the Michigan Upper Peninsula. It was added to the National Priorities List (NPL), also known as

[2] In 2010, the Michigan Department of Environmental Quality (MDEQ) merged with the Michigan Department of Natural Resources (MDNR) and became the Michigan Department of Natural Resources and Environment (MDNRE). In 2011, the MDNRE was separated back into the MDEQ and MDNR. In this document, "MDEQ" is used within the text, regardless of timeline. However, citations refer to the agency name at the time the reference was created.

Superfund, in 1984 due to the presence of copper-mining and industrial waste. Copper mining occurred in this area from the 1890s until 1969. Waste from the copper mining includes stampsands (a type of tailing), slag piles, and remains of industrial facilities. Stampsands are composed of the crushed rock or ore left over after extracting the copper. Approximately 200 million tons of stampsands were disposed of in Torch Lake, filling about 20% of the original lake volume. The thickness of the stampsand sediments may extend 70 feet down from the sediment-water interface in some locations. Stampsand from the shoreline and lake was dredged from the early to mid-1900s for copper reclamation activities. Processes used to remove any remaining copper from the stampsands included flotation and leaching chemicals. Some of the chemicals were present in the stampsands when they were returned to the lake or shoreline. Other wastes possibly present in the lake or along the shoreline include water pumped from the mines, leaching chemicals, explosives residues, barrels, and mining byproducts (Weston 2007).

Although the contamination at the Torch Lake Superfund site and surrounding areas has been in existence for years, because of the size of the impacted area and the diversity of contamination from historical mining operations, there have been very few comprehensive environmental sampling investigations. Due to the nature of the contamination, the contaminant levels present in one area might not be similar to another area, even if the areas are in close proximity. Stampsand is present throughout the Torch Lake area, and municipal or residential wells could be installed or screened in stampsands.

Discussion

The chemical values were compared to screening levels, which are the MDEQ's Part 201 Residential Drinking Water Criteria (RDWC)[3] (MDEQ 2006) or the MDEQ's health-based Rule 57 drinking water values (MDEQ 2010A). Certain RDWC are set for aesthetic reasons, such as color, taste, or odor of the water. RDWC set for aesthetic reasons were not used. Instead, the MDEQ health-based drinking water value was used as a screening level (MDEQ 2011). If levels for a particular chemical were above the screening levels, that chemical is discussed in the Exposure Pathways section.

