Health Consultation

TORCH LAKE

HUBBELL, HOUGHTON COUNTY, MICHIGAN

CERCLIS NO. MID980901946

MARCH 23, 1998

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

Health Consultation: A Note of Explanation

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

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR TOLL FREE at
1-800-447-1544
or
Visit our Home Page at: http://atsdr1.atsdr.cdc.gov:8080/

HEALTH CONSULTATION

TORCH LAKE

HUBBELL, HOUGHTON COUNTY, MICHIGAN

CERCLIS NO. MID980901946

Prepared by:

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

FOREWORD

The federal Agency for Toxic Substances and Disease Registry (ATSDR) and the Michigan Department of Community Health (MDCH) have a cooperative agreement for conducting assessments and consultations regarding potential health hazards at toxic chemical contamination sites within the State of Michigan. The Michigan Department of Environmental Quality (MDEQ), Superfund Section, has asked the MDCH to evaluate any health risks associated with several properties included in the Brownfield Pilot Projects in Detroit and other cities in Michigan.

The U.S. Environmental Protection Agency (U.S. EPA) defines Brownfields as "abandoned, idled, or under-used" industrial and commercial facilities where expansion or redevelopment is complicated by real or perceived environmental contamination. Local governmental entities have asked the MDEQ to conduct environmental assessments of the Brownfield properties in their jurisdiction. The MDEQ has consulted with the MDCH concerning public health aspects of these assessments.

The MDCH health consultation for a Brownfield property includes consideration of the following fundamental questions:

- Are there any imminent or urgent threats to public health associated with the property?
- Does the proposed future use of the property pose any long-term public health hazard?
- What specific actions, if any, are necessary to make the property safe for future use?
- Is there enough information available to answer these questions, and if not, what additional information is needed?

SUMMARY

The Torch Lake Area Brownfields properties are several parcels on and near Torch Lake, Houghton County, Michigan. From the 1860s until the 1920s, copper mills in the area deposited tailings, waste rock from copper mining operations, on these parcels. After 1920, as copper mining decreased, the mills treated the tailings with chemicals to extract the residual copper. Citing threats to humans and to biota in and near the lake, the U.S. Environmental Protection Agency (U.S. EPA) placed the lake, adjacent tailings piles, and several inactive copper mills and associated tailings piles in the area on the National Priorities List (NPL) on June 10, 1986. Because of reports of human access to several tailings piles near Torch Lake, the Michigan Department of Environmental Quality (MDEQ) investigated the piles in August 1997.

Based on the available information and data, the tailings piles pose no urgent public health hazard. Several of the piles contain concentrations of metals that would be of public health concern if the piles were developed for residential use, and two of those parcels are under consideration for such development. Those specific parcels should be further evaluated before any residential development goes forward.

BACKGROUND AND STATEMENT OF ISSUES

The Michigan Department of Environmental Quality (MDEQ) has asked the Michigan Department of Community Health (MDCH) to evaluate the health risks associated with the Torch Lake Area Brownfields property as part of a Brownfields Pilot Project.

The Torch Lake Area Brownfields properties are several parcels on and near Torch Lake, Houghton County, Michigan (Figure 1). The areas investigated include parts of four communities along the west side of the lake, Lake Linden, Hubbell, Tamarack City, and Mason (locations A, B, C, and D in Figure 1), a City of Houghton sand stockpile (E), a closed copper smelter between Hancock and Ripley (F), closed copper mills at Calumet (G) and Boston (H), and tailings (waste from copper mining) deposits at the outlet from Torch Lake to Portage Lake (I), at the north entry to the Portage Lake Ship Canal (J), and near Gay, on the east shore of the Keweenaw Peninsula (K) (1).

Torch Lake is located in the Keweenaw Peninsula of northern Michigan, the site of large deposits of native metallic copper, which have been mined since the first humans reached the area. By the 1860s, large-scale mining operations were underway in the Keweenaw, and the first mill on Torch Lake began operation in 1868. The metal was isolated from the surrounding rock by crushing the ore to a gravel, then using water to separate the metal from the rock. The waste rock, called tailings or stamp sands, was often dumped beside or into the lake. After mining for copper in the Keweenaw peaked between 1900 and 1920, new technology was developed to recover the traces of copper remaining in the tailings. This involved treating the tailings with various chemicals, including cupric ammonium carbonate, lime, pyridine oil, coal-tar and wood creosotes, pine oil, and xanthates, to facilitate removing the remaining copper by flotation. After this reclamation

process, the tailings were then returned to the lake and lakeshore. Mining activity in the area decreased after 1920, though copper recovery from the tailings continued until 1968, when the last mill on Torch Lake closed. At least 200 million tons of tailings were discharged into Torch Lake during the century of milling operations on the lake, filling at least 20 percent of the original volume of the lake and causing drastic changes to the shoreline. People living along the lake have used the new land provided by the tailings for a landfill, lagoons for two wastewater treatment plants, and a park with campground, bathing beach, and boat launching ramp (2, 3).

