Health Consultation

HILLMAN POWER COMPANY

HILLMAN, MONTMORENCY COUNTY, MICHIGAN

MARCH 21, 2005

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

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HEALTH CONSULTATION

HILLMAN POWER COMPANY

HILLMAN, MONTMORENCY COUNTY, MICHIGAN

Prepared by:

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

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Acronyms and Abbreviations

µg/dL	micrograms per deciliter
µm	micron (or micrometer)
ATSDR	Agency for Toxic Substances and Disease Registry
CLPPP	Childhood Lead Poisoning Prevention Program
DCC	Direct Contact Criteria
DWC	Drinking Water Criteria
EMEG	Environmental Media Evaluation Guide
EPA	U.S. Environmental Protection Agency
IRSL	Initial Risk Screening Level
ITSL	Initial Threshold Screening Level
lpm	liters per minute
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
MDNR	Michigan Department of Natural Resources
NAAQS	National Ambient Air Quality Standard
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyls
PM	particulate matter
$PM_{2.5}$	particulate matter smaller than 2.5 microns in diameter
PM_{10}	particulate matter smaller than 10 microns in diameter
ppb	parts per billion
ppm	parts per million
TDF	tire-derived fuel
TSP	total suspended particulates
VOC	volatile organic compound

Summary

The Hillman Power Company in the village of Hillman, Montmorency County, Michigan, experienced a power failure on April 8, 2004. Shutdown of the pollution control equipment allowed a release of fly ash to the air. The ash settled on a local elementary school playground, where children were at recess. Several children complained of dermal irritation, irritated eyes, or transient respiratory problems. Fly ash emissions from the plant reportedly have occurred in the past. Local citizens were concerned that emissions from the power company were harmful. Environmental data collected in the area showed that no chemicals exceeded their health-based screening levels. There is no apparent public health hazard.

Purpose and Health Issues

The purpose of this health consultation is to document formally the environmental evidence reviewed and public health conclusions reached by the Michigan Department of Community Health (MDCH) regarding the emissions from the Hillman Power Company in Montmorency County, Michigan. Area residents were concerned that emissions from the facility were negatively affecting the health of the community. Some persons dermally exposed to the fly ash experienced skin irritation. One asthmatic child reportedly experienced breathing difficulties following exposure.

Background

The Hillman Power Company, located in the village of Hillman in Montmorency County (Figures 1-2b), burns wood chips and tire-derived fuel (TDF) to generate electricity. On April 8, 2004, the power company experienced an unplanned shutdown due to a short circuit (water had entered a transformer and tripped the breaker). This sudden shutdown caused fly ash to be released to the ambient air. Due to abnormal meteorological conditions, the released ash dispersed over and settled on the neighboring (to the southwest) elementary school playground (Figure 3). Students outdoors at the time came into contact with the ash before being ushered indoors. School personnel administered first aid to children complaining of irritation from the dermal contact. One child, an asthmatic experiencing breathing difficulties, was brought to a medical facility, where the child was treated and released. School administrators sent a letter home with the students that day, detailing the event and actions taken by school personnel. The Michigan Department of Environmental Quality (MDEQ) requested the power company to wash the playground equipment in order to remove any remaining caustic particulate matter.

This incident, along with other planned and unplanned shutdowns at the Hillman Power Company, has caused several area residents to question whether the emissions from the plant could be a public health threat. Village and school board officials and concerned citizens met with the local health department and MDEQ to discuss the issue. Several residents requested environmental sampling.

The local health department contacted MDCH for assistance in determining what types of sampling (environmental medium as well as chemicals of potential concern) might be appropriate. MDCH replied that the primary chemicals of interest would be those expected to be released by a facility burning waste wood products and TDF. Also, testing should take into consideration the health effects claimed by those exposed (dermal irritation) (2004, C. Bush, MDCH, personal communication with Michigan District Health Department #4).

Discussion

Environmental Sampling

Environmental data were compared, when appropriate, to available screening levels (also called criteria, standards, or comparison values) established by MDEQ and the Agency for Toxic Substances and Disease Registry (ATSDR). Differences between the two agencies' criteria can occur as a result of the data used to generate the criteria: MDEQ uses toxicological studies of all exposure durations to determine the most sensitive endpoint whereas ATSDR uses short-term studies to address short-term (acute) exposures and long-term studies to address long-term (chronic) exposures. Chemical concentrations greater than the screening levels do not indicate that adverse health effects will occur. Rather, regulators or health assessors must evaluate chemicals with exceedances further, considering environmental matrix, exposure pathways, and toxicological information to determine risk or health threat.

The MDEQ criteria to which environmental data were compared in this consultation are the Residential and Commercial I Direct Contact Criteria (DCC, for evaluating soil), the Residential and Commercial I Drinking Water Criteria (DWC, for evaluating water), and the Initial Threshold and Initial Risk Screening Levels (ITSL and IRSL, for evaluating air). The **DCC** identify soil concentrations that are protective against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil. The criteria do *not* address risks posed by inhalation and physical hazards. The **DWC** identify drinking water concentrations that are safe for long-term, daily residential or light commercial-setting consumption. The criteria are *not* applicable if drinking water use is prohibited by land use restrictions. Adverse aesthetic impacts are considered for select chemicals. The **ITSL** is a concentration of a chemical in the ambient air that is used, for regulatory purposes, to evaluate noncarcinogenic health effects. The **IRSL** is a concentration of a possible, probable, or known human carcinogen in ambient air that is used, for regulatory purposes, to assess an estimated upper-bound lifetime cancer risk of 1 in 1,000,000 (no more than one person out of one million exposed to the chemical of interest would be at risk of developing cancer as a result of that exposure).

The ATSDR comparison value to which environmental data were compared in this consultation is the Environmental Media Evaluation Guide (**EMEG**), which is specific for environmental medium (soil, water, air) and exposure duration (acute [up to two weeks], intermediate [greater than two weeks to one year], chronic [greater than one year]). The most protective value available was selected for comparison.

Some of the environmental samples used in the analysis of this site were problematic in that either there were no environmental standards to which the data could be directly compared (air-handler filter data) or the collection or analytical method was unclear or was not the MDEQ-designated method. Each data set, along with its limitations and implications, is discussed below.

HVAC Air-Filter Data

On April 19, 2004, an MDEQ staff person, accompanied by a local resident, collected a sample from a filter from one of the air handlers in the heating/ventilation/air-conditioning (HVAC) system at Hillman Elementary School shaking the collected dust into a sampling jar. The intent of this sampling, and subsequent analysis, was to make a rough calculation of ambient air concentrations of airborne particulate metals and to compare the profile of metals found in the filter with the profile of metals found in wood ash (2004, M. Stephens, MDEQ, personal communication). The local resident split the sample with MDEQ and obtained HVAC air-filter samples from two other rural schools in northern Michigan and from an inner city school in Detroit. The resident reportedly wanted to compare the air quality between supposedly "clean" areas and urban areas. Analytical findings for air filter data are not reported here due to the issues discussed below.