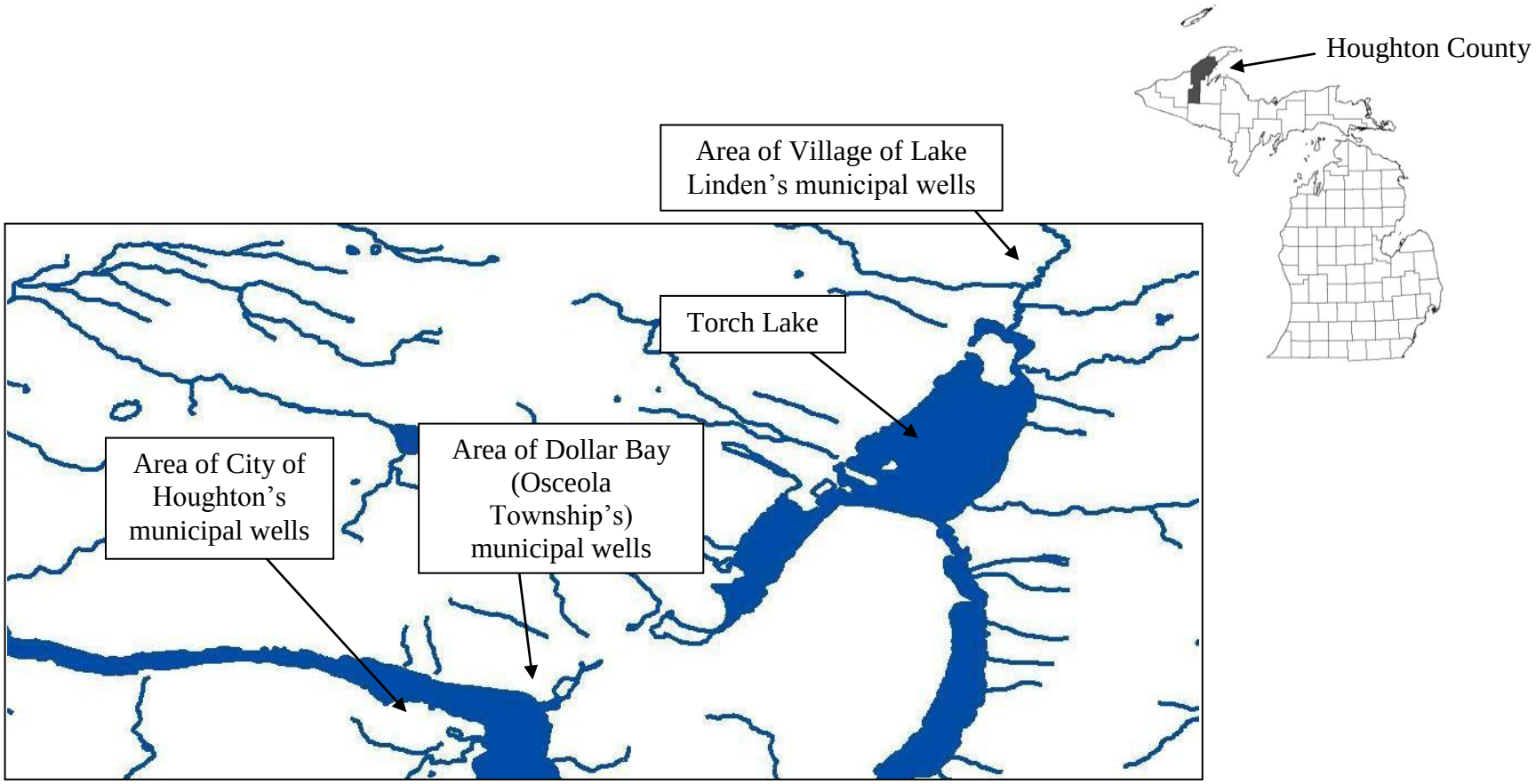
Environmental Contamination

Municipal drinking water

Many communities in Houghton County use groundwater for municipal drinking water. Several municipal drinking water wells are near the Torch Lake Superfund site. All public water supplies in the area, regardless of whether they are screened in stampsand or not, are regularly analyzed for regulated chemicals, as required by the EPA and the MDEQ. The two Dollar Bay (Osceola Township's) municipal wells are installed in an area with a thin stampsand layer (C. Thomas, MDEQ, personal communication, 2011). These wells draw groundwater from 33 to 64 feet below ground surface (bgs) in a natural sand aquifer located below the stampsand cover.

[3] Typically, the MDEQ Part 201 RDWC is the EPA Maximum Contaminant Level (MCL), if one exists for a chemical.

Figure 1: Overview of City of Houghton, Village of Lake Linden, and Dollar Bay (Osceola Township) municipal wells near the Torch Lake Superfund site.



The City of Houghton's municipal wells (three wells) are installed in stampsand, but access groundwater below the stampsand (C. Thomas, MDEQ, personal communication, 2011), between 38 and 61 feet bgs. The Village of Lake Linden's municipal wells (three wells) are not installed in an area with stampsand (C. Thomas, MDEQ, personal communication, 2011) and access the groundwater approximately 207 to 227 feet bgs. These wells were sampled in May 2010 by the MDEQ for volatile organic chemicals and inorganic contaminants, primarily metals. (This sampling was in addition to the regular testing done for chemicals in public drinking water supplies.) Only Dollar Bay wells were analyzed for semivolatile organic compounds.

No volatile organic chemicals (Table A-1) were detected in the eight municipal well water samples. No semi-volatile organic compounds (Table A-2) were detected in the Dollar Bay municipal wells. It should be noted that drinking water analytical methods were *not* used to analyze for the organic chemicals. However, the reporting limits for a majority of the chemicals were at or below the respective drinking water screening levels. These chemicals are discussed further in Appendix A.