Because the U.S. Environmental Protection Agency (U.S. EPA) concluded the copper and flotation chemicals leaching out of the tailings could have an adverse impact on biota in the lake and humans living in the area, Torch Lake, tailing piles on its shores, and various other sites in the vicinity were placed on the U.S. EPA National Priorities List, also known as the Superfund list, on June 10, 1986. After a Remedial Investigation and other studies, the U.S. EPA decided to cover the tailing piles with vegetative covers (2).

On April 24, 1989, the Michigan Department of Public Health (MDPH),[1] working under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR), prepared a Preliminary Health Assessment for the Torch Lake NPL site. The MDPH concluded that the site was of potential human health concern because of the possibility of human exposure to an as-yet unidentified etiologic agent. They noted that no human health effects have been documented as connected to the pollution in the lake. However, fish from the lake had shown a high incidence of tumors. The MDPH advised additional investigation of fish from the lake, private wells in the area, and rumors that drums had been dumped in the area (3). On May 25, 1995, the MDPH, under the same cooperative agreement with the ATSDR, issued a Site Review and Update for the Torch Lake NPL site. In this report, the MDPH concluded that the site posed a public health hazard from the copper, other metals, and polynuclear aromatic hydrocarbons found in the tailings. The cause for the tumors in the fish had not been identified, however, the incidence of tumors had decreased to normal levels. The recommended investigations of the site had been carried out, and more than 100 drums had been removed from the lake. The SRU recommended that a full Public Health Assessment of the site be carried out (2).

There have been reports of the tailing piles being used for recreation, for example, as off-road vehicle tracks, of residences being built on top of tailing piles, and tailings being excavated for winter use on roads to increase tire traction (1). Current and projected uses for the subareas of the Torch Lake Area Brownfields study are listed in Table 1 (4). In August 1997, the MDEQ investigated the Torch Lake Area Brownfields study areas to evaluate the potential for human health impact from these activities.

---

[1] On April 1, 1996, the Michigan Department of Public Health (MDPH) Division of Health Risk Assessment (DHRA) was absorbed into the newly-formed Michigan Department of Community Health (MDCH). The site history and background section of this document uses the departmental identifiers in effect at the time of the events.

Table 1. Current and projected uses of Torch Lake Area Brownfields areas, from the Michigan Department of Environmental Quality.

Index to Figure 1	Sampling Area	Current and Projected Uses
A	Lake Linden Campground	Current village campground, beach, boat launch.
B	Hubbell Slag	Recreation, including all-terrain vehicles (ATVs) and dirt bikes. Plans for residential development
C	Tamarack/Mason Dredge	Recreation. Plans for historic park.
D	Mason Sands	Current sewage sludge disposal. Potential residential or recreational use.
E	Houghton City Stockpiles	Winter road traction.
F	Quincy Smelter	Recreation, including walking and bike riding. Potential development as historical park or residential properties.
G	Calumet Lake	Recreation. Potential for historic park area.
H	Boston Pond	Recreation, ATVs, camping, trails. Boat launch with parking area.
I	Point Mills Sands	Road traction. Platted for canals and homes.
J	North Entry	Beach area adjacent to township park and campground, with ATV and camper use.
K	Gay Stamp Sands	Recreation, tailings used for road traction.

Reference: 4

DISCUSSION

The sampling results discussed in this consultation were taken from the available investigations of the property, and are not adjusted for limitations or bias in the sampling programs. The Tables presented in this consultation include maximum and median concentrations in the samples collected. Health discussions are based on the maximum concentrations reported and long-term, frequent exposure scenarios, reasonably conservative assumptions.

In August 1997, the MDEQ collected a total of 50 surface soil samples from 11 locations in the Torch Lake area (Table 2). These were all analyzed for metals, and a selected 9 samples were split for analysis for semi-volatile organic chemicals. The arsenic concentration in one sample,

Table 2. Sampling locations and counts, Michigan Department of Environmental Quality Torch Lake Area Brownfields Investigation, August 1997.

