

# Letter Health Consultation

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KALAMAZOO RIVER/ENBRIDGE OIL SPILL-  
PLAY CARE LEARNING CENTER

MARSHALL, MICHIGAN

**Prepared by:**  
**Michigan Department of Community Health**

OCTOBER 27, 2010

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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LETTER HEALTH CONSULTATION

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STATE OF MICHIGAN

DEPARTMENT OF COMMUNITY HEALTH  
LANSING

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September 8, 2010

Mr. James Rutherford, Health Officer  
Calhoun County Public Health Department  
190 East Michigan Avenue  
Battle Creek, Michigan 49014

Mr. Rutherford:

At the request of the Calhoun County Public Health Department (CCPHD), I have reviewed the environmental data for air and well water samples collected at the Play Care Learning Center, Marshall, Michigan. My comments and recommendations are provided below.

### Background

On July 26, 2010, Enbridge Energy Partners, LLP (Enbridge) reported the break of a 30-inch pipeline near the city of Marshall, Calhoun County, Michigan. The break resulted in the spill of more than 800,000 gallons of crude oil into Talmadge Creek, which is a tributary of the Kalamazoo River (see attached figure).<sup>1</sup> The United States Environmental Protection Agency (EPA) established a Unified Command to contain the oil, remediate the contamination, and monitor environmental levels of oil-related contaminants. Members of the Unified Command included federal, state and local agencies, and Enbridge representatives.

The Play Care Learning Center (PCLC) is located in the city of Marshall, about eight tenths of a mile northeast of the confluence of Talmadge Creek and the Kalamazoo River. The PCLC provides day care services for up to 128 children from birth to 12 years of age. Following the pipeline break, the owners of PCLC reported smelling strong odors and that several staff had become ill as a result. The owners also expressed concern for the safety and well-being of the children in their care.

### Discussion

The oil product spilled from the Enbridge pipeline is composed of petroleum hydrocarbons, which are a broad family of chemical compounds that include:

- short, straight chain molecules with nine or fewer carbons referred to as gasoline range organics (GRO),
- longer, sometimes branched molecules with 10 to 28 carbons referred to as diesel range organics (DRO),
- semivolatile organic hydrocarbons, including polycyclic aromatic hydrocarbons (PAHs), and
- volatile organic hydrocarbons (VOCs) such as benzene, toluene, ethylbenzene, and xylene.

These chemicals are present in many products that are used in homes and businesses. They are also emitted in automobile exhaust and from many industrial processes. Therefore, it is possible that levels of these chemicals monitored in air near the PCLC could come from sources other than the Enbridge

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<sup>1</sup> "EPA's Response to the Enbridge Oil Spill." 2010. available at <http://www.epa.gov/enbridgespill>.

oil spill. People can smell these chemicals at levels lower than those that would be expected to cause harm to human health.

#### Air Data

Soon after the oil spill was reported, EPA emergency response personnel began “real-time” air monitoring near the spill site and along Talmadge Creek and the Kalamazoo River. EPA focused this monitoring on locations where people could be exposed to spill-related air contaminants in their homes and businesses. Enbridge also employed a contractor, the Center for Toxicology and Environmental Health (CTEH), to conduct additional air monitoring. Real-time air monitoring is conducted with a hand held instrument that gives an immediate readout of a contaminant concentration in air in units of parts per million and also continuously records all the readings. For consistency, I have converted all air concentrations to units of parts per billion (one part per million is equal to 1000 parts per billion). Table 1 shows the levels of contaminants found during air monitoring conducted at the PCLC.

Table 1. Levels of air contaminants monitored by the U.S. Environmental Protection Agency at the Play Care Learning Center, Marshall, Michigan from August 2, 2010 to August 27, 2010.