Inorganic chemicals were measured, using drinking water methods, in all eight municipal well samples. Maximum inorganic chemical levels from the Dollar Bay, City of Houghton, and Village of Lake Linden municipal wells are displayed in Table 1.

The maximum levels from the Dollar Bay municipal wells were not above the drinking water screening levels.

Maximum levels of the inorganic chemicals, in the City of Houghton's municipal wells, were almost all below the drinking water screening levels. Manganese levels were above the aesthetic screening level, but not the health-based screening level. The EPA evaluated data from the City of Houghton's wells and concluded that those wells did not have contaminants at levels that would cause health concerns (SulTRAC 2010).

Almost all of the inorganic chemicals in the Village of Lake Linden's municipal wells were below the screening levels. All three wells had levels of vanadium that were over the screening level of 4.5 µg/L. Vanadium is discussed in the Exposure Pathways section.

Uranium has previously been found in wells that are in Houghton County. The uranium may be naturally occurring from Jacobsville and Freda Sandstone, types of bedrock in the area. All municipal wells are screened for alpha particles, which are from radionuclides such as uranium, as part of the standard public water supply testing. Levels of alpha particles in the eight municipal wells discussed above were below the EPA's MCL[4], indicating that uranium is not a concern in these wells (C. Thomas, MDEQ, personal communication, 2011). Uranium will not be discussed further.

[4] The EPA's MCL for alpha particles is 15 picocuries per liter (EPA 2009).

Table 1: Maximum levels of inorganic chemicals (in micrograms per liter [µg/L]) from the Dollar Bay (Osceola Township), City of Houghton, and Village of Lake Linden municipal wells (MDNRE 2010B).

Analyte	Drinking water screening level[a] (µg/L)	Maximum level in Dollar Bay wells (µg/L)	Maximum level in City of Houghton wells (µg/L)	Maximum level Village of Lake Linden wells (µg/L)
Aluminum - Total	300[b]	ND[c]	ND[c]	ND[c]
Ammonia	10,000[d]	ND	160	ND
Antimony - Total	6	ND	ND	ND
Arsenic - Total	10	4.7	ND	2.2
Barium - Total	2,000	35	98	49
Beryllium - Total	4	ND	ND	ND
Cadmium - Total	5	ND	ND	ND
Chromium - Total	100	ND	ND	ND
Cobalt - Total	40	ND	ND	ND
Copper - Total	1,400[b]	6.5	1.9	ND
Iron - Total	2,000[b]	ND	280	74
Lead - Total	4	ND	ND	ND
Lithium - Total	170	ND	ND	ND
Manganese - Total	860[b]	7.5	210	ND
Mercury - Total	2	ND	ND	ND
Molybdenum - Total	73	ND	ND	ND
Nickel - Total	100	ND	ND	ND
Nitrate + Nitrite	10,000[d]	1,290	820	370
Selenium - Total	50	ND	ND	1.3
Silver -Total	34	ND	ND	ND
Strontium - Total	4,600	62	120	250[e]
Thallium - Total	2	ND	ND	ND
Vanadium - Total	4.5	ND	ND	**13**
Zinc - Total	2,400	ND	ND	ND

Bold values are over the screening level.

a = Unless otherwise noted, the screening levels is the Michigan Department of Environmental Quality's Residential Drinking Water Criteria.

b = Residential health-based drinking water value (MDEQ 2011). Aesthetic impacts, to the color and taste of the water, can be present.

c = The chemical was not detected (ND) in the samples.

d = Ammonia, nitrate, and nitrite, when added together, should be less than 10,000 µg/L.

e = Result is estimated.

Residential drinking water

Four residential wells were sampled in 2010 and analyzed for metals (SulTRAC 2010). Data from these wells were uninformative in evaluating potential chemicals in people's drinking water because several of the detection limits for metals were over the applicable screening levels due to use of a drinking water analytical method not suited for all of the metals. Additionally, these wells may not have been in locations to have been impacted by chemicals in the stampsand (MDNRE 2011).