Index to Figure 1	Sampling Area	Metals Samples	Organics Samples
A	Lake Linden Campground	4	1
B	Hubbell Slag	5	0
C	Tamarack/Mason Dredge	6	2
D	Mason Sands	7	0
E	Houghton City Stockpiles	3	0
F	Quincy Smelter	5	2
G	Calumet Lake	3	0
H	Boston Pond	3	0
I	Point Mills Sands	4	1
J	North Entry	3	0
K	Gay Stamp Sands	7	3

Reference: 4

from the Quincy Smelter area (area F in Figure 1), and the lead concentration in another sample, from the Tamarack/Mason Dredge area (area C), exceeded the MDEQ Generic Clean-Up Criteria for Industrial, Commercial or Residential Use[2] (Table 3) (5, 6). Many other samples contained arsenic, benzo(a)pyrene, beryllium, or copper concentrations above the MDEQ Residential Use Criteria (Table 3) (6). The sample with the benzo(a)pyrene concentration above the Residential Criteria was collected from the Tamarack/Mason Dredge area (area C), those with beryllium above the Residential Criteria were collected from the Hubbell Slag area (area B) (4).

A child subject to pica behavior[3] might ingest enough arsenic from the soil on the Hubbell Slag (B), Tamarack/Mason Dredge (C), or Quincy Smelter (F) areas to exceed the doses at which people experienced impairments of the circulatory system, gastrointestinal distress, changes in the liver, neurological effects, and changes in the skin on long-term exposure. Any child might incidentally ingest enough arsenic from the same areas to exceed the ATSDR Minimum Risk

[2] The MDEQ Industrial and Commercial Cleanup Criteria for lead were developed using the U.S. EPA Integrated Uptake Biokinetic Model for children. No risk assessment methods are currently available to evaluate lead toxicity in adults.

[3] Pica behavior is an abnormal consumption of non-food materials, such as soil, most often seen in children under 5 years of age.

Table 3. Concentrations of chemicals found in surface soil samples collected during the Michigan Department of Environmental Quality Torch Lake Area Brownfields Investigation, August 1997.

Chemical	Maximum Concentration (ppm)										
Sampling area	A	B	C	D	E	F	G	H	I	J	K
acenaphthene	ND	NA	0.23	NA	NA	ND	NA	NA	ND	NA	ND
anthracene	ND	NA	1.1	NA	NA	ND	NA	NA	ND	NA	ND
arsenic	2.6	50	22	ND	8.3	99	3.2	4.7	5.8	9.1	3.1
barium	41	670	112	10	6	177	16	5	8	22	6
benzo(a)anthracene	ND	NA	5.5	NA	NA	0.3	NA	NA	ND	NA	ND
benzo(a)pyrene	ND	NA	4.7	NA	NA	0.3	NA	NA	ND	NA	ND
benzo(b)fluoranthene	ND	NA	3.4	NA	NA	0.7	NA	NA	ND	NA	ND
benzo(g,h,i)perylene	ND	NA	3.2	NA	NA	0.26	NA	NA	ND	NA	ND
benzo(k)fluoranthene	ND	NA	3.2	NA	NA	0.7	NA	NA	ND	NA	ND
beryllium	0.8	3.8	1	0.8	0.6	1	0.9	1.3	0.7	0.3	0.7
bis(2-ethylhexyl)phthalate	4.9	NA	ND	NA	NA	2.4	NA	NA	ND	NA	3.6
chromium	22	960	23	33	84	1,100	20	11	74	48	27
chrysene	ND	NA	6.4	NA	NA	0.48	NA	NA	ND	NA	ND
cobalt	14	19	26	35	39	34	8.4	8	33	27	32
copper	830	16,800	4,100	1,130	1,710	17,700	16,900	23,800	2,260	1,870	3,200
di-n-butylphthalate	0.24	NA	ND	NA	NA	0.11	NA	NA	ND	NA	0.25
dibenz(a,h)anthracene	ND	NA	0.85	NA	NA	ND	NA	NA	ND	NA	ND
diethylphthalate	0.24	NA	ND	NA	NA	0.44	NA	NA	ND	NA	1.9
fluoranthene	ND	NA	7	NA	NA	0.87	NA	NA	ND	NA	ND
indeno(1,2,3-cd)pyrene	ND	NA	2.1	NA	NA	0.22	NA	NA	ND	NA	ND
lead	48	129	728	ND	ND	100	49	ND	6.9	ND	ND
lithium	5	12	6	8.5	12	13	7.4	11	12	7.8	7.8
manganese	370	881	765	1,100	1,200	1,100	270	200	975	738	637
mercury	0.07	ND	0.28	0.09	ND	0.53	0.2	0.47	ND	ND	ND
molybdenum	ND	15	ND	ND	ND	ND	ND	ND	ND	ND	ND
naphthalene	ND	NA	0.45	NA	NA	ND	NA	NA	ND	NA	ND
nickel	42	69	34	51.5	99	39	22	13	78.5	85	37
phenanthrene	ND	NA	5.1	NA	NA	0.36	NA	NA	ND	NA	ND
pyrene	ND	NA	14	NA	NA	0.89	NA	NA	ND	NA	ND
selenium	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND	ND
silver	2.6	5	7.9	1.7	3	13	12	20	1.8	1	5.5
strontium	16	223	42	16	25	239	9	13	18	31	16
titanium	1,970	4,000	5,300	6,160	4,400	6,680	1,300	1,300	3,650	930	4,150
vanadium	42	140	97	134	120	220	44	17	110	45	83
zinc	110	865	99	110	84	250	110	85.1	77.5	58.3	100