Using analytical data from a dust sample to back-calculate an average ambient air concentration is rife with uncertainty. The uncertainties include, but are not limited to:

- the collection technique (shaking the dust into the sample jar) would not release all material accumulated on the filter.
- the HVAC filter likely would not capture the finer fraction of particulate matter, and therefore the sample would not be an accurate depiction of all particulate matter entering the air handler.
- the filter would not capture gases or vapors that might be of concern.
- due to ever-changing meteorological conditions, it would be difficult, if not impossible, to determine a source of the particulate matter.

Comparing the results from the air filter sample testing to those from the wood ash testing also is problematic. The MDEQ staff person wanted to demonstrate that the fly ash that settled on the playground following the shutdown on April 8 was essentially wood ash and not hazardous material. The dust from the air filter would not have identified the specific chemicals, or their concentrations, present in the brief event that occurred during the shutdown. Rather, according to school maintenance personnel, the filter had been in place for 66 days before being sampled and, therefore, would have had a two-month collection of dust. As well, the school is situated in the predominant upwind direction from the plant, although, as was evidenced April 8, the wind may occasionally come from the plant toward the school. Other sources, in the area normally upwind from the school, likely contributed the majority of the particulate matter found in the filter. Finally, although the fuel burned at the Hillman Power Company is primarily (greater than 85%) wood, the addition of the TDF would change the profile of emissions, perhaps not significantly, but comparing the two different types of ashes is not useful for assessing public health implications.

It is difficult to justify comparing analytical results from four HVAC air filters from different geographic locations. There are the uncertainties discussed above. As well, although the three rural schools may seem to be in similar locations, geographic, meteorological, and industrial conditions likely are very different between each community. Lastly, according to the evidence provided by the resident who obtained the samples, the other schools' filters had not been replaced for one month to 10 years. The dissimilarities between the non-chemical characteristics of each sample prevent any scientific strength, or merit, to a comparison of the chemical profiles.

After this initial sampling, the Hillman School Board hired a private consultant to review the findings of the air filter and other samples taken (discussed later in this document) and to conduct an independent environmental assessment of the area around and inside the school. As part of the independent assessment, conducted in October 2004, the consultant took separate dust samples from the HVAC system before and after the air filter, as well as a sample from the school's univent ("unit ventilator") system. (The univent reportedly had been installed more recently than the original HVAC system.) These samples were analyzed for the "Michigan 10" metals (arsenic, barium, cadmium, chromium, copper, lead, mercury, selenium, silver, and zinc) (Rodabaugh 2004). The consultant erroneously compared the findings to the MDEQ Residential Direct Contact Criteria (DCC). In truth, there are no state or federal criteria to which HVAC dust samples can be compared to assess public health implications. The DCC identify soil concentrations that are protective against adverse health effects due to long-term ingestion of and dermal exposure to contaminated soil. The criteria do *not* address risks posed by inhalation and physical hazards, nor are the criteria meant to be compared to dust concentrations. As previously discussed, HVAC dust samples cannot and should not be used to determine air quality.

Ideally, to determine long-term ambient air concentrations of metal particulates, one should collect a series of 24-hour samples in a high-volume air sampling pump and correlate the findings to other collection sites in the state and local meteorological data. It may not be possible to determine acute ambient air concentrations, such as might occur during shutdowns at the power company, using this method. However, if shutdowns occur more frequently than considered normal, regulators could consider taking a shorter-duration sample downwind of the plant during a planned shutdown. If there are no MDEQ (or ATSDR) criteria to which acute results can be compared, regulators can compare the results to screening levels published elsewhere (e.g. California Acute Reference Exposure Levels or U.S. Environmental Protection Agency [EPA] Acute Exposure Guideline Levels). A selected bibliography regarding these screening levels is included at the end of this document.

Air quality, whether ambient or indoor, should be determined or confirmed by direct measurement (i.e., sampling the air itself). Some air sampling was conducted for this site. The results are discussed in the appropriate sections below.

Soil Sampling

On May 18, 2004, two MDEQ staff collected eight surficial soil samples in the Hillman area (Figure 4) and had the samples analyzed for total metals. The results are shown in Table 1. Most metals were below the state default background for each chemical. All metals were below their respective Residential DCC, at times by several orders of magnitude. Adverse health effects would not be expected following exposure to metals in soil at these concentrations.

The independent consultant also collected soil samples. These samples were analyzed in the field for pH levels (which indicate the acidity or alkalinity of a sample) and total hydrocarbons. The samples were sent to a lab for “Michigan 10” metals, volatile organic compound (VOC), and polychlorinated biphenyl (PCB) analyses (Rodabaugh 2004).

Out of 22 samples tested for pH, all but one indicated the soil was generally neutral (6.55–8.06, with 7.0 being neutral). The sample falling outside of this range had a pH of 4.71 and was located off the school property, on a snowmobile trail. The consultant felt that this acidic reading indicated that dumping had taken place at that site (Rodabaugh 2004). It is not known if a second sample from this site was pH-tested for verification of the initial reading.

The consultant field-tested five soil samples, selected at random, for total hydrocarbons. Results ranged between 300 and 360 parts per million (ppm). The consultant concluded that these levels were unremarkable (Rodabaugh 2004). Test method and individual chemical components of the readings were not reported. Therefore, MDCH cannot evaluate or comment on these findings.

The consultant collected four discreet (one sampling location per sample) and two composite (multiple sampling locations per sample, to determine an average concentration) soil samples (Figure 4) for “Michigan 10” metals analysis. The samples were analyzed using MDEQ-designated methods (MDEQ 2004, Rodabaugh 2004). Table 2 shows the results and the MDEQ and ATSDR screening levels for the individual metals. Similar to the MDEQ-sampling results discussed above and shown in Table 1, most metals were below their respective state background level, and all were well below their respective screening levels. Adverse health effects would not be expected following exposure to metals in soil at these concentrations.

The consultant collected three discreet and two composite soil samples (Figure 4) for VOC analysis. The samples were heated to 100°C and the volatile compounds collected on a desorption tube for subsequent analysis (Rodabaugh 2004). The preferred collection method used by MDEQ when sampling soils for VOCs is to mix methanol with the sample immediately after collection to preserve the sample and prevent any volatiles from possibly breaking down before analysis (MDEQ 2004b). Desorption tubes typically are used to take samples directly from ambient (see appropriate section below) or indoor air, not from headspace generated by VOC-containing soil. The data generated using the consultant’s method provide at least a qualitative assessment (identification of chemicals present). According the MDEQ, however, the quantitative data cannot be used to compare to the state’s screening levels (2004, A. Curtis, MDEQ Remediation and Redevelopment Division, personal communication).

Table 3 shows the soil VOC analytical results. For purposes of this document, the table also shows the available MDEQ and ATSDR screening levels for each chemical detected (although, as stated previously, MDEQ would not consider the data when evaluating the site). Sample location SS16 was the location where the pH was found to be 4.71. The consultant felt that this finding strengthened the suggestion that dumping had taken place at that site (Rodabaugh 2004). When compared to MDEQ and ATSDR screening levels, the data for this and the other sites are unremarkable and would not pose a public health threat. These samples were taken in an area of Michigan that is managed for forest products (pine plantations, lumber mills). It is probable that many of the VOCs detected are occurring naturally, emanating from resins in the trees or from other plants.