The WUPHD advises people with residential wells to test the water for uranium, particularly those that may be in areas with Jacobsville and Freda Sandstone. This naturally-occurring uranium has been found in water supplies from Baraga, Gogebic, Houghton, Keweenaw, and Ontonagon Counties that have exceeded the MCL (WUPHD 2010).

Exposure Pathways Analysis

An exposure pathway contains five elements: (1) the contaminant source, (2) contamination of environmental media, (3) an exposure point, (4) a human exposure route, and (5) potentially exposed populations. An exposure pathway is complete if there is a high probability or evidence that all five elements are present. Table 2 describes human exposure to chemicals in the municipal and residential drinking water from wells near the Torch Lake Superfund site (Houghton County), Michigan.

Table 2: Exposure pathway for groundwater used for municipal and residential drinking water near the Torch Lake Superfund site, Houghton County, Michigan.

Source	Environmental Medium	Exposure Point	Exposure Route	Exposed Population	Time Frame	Exposure
Stampsands and other mining waste	Groundwater	Municipal drinking water	Ingestion and dermal contact	Residents and visitors	Past Present Future	Potential
Stampsands and other mining waste	Groundwater	Residential drinking water	Ingestion and dermal contact	Residents and visitors	Past Present Future	Potential

None of the three sets of municipal wells are screened in stampsand. The City of Houghton and Dollar Bay (Osceola Township) wells are installed in areas of stampsand, but do not have chemical levels above the health-based screening levels.

Although the City of Houghton municipal wells had manganese levels below the health-based screening level, people would be exposed to even lower levels of manganese from the water out of their faucets. The City of Houghton municipal well water has a manganese removal system (C. Thomas, MDEQ, personal communication, 2011). The sample results discussed here were taken before the water goes through the manganese removal system (A. Keranen, MDEQ, personal communication, 2011).

The Village of Lake Linden's municipal well water had vanadium levels above the screening level. The vanadium levels ranged from 8.4 to 13 µg/L. All other inorganic chemicals were

below the screening levels. Children and adults drinking this water would be ingesting vanadium. Vanadium is discussed in the Toxicological Evaluation section.

Residential wells could be installed in areas with stampsand and possibly be screened in stampsand. People's potential exposure to chemicals in residential wells could not be evaluated because many of the samples' analytical detection limits for inorganic chemicals were over the applicable screening levels. It is possible that, especially for residential wells screened in stampsand, chemicals from the stampsand could be in their drinking water.

Toxicological Evaluation

Using the highest vanadium value found (13 µg/L), adults and children would consume up to 35 µg of vanadium per day with a dose no higher than 1.3 µg/kg/day[5]. This value is lower than the EPA's oral reference dose of 5.0 µg/kg/day for vanadium and vanadium compounds (EPA 2011a). The reference dose is a value that is protective for a lifetime of exposure. It is not expected that adults or children would have health effects from drinking vanadium in the Village of Lake Linden municipal water.

Although levels of manganese in the City of Houghton wells could cause the water to have a black or brown color, cause black staining, and a bitter metallic taste (EPA 2011c), manganese levels were not above a health-based screening level. However, the samples of the water were taken before the water went through the treatment system and people's municipal water would have lower levels of manganese.

Children's Health Considerations

Children could be at greater risk as compared to adults from certain kinds of exposure to hazardous substances. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage.

No chemical levels present in the municipal drinking water are expected to harm children's health. However, chemicals levels present in residential drinking water wells are unknown.

Conclusions

MDCH concludes that drinking municipal drinking water is not expected to harm people's health. Dollar Bay (Osceola Township's), City of Houghton's, and Village of Lake Linden's municipal water wells, as tested in 2010, do not have regulated chemicals at levels that would harm people health. Several unregulated chemicals were also tested in the water. These chemicals were not detected in the municipal water samples.

[5] Adults drinking 2.7 L of water per day (EPA 2011b) with 13 µg vanadium/L would drink 35 µg vanadium/day. An 80 kg (EPA 2011b) adult would have a dose of 0.4 µg/kg/day. Children drinking 1 L of water per day (EPA 2008) with 13 µg vanadium/L would drink 13 µg vanadium/day. A 10 kg (EPA 2008) child would have a dose of 1.3 µg/kg/day.