Chemical	Total Number of Samples	Number of Detections	Range of Concentrations (ppb)
Benzene	77	0	<50
Carbon monoxide	55	6	<1,000 to 2,000
Hydrogen sulfide	72	0	<1,000
Total VOCs	74	6	<100 to 500

ppb = parts per billion

VOCs = volatile organic hydrocarbons

Hydrogen sulfide can cause acute health effects at levels lower than could be detected by the MultiRAE instrument used to monitor the air at the PCLC. However, monitoring was also conducted at the oil release site (see attached figure) with a more sensitive Interscan instrument, which can detect hydrogen sulfide at 10 ppb. Levels of hydrogen sulfide at the oil spill site, which is more than two miles from the PCLC, did not exceed values protective of human health for exposures lasting up to two weeks.<sup>2</sup>

CTEH also conducted additional real-time monitoring for benzene and total VOCs at the PCLC from July 27, 2010 to August 29, 2010 (latest data available at the time of this writing). CTEH did not detect levels of either benzene or VOCs above the instrument detection limit of 100 ppb.<sup>3</sup>

Benzene is the chemical in the oil that public health officials are most concerned about for potential harm to human health. Working with the EPA and the CCPHD, toxicologists from the Michigan Department of Community Health (MDCH) Toxicology and Response Section and the Agency for Toxic Substances and Disease Registry (ATSDR) Region 5 office developed a decision tree to support decisions that are protective of human health.<sup>4</sup> When measured benzene levels were at or below 60 ppbv, no immediate action such as an evacuation was recommended. However, where any level of benzene was found or where there was greater concern for human exposure, EPA would conduct

<sup>2</sup> “EPA’s Response to the Enbridge Oil Spill.” 2010. available at <http://www.epa.gov/enbridgespill>.

<sup>3</sup> Center for Toxicology and Environmental Health. Daily Report for Play Care Learning Center. August 28, 2010.

<sup>4</sup> “EPA’s Response to the Enbridge Oil Spill.” 2010. available at <http://www.epa.gov/enbridgespill>.

additional monitoring. Because children are at greater risk of harm than adults from exposure to contaminants in air, and at the request of the PCLC owners, additional air sampling was conducted by both the EPA and CTEH.

The EPA and CTEH collected air samples in tedlar bags and in summa canisters for more extensive laboratory analysis. Tedlar bags are used to collect “grab samples” of air that can be quickly analyzed in an on-site mobile laboratory. The laboratory analysis of the tedlar bag samples provides a more accurate and sensitive measurements of benzene in air than the monitoring instruments. The concentration of the detected chemicals are expressed in units of parts per billion by volume of air (ppbv). Levels of benzene in air that are at or below 6 ppbv for up to one year are not expected to cause harm to human health.<sup>5</sup>

Table 2. Levels of benzene measured by the U.S. Environmental Protection Agency in tedlar bag samples at the Play Care Learning Center, Marshall, Michigan from August 2, 2010 to August 27, 2010.<sup>6</sup>

Chemical	Total Number of Samples	Number of Detections	Range of Concentrations (ppbv)
Benzene	47	9	<0.5 to 5.3

ppbv = parts per billion by volume

VOCs = volatile organic hydrocarbons

Summa canisters are used to collect samples that represent a time-weighted average (a few minutes or for up to 24 hours), to get a better understanding of exposure over the course of a full day. The canisters are sent to a laboratory for more extensive analysis for more than one hundred separate volatile chemicals. Table 3 shows five chemicals that were found in air samples collected from outside the PCLC on August 2, 2010 (24 hours) and August 3, 2010 (8 hours). No other chemicals, including benzene, were detected in the EPA summa canister samples. None of the chemicals found in the EPA summa canister samples are either associated with crude oil or exceeded health based screening levels.

Table 3. Levels of air contaminants measured by the U.S. Environmental Protection Agency in summa canister samples taken at the Play Care Learning Center, Marshall, Michigan on August 2 and August 3, 2010.

Chemical	Total Number of Summa Samples	Number of Detections	Range of Concentrations (ppbv)	Screening Level <sup>7</sup> (ppbv)
Acetone	2	2	0.5 to 1.0	13,000
Acetonitrile	2	2	2.5 to 3.0	38
Chloromethane	2	1	0.4 to 0.7	200
Dichlorodifluoromethane	2	2	0.24 to 0.34	42
Methylene chloride	2	2	0.46 to 0.81	300

ppbv = parts per billion by volume

VOCs = volatile organic hydrocarbons

<sup>5</sup> Agency for Toxic Substances and Disease Registry. 2007. Toxicological Profile for Benzene. Available at <http://www.atsdr.cdc.gov/ToxProfiles>.