The consultant collected four discreet and two composite soil samples for PCB analysis using U.S. EPA Method 8082 (the MDEQ-preferred method). Analytical results indicated that the chemicals were not detected (detection limit of 0.33 ppm) (Rodabaugh 2004). No health threat is posed by PCBs at this site.

Surface Water Sampling

On July 27, 2004, the Hillman Power Company submitted two surface water samples for "Michigan 10" metals and VOC analyses to Huron Valley Laboratories, Inc. (based in Romulus and Gaylord, Michigan). The samples were taken from Thunder Creek, which flows through the plant property. The samples were taken upstream and downstream of the plant. The purpose of the sampling was to determine whether the power company was impacting surface water. Analytical results showed virtually no change in the selected water quality parameters between upstream and downstream samples. There were no VOC detections. The only metals detected were barium, mercury, and zinc (average concentrations were 26, 0.0012, and 5.5 parts per billion [ppb]) (Huron Valley Laboratories, Inc. 2004). The MDEQ Residential and Commercial I Drinking Water Criteria for these chemicals are 2,000 ppb, 2 ppb, and 2,400 ppb, respectively (MDEQ 2004a). (While the creek is not a regular source of drinking water, comparing concentrations of chemicals found in the water to the DWC provides an informal basis for evaluation.) These concentrations pose no public health threat.

Indoor Air Sampling

On August 16, 2004, a consultant/trainer hired by the school board sampled the air in one of the classrooms at Hillman Elementary School. The sampling pump was placed near an open window that faces the power company. According to the consultant/trainer's records, classroom windows are open during good weather and school administrators wanted to know what chemicals might enter the classroom via the windows. The sampling duration lasted approximately 7-1/4 hours. A total of 1,310 liters of air (rate of 3 liters per minute [lpm]) passed through the cassette filter during that time. The sample was analyzed for welding fumes (aluminum, antimony, arsenic, beryllium, cadmium, cobalt, chromium, copper, iron, manganese, molybdenum, nickel, lead, titanium, vanadium, and zinc) using the Occupational Safety and Health Administration (OSHA) ID-125M method. (Metal fumes consist of very small particulates.) None of the metals was detected (QUAT Inc. 2004).

It should be noted that wind direction, as recorded by the consultant/trainer, was from the west/southwest, blowing from the school toward the power company, at about 8 miles per hour. Therefore, any emissions released by the power company during the sampling time likely did not disperse over the school and were not collected. Therefore, the data collected give no indication of the impact, if any, emissions from the Hillman Power Company had on the school environment that day. (The consultant/trainer discussed the issue of wind direction with school administrators. No subsequent sampling, with the wind from the east/northeast, has occurred.)

The independent consultant who had sampled the HVAC dust and soil tested the school's indoor air for evidence of fungal (mold) contamination and compared the results with outdoor samples. Spore counts were higher for the samples taken outdoors, indicating there was no mold problem in the school (Rodabaugh 2004).

Ambient Air Sampling

The consultant hired by the school board to sample the HVAC dust and soil conducted ambient air sampling as well. The consultant positioned three sampling pumps, set at 0.2 liters per minute (lpm), at upwind and downwind sites from the power company. Two adsorbent tubes were used at each site for VOC sampling. Total airflow was 40.5-44.9 liters. Wind direction that day, as recorded by the consultant, was from the west/southwest, blowing from the school toward the power plant (Rodabaugh 2004). The wind speed was not reported.

Table 4 shows the concentrations and the MDEQ and ATSDR screening levels for the chemicals detected. According to the consultant's report, the research team moved one of the downwind sampling pumps about halfway through the sampling event, due to shifting winds. Although this move allowed the pump to be placed more directly downwind from the power company (Rodabaugh 2004), altering the collection event most likely influenced the results. The results for this pump (samples K526 and K431) should be considered void. They are included in Table 4, however, as a qualitative indicator of chemicals present in the air around the village of Hillman. The other downwind pump (samples K322 and K216) was left in place, even though shifting winds caused it to be out of the dispersion pathway of power company emissions, to determine an average concentration for the sampling event (Rodabaugh 2004). This presents a more realistic picture of air concentrations in the predominant downwind direction from the plant. The consultant concluded that the results from the upwind samples (samples K503 and K157) did not pose a health threat (Rodabaugh 2004). The concentrations detected in the downwind samples (both those MDCH considers valid as well as those the agency considers void) posed no health threat either.

Exposure Pathways

To determine whether persons are, have been, or are likely to be exposed to contaminants, MDCH evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements: (1) a source of contamination, (2) contaminant transport through an environmental medium, (3) a point of exposure, (4) a route of human exposure, and (5) a receptor population. An exposure pathway is considered complete if there is evidence that all five of these elements are, have been, or will be present at the property. It is considered either a potential or an incomplete pathway if there is no evidence that at least one of the elements above are, have been, or will be present at the property, or that there is a lower probability of exposure. The exposure pathway elements for this site are shown in the following table:

Table 5. Exposure pathway analysis for air emissions in the village of Hillman, Montmorency County, Michigan.

Source	Environ-mental Transport and Media	Chemicals of Concern	Exposure Point	Exposure Route	Exposed Population	Time	Status
Hillman Power Company and other local emitters	Ambient air	VOCs, metals, fly ash	Ambient air	Inhalation, dermal contact, ingestion	Hillman community	Past	Complete
						Present	Complete
						Future	Potential
			Indoor air	Inhalation, dermal contact, ingestion	Hillman community	Past	Potential
						Present	Potential
						Future	Potential
			Soil	Ingestion, dermal contact, inhalation	Hillman community	Past	Potential
						Present	Potential
						Future	Potential
		VOCs, metals	Surface water (Thunder Creek)	Dermal contact, ingestion	Hillman community	Past	Potential
						Present	Potential
						Future	Potential

Ambient air testing by the independent consultant indicated the presence of VOCs, which verifies exposure, but the concentrations were well below health-based screening values. The source of metals found in the HVAC system at Hillman Elementary School is unknown, however companies using TDF have reported metals in their emissions (MDNR 1995). The Hillman Power Company has reported zinc in its emissions (2004, K. Mulka, Hillman Power Company, personal communication). It should be noted that there are other potential sources in the Hillman area besides the power company, such as a wood-fired boiler without any pollution control equipment located near the power company (2004, M. Stephens, MDEQ-Gaylord Office Air Quality Division, personal communication). Additionally, if air emissions from local sources were a problem, deposition to the soil would be apparent from the soil analyses performed, yet soil concentrations of metals were generally below background. The Hillman community likely is not being exposed, by inhalation or swallowing of air particles, to a degree that would be expected to result in adverse health effects.

The shutdown event that occurred April 8 resulted in fly ash depositing on children in the playground at the school, which clearly indicates that a dermal exposure pathway is present. However, exposure duration during this event, and likely during other events, was brief. As well, frequency of exposure appears to be minimal, as the power company is situated northeast of the school and winds are predominantly from the southwest quadrant. While the fly ash reportedly caused dermal irritation, and one child suffered an exacerbation of his asthma during the April event, it is unlikely that people would suffer long-term negative health effects as a result of sporadic dermal exposure to the ash. This is not to say that the fly ash is not, at the least, a nuisance. At the most, the ash from Hillman Power Company, like most wood ash, may cause skin irritation when released in sudden, large amounts, such as when an unplanned shutdown occurs.