MDCH is unable to determine if contaminants are present in residential wells installed or screened in stampsand and if levels may harm people's health. Only a limited number of residential wells were sampled in 2010 and the sample results were not useful in evaluating people's potential exposure to chemicals as several of the detection limits were over the drinking water screening levels and the wells tested may not have been in the best locations to investigate potential contamination from stampsand.

Recommendations

- Characterize chemicals in private residential drinking water from wells installed in areas with or screened in stampsand using analytical methods approved for drinking water samples.
- Residents who have private drinking water wells in areas with Jacobsville or Freda Sandstone should check their well for uranium (uranium has been found in wells from Baraga, Gogebic, Houghton, Keweenaw, and Ontonagon Counties).

Public Health Action Plan

- MDCH will evaluate any relevant new data on residential drinking water wells when it becomes available.

Preparers of Report

This Public Health Assessment was prepared by the Michigan Department of Community Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented. ATSDR's approval of this document has been captured in an electronic database, and the approving agency reviewers are listed below.

Authors
Jennifer Gray, Ph.D.
Toxicologist

Christina Bush, M.S.
Toxicologist

ATSDR Reviewers
Trent LeCoultre
Technical Project Officer

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1989. Preliminary health assessment for Torch Lake. Atlanta: U.S. Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Site Review and Update – Torch Lake, Hubbell, Houghton County, Michigan. Atlanta: U.S. Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ATSDR). 1998. Health consultation concerning Torch Lake, Hubbell, Houghton County, Michigan. Atlanta: U.S. Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ATSDR). 2009. Toxicological profile for Vanadium. (*Draft for Public Comment*) Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Michigan Department of Environmental Quality (MDEQ). Remediation and Redevelopment Division Operational Memorandum No. 1, Attachment 1, Table 1. Groundwater: Residential and Industrial-Commercial Part 201 Generic Cleanup Criteria and Screening Levels; Part 213 Tier 1 Risk-Based Screening Levels (RBSLs). 2006 January. http://www.michigan.gov/documents/deq/deq-rrd-OpMemo_1-Attachment1Table1GW_283547_7.pdf.

Michigan Department of Environmental Quality (MDEQ). 2010A. Rule 57 Water Quality Values. http://www.michigan.gov/documents/deq/wb-swas-rule57_210455_7.xls.

Michigan Department of Environmental Quality (MDEQ). Footnotes for Part 201 Criteria and Part 213 Risk-Based Screening Levels. 2011 March. http://www.michigan.gov/documents/deq/deq-rrd-OpMemo_1-Footnotes_284869_7.pdf.

Michigan Department of Natural Resources and Environment (MDNRE). 2010B. Laboratory Report. Remediation Division.

Michigan Department of Natural Resources and Environment (MDNRE). 2011. Comments on the Final Field Summary Report, Torch Lake Superfund Site, Houghton County, Michigan.

Organic chemicals, sampling and analytical requirements, 40 CFR Sect.141.24 (2010).

SulTRAC. Final Field Summary Report – Torch Lake Superfund Site, Houghton County, Michigan. Prepared for United States Environmental Protection Agency. 2010 November.

United States Environmental Protection Agency (EPA).Superfund Record of Decision: Torch Lake, MI. Washington, D.C.: Office of Emergency and Remedial Response, United States Environmental Protection Agency; 1992 Sept. Report No.: EPA/ROD/R05-92/215.

United States Environmental Protection Agency (EPA). Child-Specific Exposure Factors Handbook. Washington, D.C.: U.S. Environmental Protection Agency, National Center for Environmental Assessment. Office of Research and Development; 2008. Report No.: EPA/600/R-06/096F.

United States Environmental Protection Agency (EPA). National Primary Drinking Water Regulations. 2009. Report No.: EPA 816-F-09-004. http://water.epa.gov/drink/contaminants/upload/mcl-2.pdf.