<sup>6</sup> “EPA’s Response to the Enbridge Oil Spill.” 2010. available at <http://www.epa.gov/enbridgespill>.

<sup>7</sup> “EPA’s Response to the Enbridge Oil Spill.” 2010. available at <http://www.epa.gov/enbridgespill>.

CTEH reports that it collected 15 summa canister samples at the PCLC between August 1 and August 11, 2010, some of which were taken from inside the building office and in one of the educational rooms. No benzene was detected in any of these samples. Table 4 shows the chemicals that were verified as detected in both indoor and outdoor samples

Table 4. Levels of air contaminants measured by Center for Toxicology and Environmental Health in summa canister samples taken at the Play Care Learning Center, Marshall, Michigan between August 1 and August 11, 2010.

Chemical	Total Number of Summa Samples	Number of Detections	Range of Concentrations (ppbv)	Screening Level (ppbv)
Acetone	15	13	11 to 44	13,000
Isopropyl Alcohol	15	14	12 to 250	90
Toluene	15	2	5.9 to 15	1,000

ppbv = parts per billion by volume

VOCs = volatile organic hydrocarbons

Several other chemicals such as acetaldehyde (7.5-20 ppbv), butanal (9.6 ppbv), butane (27-35 ppbv), 1,2-diethyl-benzene (6-6.7 ppbv), ethyl alcohol (20-90 ppbv), hexanal (8.5 ppbv), isobutane (26-35 ppbv), nonanal (6.5 ppbv), and propane (6.3 ppbv) were tentatively identified in the CTEH summa samples at very low levels that would not be expected to cause human health effects.

Only isopropyl alcohol exceeds a health based screening level developed by the Michigan Department of Natural Resources and Environment, Air Quality Division. Isopropyl alcohol is also known as rubbing alcohol and has many common uses in homes and businesses for medicinal purposes, as a solvent for glues in arts and crafts, and as a cleaning and disinfecting agent. Isopropyl alcohol is not a component in crude oil.

On August 5, 2010, a public health nurse employed by CTEH monitored outside air at the PCLC for several hours. No benzene was detected in any of these monitoring events. On August 6, 2010, the public health nurse spent several hours inside the PCLC main office where odors and symptoms had been reported by the owners. The nurse reported no unusual odors or health symptoms after spending the day in the PCLC.

#### Drinking Water Data

The CCPHD collected a drinking water sample from the PCLC private well on August 2, 2010. The sample was analyzed for a target list of 59 VOCs including benzene and other chemicals that may have been in the crude oil. No chemicals were detected in the drinking water sample.

#### Odors and Health Concerns

Between August 10 and 13, 2010, MDCH epidemiology staff interviewed all the employees at the PCLC regarding health effects that may have been associated with exposure to odors from the spill. Questions were asked in an open-ended format about whether employees had noticed any odors since the Enbridge oil spill, if they had chronic or pre-existing health conditions that made them sensitive to odors, and if they had developed any new health symptoms or a worsening of pre-existing symptoms after the spill. A summary of the results follows:

- All the employees (100%) noted the odor. Many noted that the worst days for odor were early in the first week following the oil spill (the week of July 26).
- Most of the employees (92%) said they still smelled the odor when they were interviewed (the second week after the spill).
- Some of the employees (33%) noted that they had pre-existing chronic health conditions that made them sensitive to fumes or odors.
- Most of the employees (92%) noted a variety of new onset or worsened symptoms after the spill, including: headache (92%); respiratory symptoms (33%), dizziness (50%); gastrointestinal symptoms (33%); fatigue (33%); eye, nose, throat irritation (75%), and anxiety (42%).
- Some of the employees (17%) noted that they were planning to see a physician for these symptoms. MDCH has no evidence to conclude whether any PCLC workers sought medical attention.