The indoor air analysis performed by the consultant/trainer did not indicate any problems when the winds were from the west/southwest. It is unknown what concentrations may be present when the wind is from the opposite direction. The HVAC dust data provide no scientific basis on which to determine air quality, indoor or ambient (outdoor). If there were concerns regarding the ambient air data, which there are not, then there would be justification to think that indoor air is being impacted by emissions.

As stated earlier, the soil does not appear to be impacted by emissions from the power company. Children exposed to the soil through their regular activities may unintentionally eat some dirt and be exposed to compounds in the soil, especially if they do not wash their hands before eating. However, the data indicate chemicals present in the soil are well below health-based screening levels. Exposure to the chemicals detected in the soil is not expected to result in adverse health effects.

Children playing in Thunder Creek or other local surface waters might accidentally swallow some water from those areas. Environmental data from the creek indicate that chemical levels are not of concern. As well, the creek is not a source of regular drinking water and exposure to it would be seasonal and infrequent.

<u>Toxicological Evaluation</u>

Particulate Matter

Particulate matter, or PM, is one of the criteria pollutants listed in the Clean Air Act and its Amendments for which the EPA has listed National Ambient Air Quality Standards (NAAQS). Beginning in 1987, the EPA restricted the standard from Total Suspended Particulates (TSP) to the mass concentration of inhalable particles less than or equal to 10 microns (or micrometers [µm]), or PM_{10} (Federal Register, as cited by Bascom et al. 1996). PM_{10} can enter the thoracic airway, whereas some components of TSP might be filtered or expelled earlier along the respiratory tract by the body’s protective mechanisms (nostril filtration, coughing). In a 1996 risk assessment of PM, EPA stated that the pollutant should be split further into a coarse fraction (PM_{10}) and a fine fraction ($PM_{2.5}$, less than 2.5 microns). Particles ranging from 2.5-10 µm in size include resuspended road dust (soil particles, engine oil including metals, tire particles, sulfate, and nitrate), construction and wind-blown dust, silicon, titanium, aluminum, iron, sodium, and chlorine. Particles smaller than 2.5 µm include combustion, condensation, and coagulation products of gases and ultrafine particles; carbon; lead; vanadium; bromine; and sulfur and nitrogen oxides. In studies where coarse fraction particles were the dominant fraction of PM_{10}, major short-term effects observed included aggravation of asthma and increased upper respiratory illness (Bascom et al. 1996). Fly ash released during the April 8 shutdown was visible, likely PM_{10} or larger, and could explain respiratory symptoms reported following the event.

Chemical Mixtures

The individual chemical data collected in the Hillman area indicated that the chemicals investigated did not exceed their respective comparison values. Therefore, it is not likely that exposure to any chemical by itself would result in adverse health effects. However, these chemicals did not occur alone but rather as complex mixtures. The science regarding interactions of chemical mixtures is still in its infancy. One chemical might have no effect on another, or may act synergistically (one chemical causes the action of another chemical to be greater than expected), or antagonistically (one chemical causes the action of another chemical to be less than expected). Because the concentrations of the detected chemicals were, for the most part, more than one order of magnitude (more than 10 times) lower than their respective lowest comparison values, current exposure-based assessment of joint toxic action of chemical mixtures (ATSDR 2002) suggests that chemical mixtures in the Hillman area would not be expected to cause adverse health effects.

Chemicals Without Screening Levels

A number of the chemicals detected in the environmental samples did not have corresponding MDEQ or ATSDR screening levels. The ATSDR develops screening levels for those chemicals most commonly found at National Priority List ("Superfund") sites, since the Agency was originally created to assess public health implications at these sites. There are about 250 chemicals for which ATSDR has set comparison values. The MDEQ calculates screening levels for the chemicals it regulates: over 200 chemicals have a DWC and over 1,000 chemicals have ITSLs and/or IRSLs. If a chemical does not have a corresponding screening level, it is likely because the chemical is not seen as a concern or priority.

There are no MDEQ DCC for calcium or potassium, both nutritional elements and not of concern. Nor is there a DCC for titanium. The exposure route of concern for titanium is via inhalation, however the most likely route of exposure is via food (HSDB 2004). As well, the metal was not detected in the indoor air sampling event at the school, although that was on a day when winds were from the west/southwest, toward the power company.

Some of the VOCs detected in air and soil samples were only tentatively identified, as carbon chains of varying length. The remaining VOCs for which there were no DCC or ITSLs all occur naturally, being produced by plants and trees (HSDB 2004). As discussed earlier, the area around Hillman is forested. It is likely plants, trees, or forest products generated at least some of the VOCs detected.

ATSDR Children's Health Considerations

Children may be at greater risk than adults from exposure to hazardous substances at sites of environmental contamination. Children engage in activities such as playing outdoors and hand-to-mouth behaviors that could increase their intake of hazardous substances. They are shorter than most adults, and therefore breathe dust, soil, and vapors closer to the ground. Their lower body weight and higher intake rate results 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. Even before birth, children are forming the body organs they need to last a lifetime. Injury during key periods of growth and development could lead to malformation of organs (teratogenesis), disruption of function, and premature death. Exposure of the mother could lead to exposure of the fetus, via the placenta, or affect the fetus because of injury or illness sustained by the mother (ATSDR 1998). The obvious implication for environmental health is that children can experience substantially greater exposures than adults to toxicants that are present in soil, water, or air.

The children exposed to the ash that was released from the Hillman Power Company during the shutdown on April 8 complained of skin irritation, yet the consultant who conducted soil and ambient air testing reportedly handled on-site fly ash at the plant without claiming any health effects. It is possible that the children were sweating while playing during recess and the ash reacted with the moisture on the skin, causing the caustic reaction. Additionally, the children likely received most of their exposure on their face, since the weather can still be cold in northern Michigan in April and the children would have been wearing jackets. Skin on the head is not callused like it would be on fingertips, which is probably where the consultant was exposed. Therefore, any irritation conceivably could be felt sooner after exposure to the face rather than to the fingertips.

It is understandable that parents are concerned about potential health effects in their children following exposure to the ash emitted during shutdown events at Hillman Power Company. The American Academy of Pediatrics recently released a policy statement on ambient air pollution and health hazards to children (AAP 2004). Airborne particulates can affect the development of children's lungs. It should be noted, however, when setting criteria for pollutants, regulatory and health agencies consider the most sensitive toxicological endpoint and apply additional safety factors as they calculate an acceptable concentration. The criteria used in this document were not set haphazardly. The environmental data for the area around Hillman indicate that there are no concentrations of concern for children or adults.