United States Environmental Protection Agency (EPA). 2011a. Exposure Factors Handbook: 2011 Edition. Washington, D.C.: National Center for Environmental Assessment, Office of Research and Development, U.S. Environmental Protection Agency; 2011 Report No.: EPA/600/R-090/052F.

United States Environmental Protection Agency (EPA). Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals. http://water.epa.gov/drink/contaminants/secondarystandards.cfm. Updated 7 January 2011b. Accessed 7 February 2011.

United States Environmental Protection Agency (EPA). 2011c. Regional Screening Level (RSL) Summary Table June 2011. http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/pdf/master_sl_table_run_JUN2011.pdf.

Weston Solutions, Inc. (Weston). Summary Report for the Torch Lake Area Assessment: Torch Lake NPL Site and Surrounding Areas Keweenaw Peninsula, Michigan. Prepared for United States Environmental Protection Agency. 2007 December. Document No.: 274-2A-ABDT.

Western Upper Peninsula District Health Department (WUPDHD). Uranium and Fluoride Advisory. http://www.wupdhd.org/?page_id=1442. Updated 3 March 2009. Accessed 16 December 2010.

Appendix A: Results from municipal drinking water wells sampled in May 2010.

Eight municipal wells near the Torch Lake Superfund site were sampled in May 2010. This sampling was in addition to the regular testing that is done for public drinking water supplies. The eight wells were: two from Dollar Bay (belonging to Osceola Township), three belonging to the City of Houghton, and three belonging to the Village of Lake Linden. The method (Method 8260) used to analyze for volatile organic chemicals is not the method required for drinking water samples. Drinking water methods for organic chemicals are Method 524.2 and 525.2, among others (40 CFR 141.24). Many of the chemicals had reporting limits below the screening levels. Table A-1 presents the list of volatile compounds tested along with the drinking water screening levels, reporting limits, and the results.

Table A-1: Volatile organic chemicals results (in micrograms per liter [µg/L]) from the eight municipal wells (owned by Osceola Township [located in Dollar Bay], the City of Houghton, and the Village of Lake Linden) sampled in May 2010 and drinking water screening levels (MDNRE 2010B).

Volatile organic chemicals	Drinking water screening level[a] (µg/L)	Result (µg/L)	Reporting limit (µg/L)
1,1,1,2-Tetrachloroethane	77	ND[b]	1
1,1,1-Trichloroethane	200	ND	1
1,1,2,2-Tetrachloroethane	8.5	ND	1
1,1,2-Trichloroethane	5.0	ND	1
1,1-Dichloroethane	880	ND	1
1,1-Dichloroethylene	7.0	ND	1
1,2,3-Trichlorobenzene	29[c]	ND	5
1,2,3-Trichloropropane	42	ND	1
1,2,3-Trimethylbenzene	10[c]	ND	1
1,2,4-Trichlorobenzene	70	ND	5
1,2,4-Trimethylbenzene	1,000[d]	ND	1
1,2-Dibromo-3-chloropropane	0.2	ND	5
1,2-Dibromoethane	0.05	ND	1
1,2-Dichlorobenzene	600	ND	1
1,2-Dichloroethane	5.0	ND	1
1,2-Dichloropropane	5.0	ND	1
1,3,5-Trimethylbenzene	1,000[d]	ND	1
1,3-Dichlorobenzene	6.6	ND	1
1,4-Dichlorobenzene	75	ND	1
2-Butanone (MEK)	13,000	ND[e]	5
2-Hexanone	1,000	ND	5
2-Methylnaphthalene	260	ND	5
2-Propanone (acetone)	730	ND	20