These reported symptoms are consistent with the known acute symptoms of exposure to crude oil. However, it cannot be determined if workers at the PCLC experienced these symptoms as a result of exposure related to the Enbridge oil spill.

These results should be interpreted with caution. First, this was a survey of a very small group of individuals, thus subject to the instability of small numbers. Second, there are a number of factors that could have contributed to recall bias, resulting in over- or under-reporting of symptoms. Because these individuals worked closely together, individual responses could have been influenced by prior discussions and concerns about the spill. Further, overstated reporting of symptoms could have resulted from the considerable publicity surrounding the event and attendant legal issues.

On the other hand, the open-ended format of the questions, rather than a structured list of possible responses, could have meant that individuals were less likely to remember and report on specific types of symptoms. Although self-reported health surveys have been found to be less accurate than studies using clinical records, they still have been found to be reliable sources of information and are widely used.

## Conclusions

*MDCH concludes that breathing the air near and in the Play Care Learning Center is not expected to cause long-term harm to people's health, including children.* No benzene was found in any air sample taken at the PCLC. No chemical found in the air samples exceeded health based screening levels with the exception of isopropyl alcohol, which is used for many common purposes in the home and in businesses.

*MDCH concludes that drinking the water at the Play Care Learning Center is not expected to cause harm to people's health, including children.* No chemical contaminants were found in the drinking water at the PCLC.

*MDCH cannot determine if breathing the air near and in the Play Care Learning Center in the days following the Enbridge oil spill could have caused short term effects to employees' health.* In the days following the Enbridge oil spill, employees at the Play Care Learning Center reported a variety of symptoms, similar to those that have been associated with exposure to crude oil vapors and odors. However, extensive sampling of ambient and indoor air at PCLC has not confirmed the presence of chemicals at levels that would explain these symptoms. Since no children were interviewed, MDCH

cannot determine if children experienced similar symptoms. As a result, we do not have an explanation for the symptoms experienced by the PCLC employees.

**Recommendations**

- MDCH recommends that air monitoring for benzene and VOCs be conducted at the PCLC if clean up activities on the Kalamazoo River occur in close proximity to the PCLC. Clean up activities may release these contaminants to the air as the oil is removed from vegetation along the river or when absorbent and containment booms are retrieved.
- MDCH recommends that drinking water be periodically sampled and analyzed to ensure that oil related contaminants do not impact the private well at the PCLC.
- MDCH recommends that employees and others at the PCLC who experience health effects consult with their private physician for appropriate treatment.

**Public Health Action Plan**

- The EPA will provide oversight to Enbridge and their contractors to ensure that air monitoring is conducted where cleanup activities are on-going.
- The CCPHD, the EPA and the Michigan Department of Natural Resources and Environment will review and approve long-term sampling plans to ensure that drinking water is not impacted by oil spill related contaminants.
- The MDCH will remain available to review all environmental data resulting from on-going environmental monitoring and sampling related to the Enbridge oil spill. MDCH will make recommendations for actions to protect public health as appropriate.