Community Health Concerns/Health Outcome Data

Arsenic Testing

In the report prepared by the consultant who sampled the HVAC dust, soil, and ambient air, one of the recommendations discussed medical screening. The consultant felt that there was an increased risk of lead and arsenic exposure to children and stated that "some parents may wish to have their children tested" (Rodabaugh 2004). Following the release of this report, MDCH received a telephone call from the Thunder Bay Community Health Services clinic requesting guidance regarding arsenic testing. In its reply, MDCH explained that children were *not* at an increased risk of exposure and that the testing was *not* necessary. However, to assist the clinic, and other healthcare providers in the region who might be contacted for testing, MDCH reviewed biomarker-testing information on arsenic and created a factsheet with cover letter and placed it on the department's website (www.michigan.gov/mdch-toxics, under Health Assessments and Related Documents, click on Hillman Power Company). A copy of the factsheet is in Appendix A.

Lead Testing

Upon reading the private consultant's report, staff from the MDCH Division of Environmental and Occupational Epidemiology informed staff from the MDCH Childhood Lead Poisoning Prevention Program (CLPPP) that parents in the Hillman community might have interest in testing their children for blood lead levels. Lead is a potent neurotoxin and can affect behavior and learning. Children's brains are still developing as they grow and can be more susceptible than adult brains to chemical insult. Blood lead testing of children under six years of age, and particularly of children aged 1 to 2 years, is recommended for those children at a high risk of exposure (e.g., their residence was built before the 1950s, when lead paint was banned). One- and two-year-olds generally exhibit the most "hand-to-mouth" behavior seen in children and they may ingest lead-contaminated paint chips, household dust, or soil.

The MDCH reports blood lead data for all Michigan counties. In 2003, Montmorency County (in which the village of Hillman is situated) had 544 children under the age of six and 192 children between the ages of one and two years old. Of those less than six years, 37 (7%) were blood lead tested, with none reported having elevated blood lead levels (MDCH 2004). ("Elevated blood lead level" is defined as greater than 10 micrograms per deciliter [µg/dL].) Of those children in the county between the ages of one and two, 21 (11%) were tested, with none reported having elevated blood lead levels (2004, S. Hudson, MDCH-CLPPP, personal communication). U.S. Census data indicate that 18% of the homes in Montmorency County are "pre-1950 housing" (MDCH 2004), suggesting that these homes may have lead paint in them. As well, out-buildings, such as barns, built before the 1950s and certain hobbies (see Appendix B) may also be sources of lead exposure.

The CLPPP office provided blood lead data for the village of Hillman (zip code 49746) for samples taken in 2004. As of the middle of December 2004, 37 children residing in the area have been tested. Age at testing ranged from approximately six months to 12 years. (As stated above, the children most at risk of exposure to lead would be those under the age of six, and especially in the one- to two-year-old range. It is unclear why children over six were tested.) Table 6 shows the data divided by age group:

Table 6. 2004 Blood lead levels reported for the village of Hillman, Montmorency County, Michigan.

Age Group (years)	Number tested	Blood lead levels (µg/dL): Range (Average)
Less than 1	2	1-6 (3.5)
1-2	11	1-4 (1.8)
2-6	15	1-9 (2.4)
Older than 6	9	1-2 (1.2)

It should be noted that the laboratory minimum detection level for blood lead is 1 µg/dL and that non-detects are reported as 1. Therefore, the actual blood lead concentrations for those children listed as "1" might be less than that value and could be zero. The highest level reported was 9 µg/dL, in a five-year-old. The next highest concentration in that age group was 4 μg/dL. None of the blood lead levels reported fit the definition of "elevated."

As with all exposure evaluations and testing, patients should discuss all potential sources of exposure to the chemical of interest with their healthcare provider. The MDCH CLPPP has developed a lead-testing information sheet for healthcare providers that discusses screening patients, assessing all exposure sources, and implementing recommended follow-up actions when blood lead levels are elevated. Appendix B contains this information.

Conclusions

The environmental data taken in Hillman Elementary School and around the village of Hillman indicate that chemicals of interest were all well below their respective health-based screening levels. As well, prevailing winds normally carry emissions from the Hillman Power Company toward the east/northeast, away from the village and school. Occasional large releases of fly ash during shutdown events may deposit locally if winds shift. However, proactive measures such as establishing a procedure that alerts people to wind direction (such as erecting a wind sock), should a shutdown event occur, will help prevent exposure to the ash. If there is dermal exposure to the ash, washing the skin as soon as possible should remove any caustic material. (Hand-washing benefits personal hygiene in general.) Even though there is exposure, the low concentrations found and the infrequency and minimum duration of the exposure lead to the conclusion that **there is no apparent public health hazard.**

The HVAC system at Hillman Elementary School should be maintained according to manufacturer's suggestions, at the least, and might need cleaning or updating. (The independent consultant also reached this conclusion.)

Recommendations

1. The low pH and elevated VOC findings in soil sample SS16 should be addressed to determine if dumping (unrelated to the Hillman Power Company) has occurred.
2. Hillman Elementary School officials should safeguard indoor air quality at the school.
3. MDCH does *not* recommend biomarker testing for arsenic, since exposure is not expected.
4. MDCH recommends blood lead testing for children under six years who have a high degree of exposure to lead sources (such as those who live in pre-1950 housing). (State law requires testing for one- and two-year-olds who are covered by Medicaid [MDCH 2004].)
5. Children should be encouraged to wash their hands after coming inside and before eating.

Public Health Action Plan

1. MDEQ has concluded that the elevated VOCs are likely due to naturally-occurring compounds emitted by plants, trees, and forest products in the area (2004, M. Stephens, MDEQ-Gaylord Office Air Quality Division, personal communication).
2. MDCH has provided Hillman school board officials with contact information for the U.S. EPA program, "Tools for Schools," which discusses indoor air quality programs (see Selected Bibliography).
3. Healthcare providers who conduct biomarker testing for arsenic should refer to the factsheet in Appendix A.
4. Healthcare providers who conduct blood lead testing should refer to the information in Appendix B.

MDCH remains available to answer questions or provide information and guidance. Staff for the Division of Environmental and Occupational Epidemiology can be reached at 1-800-648-6942. Staff for CLPPP can be reached at 1-517-335-8885.

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Table 1. MDEQ soil sampling results - metals. Village of Hillman, Montmorency County, Michigan.