Reference: 4

ND — Not detected

NA — Not analyzed for

Levels (MRLs) for non-cancer adverse health effects, though they would not be likely to exceed the levels at which adverse health effects have been observed. Exposure to arsenic has been directly linked to skin cancer in humans, and there is weaker evidence linking exposure to the chemical with increased incidence of cancers of the liver, lung, and bladder. The U.S. EPA has classified arsenic as a human carcinogen (U.S. EPA Class A). People who spend their lifetime near soils containing the arsenic concentration found in the areas mentioned above might incidentally ingest enough arsenic to incur some increased risk of contracting skin cancer. There is not enough information available to evaluate the increased risk of contracting other types of cancer from exposure to arsenic (7). The Hubbell Slag and Quincy Smelter areas are under

consideration for future residential development (Table 1). Recreational use of any of these areas is not likely to lead to exposures of human health concern.

The lead concentrations found in soil from the various areas were within the range commonly found in urban areas. Lead is a cumulative poison, causing damage to the nervous system, kidneys, and blood. A child might incidentally ingest enough lead from the soil in the Tamarack/ Mason Dredge area (C) to exceed the amounts that were observed to cause minor adverse health effects in experimental studies on human volunteer subjects.[4] A child subject to pica behavior might ingest enough lead from the soil in the Lake Linden Campground (A), Hubbell Slag (B), Tamarack/Mason Dredge (C), Quincy Smelter (F), or Calumet Lake (G) areas to attain that dose. There is no evidence directly linking exposure to lead to cancer in humans, though some laboratory animals who ingested lead in their food or water developed cancer of the kidneys. The U.S. EPA has classified lead as a probable human carcinogen (U.S. EPA Class B2). It is not possible to evaluate the cancer risk from exposure to lead based on the available information (8). The Hubbell Slag and Quincy Smelter areas are under consideration for future residential development (Table 1). Recreational use of the properties is not likely to result in exposures of human health concern.

Benzo(a)pyrene is one of a class of chemicals known as polycyclic aromatic hydrocarbons (PAHs)[5]. PAHs are ubiquitous products of incomplete combustion. The concentrations of PAHs found in the soils of the study areas are within the range of concentrations typically found in urban areas. Benzo(a)pyrene and several other PAHs have been linked to cancer in workers who were exposed to them on the job and in laboratory animals who had the chemicals applied to the skin. The U.S. EPA has classified benzo(a)pyrene as a probable human carcinogen (U.S. EPA Class B2). People who spend their lifetime exposed to soil containing the benzo(a)pyrene found in the Tamarack/Mason Dredge area might incur a low increased risk of contracting cancer. PAHs in soils tend to bond to organic materials in the soil and are not readily absorbed through the skin (11). The Tamarack/Mason Dredge area is not currently under consideration for residential development (Table 1), and recreational use of the property is not likely to result in significantly increased risk of contracting cancer.

No one is likely to ingest enough beryllium from the soils within the study areas to experience any non-cancer adverse health effects. Some laboratory animals who inhaled or ate beryllium compounds developed lung cancer more often than did animals who were not exposed to the metal. The U.S. EPA has classified beryllium compounds as probable human carcinogens (U.S.