Table A-1 continued			
Volatile organic chemicals	Drinking water screening level (µg/L)	Result (µg/L)	Reporting limit (µg/L)
4-Methyl-2-pentanone (MIBK)	1,800	ND	5
Acrylonitrile	2.6	ND	5
Benzene	5.0	ND	1
Bromobenzene	18	ND	1
Bromochloromethane	83[c]	ND	1
Bromodichloromethane	80	ND	1
Bromoform	80	ND	1
Bromomethane	10	ND[e]	5
Carbon disulfide	800	ND	1
Carbon tetrachloride	5.0	ND	1
Chlorobenzene	100	ND	1
Chloroethane	430	ND	5
Chloroform	80	ND	1
Chloromethane	260	ND[e]	5
cis-1,2-Dichloroethylene	70	ND	1
cis-1,3-Dichloropropylene	0.43[c]	ND	1
Cyclohexane	13,000[c]	ND	5
Dibromochloromethane	80	ND	1
Dibromomethane	80	ND	1
Dichlorodifluoromethane	1,700	ND[e]	5
Diethyl ether	3,700[d]	ND	5
Diisopropyl Ether	30	ND	5
Ethylbenzene	700[d]	ND	1
Ethyltertiarybutylether	49[c]	ND	5
Hexachloroethane	7.3	ND	5
Isopropylbenzene	800	ND	1
m & p - Xylene	10,000[d]	ND	2
Methyl iodide	NA[f]	ND[e]	1
Methylene chloride	5.0	ND[e]	5
Methyltertiarybutylether	240[d]	ND	1
Naphthalene	520	ND	5
n-Butylbenzene	80	ND	1
n-Propylbenzene	80	ND	1
o-Xylene	280	ND	1
p-Isopropyl toluene	NA	ND	1
sec-Butylbenzene	80	ND	1
Styrene	100	ND	1
tert-Butylbenzene	80	ND	1
tertiary Butyl Alcohol	3,900	ND	50
tertiaryAmylmethylether	910[d]	ND	5

Table A-1 continued			
Volatile organic chemicals	Drinking water screening level (µg/L)	Result (µg/L)	Reporting limit (µg/L)
Tetrachloroethylene	5.0	ND	1
Tetrahydrofuran	95	ND	5
Toluene	1,000[d]	ND	1
trans-1,2-Dichloroethylene	100	ND	1
trans-1,3-Dichloropropylene	8.5	ND	1
trans-1,4-Dichloro-2-butene	0.0012[c]	ND	5
Trichloroethylene	5.0	ND	1
Trichlorofluoromethane	2,600	ND	1
Vinyl chloride	2.0	ND	1

a = Unless otherwise noted, the screening levels is the Michigan Department of Environmental Quality's Residential Drinking Water Criteria.
b = The chemical was not detected (ND) in the sample.
c = Tapwater value from the EPA's Regional Screening Levels table (EPA 2011c).
d = Residential health-based drinking water value (MDEQ 2011). Aesthetic impacts, to the color and taste of the water, can be present.
e = Result and reporting limit are estimated.
f = A screening level was not available (NA).

A majority of the chemicals had reporting limits below the drinking water screening levels. Five chemicals (1,2-dibromo-3-chloropropane, 1,2-dibromoethane, acrylonitrile, cis-1,3-dichloropropylene, and trans-1,4-dichloro-2-butene) had reporting limits above the drinking water screening levels. It is not known if these chemicals were above the screening levels or even if these chemicals were present in the water. Methyl iodide and p-isopropyl toluene have no screening levels but were not detected above the reporting limits. These chemicals are not expected to have been used during the historical mining activities in the area. People's health is not expected to be harmed by the chemicals in Table A-1. Drinking water analytical methods should be used to determine the levels of these chemicals and if they are present in future water samples.

Samples from the two Dollar Bay (Osceola Township) wells were also analyzed for semivolatile organic chemicals. The method used to analyze for these chemicals (Method 8270) is not the method required for drinking water samples. Drinking water methods for organic chemicals are Method 524.2 and 525.2, among others (40 CFR 141.24). Table A-2 presents the list of semivolatile organic chemicals tested along with the drinking water screening levels, reporting limits, and the results. No chemicals were detected in the water samples.

Table A-2: Semivolatile organic compound results (in micrograms per liter [µg/L]) from the Dollar Bay (Osceola Township) municipal wells sampled in May 2010 and drinking water screening levels (MDNRE 2010B).