	Concentrations							
Chemical	**Playground (SS1-SS4)**	**Ballfield (SS 5)**	**Northeast Area (SS6-SS7)**	**High School (SS 8)**	**Michigan Background**	**MDEQ R/C1 DCC**	**ATSDR EMEG**	**Exposure Rate**
aluminum	1,200 - 1,500	1,300	1,300 - 1,600	9,800	6,900	50,000	NA	
arsenic	0.7 - 0.9	0.5	0.5 - 1.8	1.8	5.8	7.6	10	pica
barium	11 - 15	9.1	12 - 62	53	75	37,000	NA	
beryllium	ND	ND	ND - 0.48	0.41	NA	410	100	chronic
cadmium	ND	ND	ND	ND	1.2	550	10	chronic
calcium	3,360 - 34,000	95,500	11,900 - 89,800	12,800	NA	NA	NA	
chromium	3.6 - 4.2	2.7	4.4 - 24	18	NA	2,500	NA	
cobalt	ND	ND	ND - 8.1	6	6.8	2,600	NA	
copper	5.9 - 9.4	5.6	6.6 - 17	16	32	20,000	NA	
lead	2.5 - 10	ND	ND - 21	21	21	400	NA	
magnesium	803 - 2,470	3,500	6,350 - 9,450	5,590	NA	1,000,000	NA	
manganese	36 - 65	57	100 - 280	420	440	25,000	NA	
mercury	ND	ND	ND	ND	0.13	160	NA	
molybdenum	ND	ND	ND	ND	NA	2,600	NA	
nickel	ND	ND	ND - 18	14	20	40,000	NA	
potassium	111 - 158	119	340 - 2,390	2,520	NA	NA	NA	
selenium	ND	ND	ND	ND	0.41	2,600	300	chronic
silver	ND	ND	ND	ND	1	2,500	NA	
sodium	ND	ND	ND	ND	NA	1,000,000	NA	
strontium	5.6 - 28	47	16 - 52	15	NA	330,000	NA	
thallium	ND	ND	ND	ND	NA	35	NA	
titanium	46 -61	33	64 - 250	180	NA	NA	NA	
vanadium	4.2 - 5.9	3.5	5 - 25	18	NA	750	NA	
zinc	20 - 240	140	24 - 78	56	47	170,000	20,000	chronic

MDEQ R/C1 DCC = Michigan Department of Environmental Quality Residential and Commercial I Direct Contact Criteria
ATSDR EMEG = Agency for Toxic Substances and Disease Registry Environmental Media Evaluation Guide
SS = soil sample
ND = not detected
NA = not available

Notes:
1. Samples taken 5/18/04
2. All values in ppm (parts per million)
3. Pica individuals show an abnormal behavior of eating nonfood items, such as dirt.

Reference: MDEQ 2004

Table 2. Private consultant soil sampling results - metals. Village of Hillman, Montmorency County, Michigan.

Chemical	Concentration Range	Michigan Background	MDEQ R/C1 DCC	ATSDR EMEG	Exposure Rate
arsenic	0.3 - 2.5	5.8	7.6	10	pica
barium	9 - 59	75	37,000	NA	
cadmium	0.17 - 0.43	1.2	550	10	chronic
chromium	1.4 - 16	NA	2,500	NA	
copper	ND - 11	32	20,000	NA	
lead	7 - 16	21	400	NA	
mercury	ND - 11	0.13	160	NA	
selenium	ND - 0.5	0.41	2,600	300	chronic
silver	ND	1	2,500	NA	
zinc	15 - 50	47	170,000	20,000	chronic

MDEQ R/C1 DCC = Michigan Department of Environmental Quality Residential and Commercial I Direct Contact Criteria

ATSDR EMEG = Agency for Toxic Substances and Disease Registry Environmental Media Evaluation Guide

ND = not detected

NA = not available

Notes:

1. Samples taken 10/4/04.
2. All values in ppm (parts per million)
3. Pica individuals show an abnormal behavior of eating nonfood items, such as dirt.

Reference: Rodabaugh 2004

Table 3. Private consultant soil sampling results - VOCs. Village of Hillman, Montmorency County, Michigan.

Chemical	OG1 (SS1)	OG2 (SS2)	OG3 (SS16)	OG4 (H.S.comp)	OG5 (BKGcomp)	MDEQ R/C1 DCC	ATSDR EMEG	Exposure Rate
	Concentrations							
Total VOCs	<0.15	<0.15	0.42	<0.15	<0.15	NA	NA	
2-Methylbutanal	ND	ND	0.009	ND	0.002	NA	NA	
Acetaldehyde	0.025	ND	0.025	ND	0.005	29,000	NA	
Acetone	ND	ND	0.027	0.004	0.005	23,000	4,000	pica
a-Pinene	ND	ND	0.01	ND	ND	NA	NA	
b-Pinene	ND	ND	0.011	ND	ND	NA	NA	
C3-C5	ND	ND	0.006	ND	ND	NA	NA	
C4-C6	ND	ND	0.022	0.006	0.006	NA	NA	
C7-C9	ND	ND	0.004	ND	ND	NA	NA	
C8	ND	ND	0.008	ND	ND	NA	NA	
Carbonyl sulfide	ND	ND	ND	ND	0.002	NA	NA	
Eucalyptol	ND	ND	0.009	ND	ND	NA	NA	
Heptanal	ND	ND	0.009	ND	ND	NA	NA	
Hexanal	ND	ND	0.018	ND	ND	NA	NA	
Methanol	2	<0.1	<0.1	0.45	0.49	3,100	30,000	chronic
Methyl ethyl ketone	ND	ND	0.07	ND	ND	27,000	30,000	chronic
Nonanal	ND	ND	0.029	ND	ND	NA	NA	
o-Xylene	ND	ND	ND	0.0057	ND	150	400	pica
Pentanal	ND	ND	0.01	ND	ND	NA	NA	
Terpine	ND	ND	ND	ND	0.005	NA	NA	
Toluene	0.003	ND	0.012	ND	0.0069	250	40	intermediate

VOC = volatile organic compound
OG = sample identifier
SS = soil sample
H.S.comp = high school composite sample
BKGcomp = background composite sample
MDEQ R/C1 DCC = Michigan Department of Environmental Quality Residential and Commercial I Direct Contact Criteria

ATSDR EMEG = Agency for Toxic Substances and Disease Registry Environmental Media Evaluation Guide
ND = not detected
NA = not available

Notes:
1. All values in ppm (parts per million)
2. Samples taken 10/4/04.
3. "Total VOCs" does not include single- or double-carbon compounds or methanol.
4. C3, C4, etc. compounds are only identified as compounds with three-carbon, four-carbon, etc.chains.
5. Pica individuals show an abnormal behavior of eating nonfood items, such as dirt.

Reference: Rodabaugh 2004

Table 4. Private consultant ambient air sampling results - VOCs. Village of Hillman, Montmorency County, Michigan.