---

[4] People who consumed lead acetate in capsules evinced decreased concentrations of an enzyme involved in the production of blood after as little as 3 days exposure (9, 10).

[5] PAHs found in the study areas include acenaphthene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, indeno(1,2,3-cd)pyrene, naphthalene, phenanthrene, and pyrene.

EPA Class B2). A person who spends his lifetime around soils containing the beryllium concentrations found in the study areas would not be likely to ingest enough of the metal to incur any apparent increased risk of contracting cancer (12).

The health effects from exposure to copper depends upon the chemical form the element is in. There is no information available on the form of the copper found in the study areas. From the history of the areas, copper is probably present in the soil primarily in its metallic, elemental state, with a thin patina of copper carbonate covering the copper particles. There is little evidence linking exposure to metallic copper with adverse health effects (13).

Parts of the Lake Linden Campground (A), Tamarack/Mason Dredge (C), Mason Sands (D), Calumet Lake (G), Point Mills (I), and North Entry (J) areas are fenced, according to maps provided by the MDEQ. However, the other areas, including the Hubbell Slag (B) and Quincy Smelter (F) areas, are not fenced, and the MDEQ reports signs of access to all of the areas they have investigated (4).

CONCLUSIONS

Based on the information available, none of the Torch Lake Area Brownfield properties pose an urgent public health hazard under current conditions. Several of the properties would pose public health hazards under long-term exposure from the metals in the soil, and are also under consideration for future residential development.

RECOMMENDATIONS

Further evaluate the Hubbell Slag and Quincy Smelter areas before any residential development is carried out there to determine the extent and appropriate treatment of the elevated lead and arsenic concentrations in the soil.

New environmental data or information concerning the future use of these properties may require future health consultations.

If any citizen has additional information or health concerns regarding the Torch Lake Area Brownfields properties, please contact the Michigan Department of Community Health, Environmental Epidemiology Division, at 1-800-648-6942.

REFERENCES

1. Michigan Department of Environmental Quality. Brownfields Redevelopment Assessment Work Plan for Torch Lake Brownfield Property. August 6, 1997.

2. Michigan Department of Public Health, for ATSDR. Site Review and Update for Torch Lake, CERCLIS No. MID980901946, Houghton County, Michigan. May 25, 1995.

3. Michigan Department of Public Health, for ATSDR. Preliminary Health Assessment for Torch Lake, CERCLIS No. MID980901946, Houghton County, Michigan. April 24, 1989.

4. Michigan Department of Environmental Quality. Unpublished laboratory data. October 14, 1997.

5. Howard, A.J., MDNR ERD. Memorandum to ERD staff, subject: Environmental Response Division Operational Memorandum #14 Revision 2: Remedial Action Plans Using Generic Industrial or Generic Commercial Cleanup Criteria or Other Requirements. June 6, 1995.

6. Howard, A.J., MDNR ERD. Memorandum to ERD staff, Subject: Interim Environmental Response Division Operational Memorandum #8, Revision 4: Generic Residential Cleanup Criteria. June 5, 1995.

7. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Arsenic, Update. ATSDR/TP-92/02. April 1993.

8. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Lead, Update, Draft for Public Comment. September 1997.

9. Cools, A., Salle, H.J.A., Verberk, M.M., et al. Biochemical Response of Male Volunteers Ingesting Inorganic Lead for 49 days. Int. Arch. Occup. Environ. Health, 28, 129-139. 1976.

10. Stuik, E.J. Biological Response of Male and Female Volunteers to Inorganic Lead. Int. Arch. Arbeitsmed., 33, 83-97. 1974.

11. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Polycyclic Aromatic Hydrocarbons, Update. August 1995.

12. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Beryllium, Update. ATSDR/TP-92/04. April 1993.

13. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Copper. ATSDR/TP-90/08. December 1990.