Semivolatile organic chemicals	Drinking water screening level[a] (µg/L)	Result (µg/L)	Reporting limit (µg/L)
1,2,4-Trichlorobenzene	70	ND[b]	2
2,4-Dinitrotoluene	7.7	ND	5
2,6-Dinitrotoluene	37[c]	ND	5
2-Chloroaniline	NA[d]	ND	5
2-Chloronaphthalene	1,800	ND	2
2-Methylnaphthalene	260	ND	5
2-Nitroaniline	370[c]	ND	20
3-Nitroaniline	NA	ND	20
4-Bromophenyl phenyl ether	NA	ND	2
4-Chloroaniline	0.34[c]	ND	10
4-Chlorodiphenyl ether	NA	ND	1
4-Nitroaniline	3.4[c]	ND	20
Acenaphthene	1,300	ND	1
Acenaphthylene	52	ND	1
Aniline	53	ND	4
Anthracene	43	ND	1
Azobenzene	23	ND	2
Benzo[a]anthracene	2.1	ND	1
Benzo[a]pyrene	5.0	ND	1
Benzo[b]fluoranthene	1.5	ND	1
Benzo[g,h,i]perylene	1.0	ND[e]	1
Benzo[k]fluoranthene	1.0	ND	1
Benzyl Alcohol	10,000	ND	50
Bis(2-chloroethoxy)methane	110[c]	ND	2
Bis(2-chloroethyl)ether	2.0	ND	1
Bis(2-chloroisopropyl)ether	0.32[c]	ND[e]	1
Bis(2-ethylhexyl)phthalate	6.0	ND	5
Butyl benzyl phthalate	1,200	ND	5
Carbazole	85	ND	5
Chrysene	1.6	ND	1
Dibenz[a,h]anthracene	2.0	ND[e]	2
Dibenzofuran	37[c]	ND	4
Diethylphthalate	5,500	ND	5
Dimethyl phthalate	73,000	ND	5
Di-n-butyl phthalate	880	ND	5
Di-n-octyl phthalate	130	ND	1

Table A-2 continued			
Semivolatile organic chemicals	Drinking water screening level (µg/L)	Result (µg/L)	Reporting limit (µg/L)
Fluoranthene	210	ND	1
Fluorene	880	ND	1
Hexachlorobenzene	1.0	ND	1
Hexachlorobutadiene	15	ND	1
Hexachlorocyclopentadiene	50	ND[e]	10
Hexachloroethane	7.3	ND	1
Indeno(1,2,3-c,d)pyrene	2.0	ND[e]	2
Isophorone	770	ND	1
N,N-dimethylaniline	16	ND	5
Naphthalene	520	ND	1
Nitrobenzene	3.4	ND	2
N-methylaniline	73[c]	ND	1
N-Nitrosodimethylamine	0.00042[c]	ND	5
N-Nitrosodi-n-propylamine	5.0	ND	2
N-Nitrosodiphenylamine	270	ND	2
Phenanthrene	52	ND	1
Pyrene	140	ND	1
Pyridine	20	ND	20
Tetramethylurea	NA	ND	1

a = Unless otherwise noted, the screening levels is the Michigan Department of Environmental Quality's Residential Drinking Water Criteria.
b = The chemical was not detected (ND) in the sample.
c = Tapwater value from the EPA's Regional Screening Levels table (EPA 2011c).
d =A screening level was not available (NA).
e = Result and reporting limit are estimated.

A majority of the chemicals had reporting limits below the drinking water screening levels. Four of the chemicals (4-chloroaniline, 4-nitroaniline, bis(2-chloroisopropyl)ether, and N-nitrosodimethylamine) had reporting limits over the screening levels. Five of the chemicals (2-chloroaniline, 3-nitroaniline, 4-bromophenyl phenyl ether, 4-chlorodiphenyl ether, and tetramethylurea) do not have drinking water screening levels. These five chemicals were not detected above the reporting limits. These chemicals are not expected to have been used during the historical mining activities in the area. People's health is not expected to be harmed by the chemicals in Table A-2. Drinking water analytical methods should be used for analysis of future water samples.

All eight wells were analyzed for inorganic chemicals. Methods specific for drinking water samples were used for the inorganic chemicals. Inorganic chemical levels are in Table 1 of the main document.