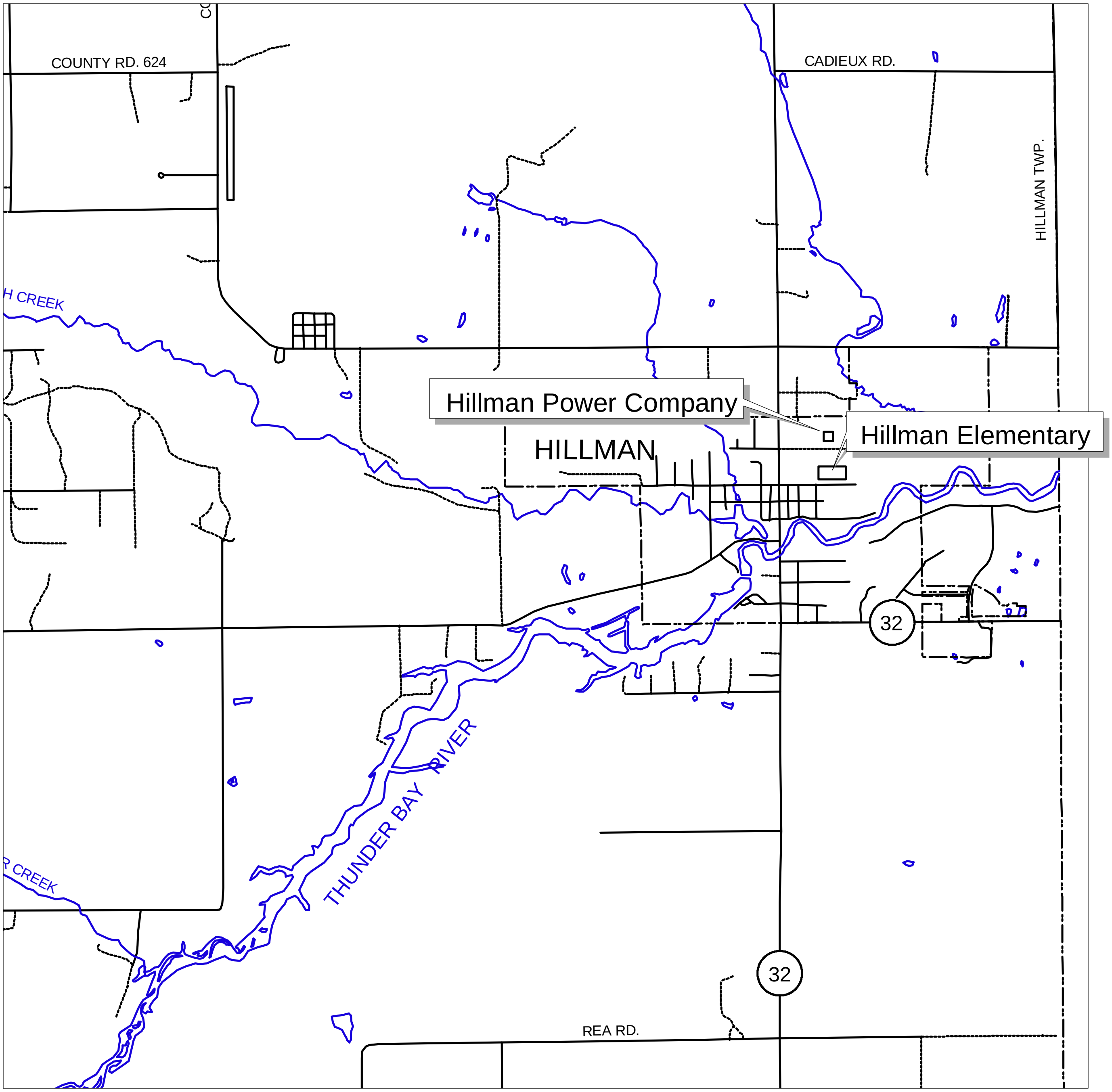
Chemical (location from plant)	**K322/K216 downwind**	**K526/K431 downwind (moved)**	**K503/K157 upwind**	**MDEQ ITSL/IRSL**	**Averaging Time**	**ATSDR EMEG**	**Exposure Rate**
Acetophenone	ND	6	ND	490,000	8 hr	NA	
Aliphatic HCs	29	30	20	NA		NA	
a-Pinene	3	110	ND	1,120,000	8 hr	NA	
a-Terpinene	ND	3.6	ND	NA		NA	
Benzaldehyde	1.4	3.6	ND	400	annual	NA	
Benzene	0.3	0.7	0.2	100	annual	100	lifetime
b-Pinene	1.5	16	ND	1,120,000	8 hr	NA	
C10	1	2	2.2	NA		NA	
C11 - C13 HCs	ND	2.4	ND	NA		NA	
C4 - C6 HCs	0.9	ND	ND	NA		NA	
C9	ND	0.9	1.1	NA		NA	
C9 - C11 HCs	1.9	2.4	1.8	NA		NA	
Camphene	ND	39	ND	NA		NA	
Decanal	ND	ND	2.7	NA		NA	
Isobutane	1.4	ND	ND	618,000	annual	NA	
Limonene	ND	34	ND	6,250,000	24 hr	NA	
Pentanal	ND	ND	2.5	NA		NA	
Phenol	ND	7	ND	600,000	1 hr	NA	
p-Isopropyltoluene	ND	13	ND	NA		NA	
Propylene	33	ND	ND	1,500,000	24 hr	NA	
Substituted benzene	ND	16	ND	NA		NA	
Terpines (4 types)	ND	1.7 - 54	ND	NA		NA	
Toluene	0.8	1.4	0.9	400,000	24 hr	80,000	chronic

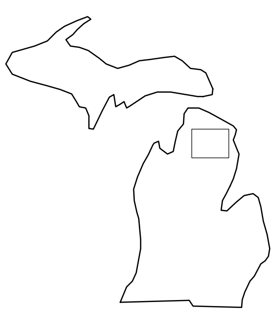
VOC = volatile organic compounds
K(number) = sample identifier
MDEQ ITSL/IRSL = Michigan Department of Environmental Quality Initial Threshold/Risk Screening Level
ATSDR EMEG = Agency for Toxic Substances and Disease Registry Environmental Media Evaluation Guide
ND = not detected
NA = not available

<u>Notes:</u>
1. All values in ng/L (nanograms per liter)
2. Samples taken 10/4/04.
3. Aliphatic HCs (hydrocarbons) are straight-chain compounds, no aromatic rings.
4. C3, C4, etc. compounds are only identified as compounds with three-carbon, four-carbon, etc.chains.

<u>Reference</u>: Rodabaugh 2004

Village of Hillman,
Montmorency County, Michigan





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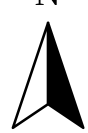

Figure 1.

Figure 2a. West view of Hillman Power Company (looking east), village of Hillman, Montmorency County, Michigan.

Figure 2b. East view of Hillman Power Company (looking northwest), village of Hillman, Montmorency County, Michigan.

Figure 3. Hillman Elementary School and playground (looking east) with Hillman Power Company in background, village of Hillman, Montmorency County, Michigan.

Environmental Sampling Locations,
Village of Hillman,
Montmorency County, Michigan