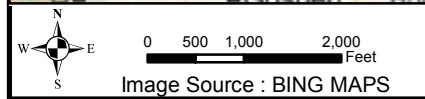
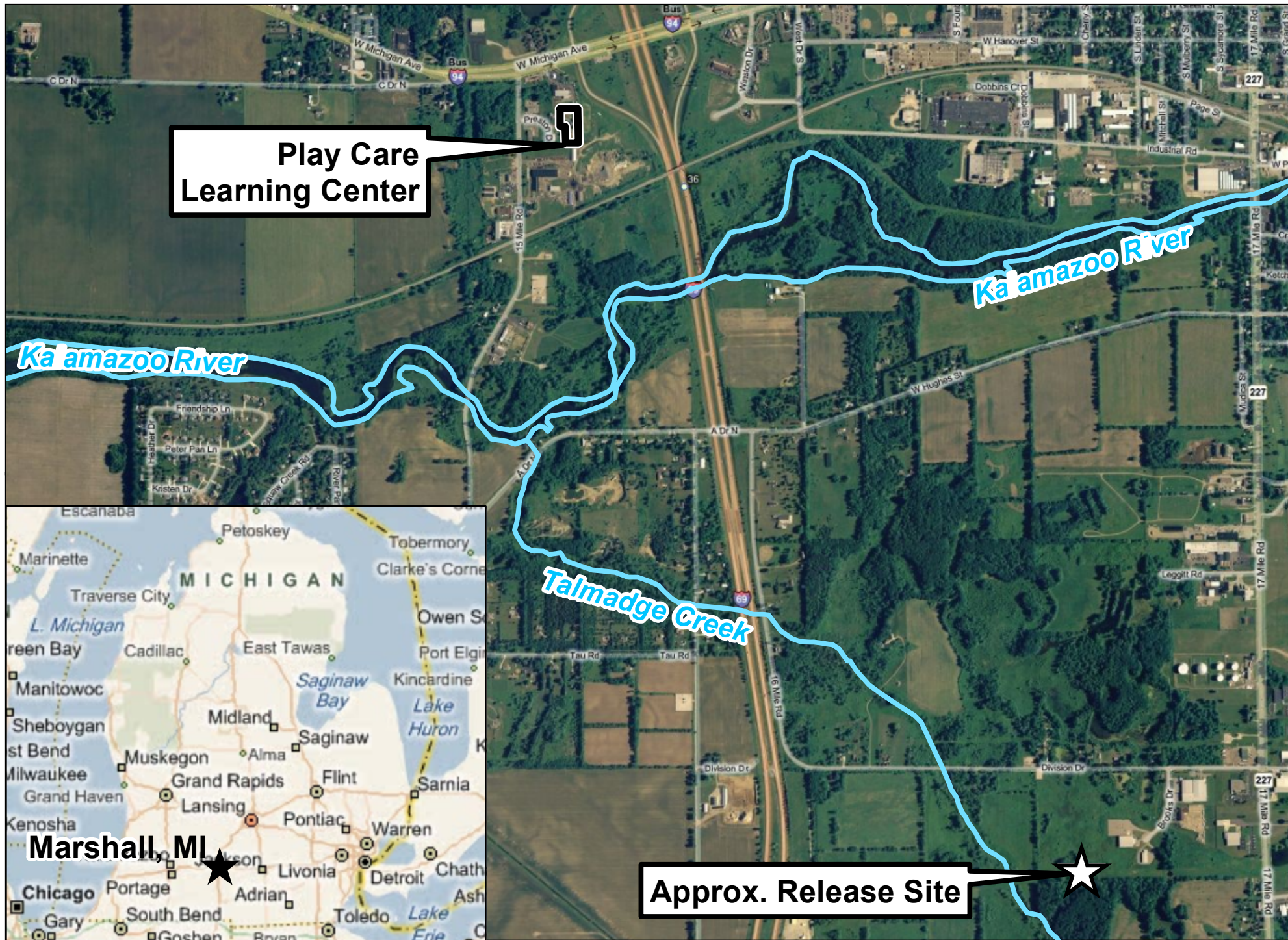
Sincerely,



Linda D. Dykema, Ph.D., Manager  
Toxicology and Response Section

Attachment

cc: Mark Johnson, Ph.D., ATSDR Region 5 Office  
Martha Stanbury, MDCH



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PLAY CARE LEARNING CENTER  
MARSHALL OIL ER  
MARSHALL, KALAMAZOO AND CALHOUN COUNTIES, MICHIGAN  
CREATED: AUGUST 31, 2010

## Certification

The Michigan Department of Community Health prepared this Health Consultation, Kalamazoo River/Enbridge Oil Spill - Play Care Learning Center, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). At the time this Health Consultation was written, it was in accordance with the approved methodologies and procedures. Editorial review was completed by the Cooperative Agreement partner.



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

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



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Team Leader, Cooperative Agreement Team, CAPEB, DHAC, ATSDR