Torch Lake Area Brownfields

HOUGHTON AND KEWEENAW COUNTIES, MICHIGAN

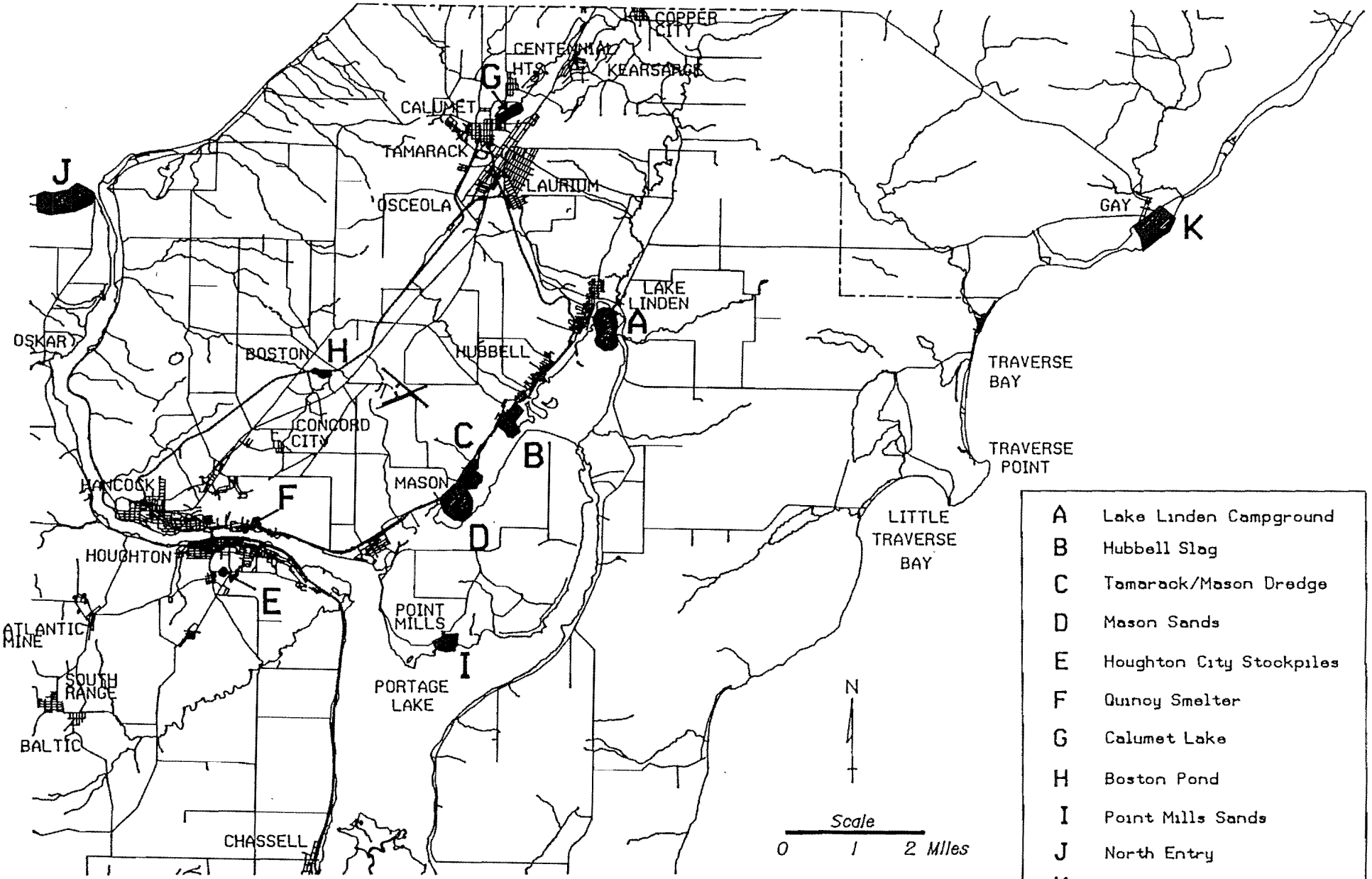


Figure 1.

PREPARERS OF REPORT

Michigan Department of Community Health

John Filpus, Environmental Engineer

Robin Freer, Resource Specialist

James Bedford, Environmental Toxicologist

Brendan Boyle, Principal Investigator

ATSDR Regional Representative

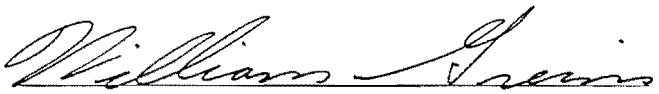
Louise Fabinski
Regional Services, Region V
Office of the Assistant Administrator

ATSDR Technical Project Officer

William Greim
Division of Health Assessment and Consultation
Superfund Site Assessment Branch

CERTIFICATION

The Torch Lake Area Brownfields Health Consultation was prepared by the Michigan Department of Community 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 initiated.



Technical Project Officer, SPS, SSAB, DHAC

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

Chief, SPS, SSAB, DHAC, ATSDR