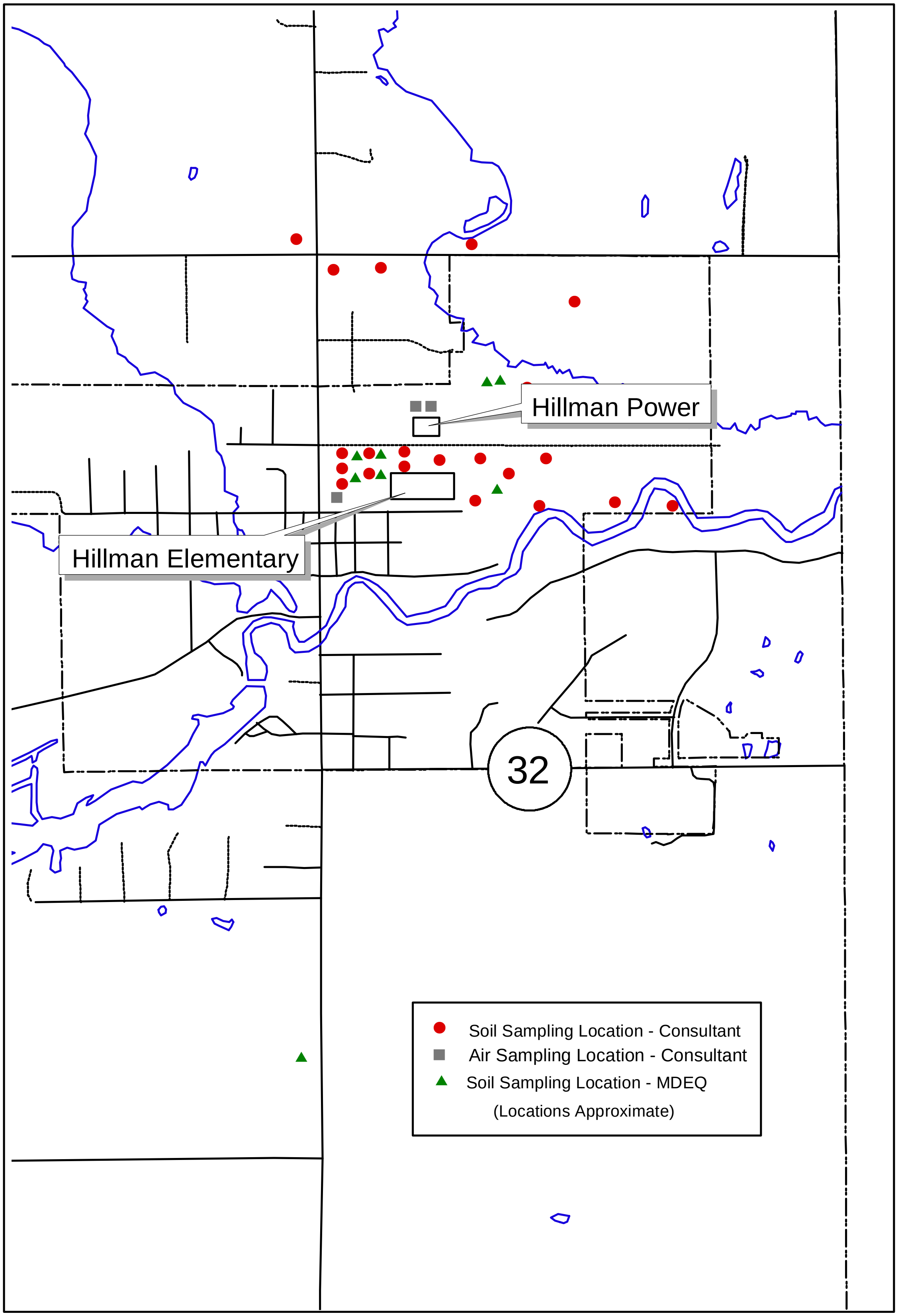

Figure 4.

Appendix A. “Evaluating Arsenic Exposure” Factsheet Prepared by MDCH for Healthcare Providers in the Hillman Area.

Evaluating Arsenic Exposure

<u>Arsenic – Key Points</u>:

●Occurs naturally in the soil; can be released to the environment from some industries
●Occurs naturally in fish and shellfish and other foods
●Numerous exposure sources (see below)
●Urine testing is best method to test for recent exposure
●Do not eat fish for several days before and during (if a 24-hour test) sampling

General Information:
Arsenic occurs naturally in soil and minerals. It can also be released into the air from primary (purifying the ore) metal smelters, coal-fired power plants, incinerators, and oil/wood combustion facilities. Organic arsenic compounds have been used in pesticides and occur naturally in fish and shellfish. Inorganic arsenic compounds have been used in preserving wood (CCA-treated lumber, which is no longer marketed). The inorganic form of arsenic is more toxic than the organic form.

Sources of Exposure:
►Wellwater (inorganic arsenic)
►Food (primarily organic arsenic): fish, shellfish, rice, grains, mushrooms, other foods
►Some medicines and herbal remedies (especially from other countries)
►"Wolmanized" (CCA-treated) lumber (no longer marketed however)
►Soil containing naturally-elevated concentrations or contaminated by human activity
►Air: airborne arsenic-containing soil or dust, tobacco smoke, emissions from industrial sources, burning CCA-treated wood
►Job-to-home: employees exposed at work to arsenic dusts might bring the dusts home with them on their clothing. Other family members can then be exposed.

Laboratory Testing:
Blood levels of arsenic are not reliable indicators of recent exposure because the concentrations clear within a few hours.

Arsenic accumulates in hair and nails. However, exogenous arsenic (arsenic that is not within the body) may adhere to the cuticle of the hair or may be present in hair-care products and be absorbed into the hair follicle, or may be present in dirt on the nails, skewing analytical results. Therefore, although easier to collect, *hair and nail samples are not reliable biomarkers*.

According to the ATSDR Toxicological Profile for Arsenic, **urinary** arsenic levels are accepted as the **most reliable indicator** of recent arsenic exposure via ingestion or inhalation. Either a 24-hour (preferred) or a random ("spot") sample is acceptable. It is advisable that the patient not consume any fish or shellfish for several days before and during the test, as the organic arsenic in the fish will elevate the results.

Reference Ranges:
The laboratory that analyzes the sample should provide a reference range to which analytical results are compared. A "reference range" is essentially a screening level, below which the arsenic concentration is of no concern. If the arsenic concentration is greater than the reference range, this indicates that speciation of the arsenic in the sample is necessary. An exposure assessment may be indicated, dependent on results.

Potential Health Effects:
Simply because a person's urinary arsenic level might be higher than the reference range provided by the testing laboratory *does not mean* that adverse health effects will occur. Similarly, exposure to a chemical *does not mean* a person will have a reaction to that chemical. There are many factors that determine one's reaction to an exposure, including how long, by what route (eating, inhaling, skin contact), and the amount to which the person was exposed, as well as the general state of health of that person.

- ●Skin effects - The single *most common characteristic* of long-term ingestion exposure to inorganic arsenic is a darkening of the skin and the appearance of small "warts" on the palms, soles and torso. Direct skin contact with arsenic may cause dermal irritation, but this generally occurs at high concentrations.
- ●Gastrointestinal effects - Eating or drinking low levels of inorganic arsenic may lead to irritation of the stomach and intestines, which could cause stomachache, nausea, vomiting, and diarrhea. Severity of symptoms would increase with increasing dose.
- ●Cardiovascular effects - Eating or drinking low levels of inorganic arsenic may lead to decreased production of red and white blood cells, possibly leading to fatigue or anemia; abnormal heart rhythm; or blood-vessel damage, possibly leading to bruising.
- ●Nerve function effects - Eating or drinking low levels of inorganic arsenic may lead to impaired nerve function, possibly leading to a "pins and needles" sensation in hands and feet.
- ●Cancer - Long-term exposure to inorganic arsenic can increase a patient's risk of developing several types of cancer.

Additional Information:
The federal Agency for Toxic Substances and Disease Registry has produced the Toxicological Profile for Arsenic and a condensed factsheet on arsenic ("ToxFAQs"). Both documents can be accessed at http://www.atsdr.cdc.gov/toxprofiles/tp2.html.

Staff from the Michigan Department of Community Health (1-800-648-6942) or the Michigan Poison Control Center (1-800-222-1222) can help interpret arsenic tests and provide further guidance.

Appendix B. MDCH Healthcare Provider Information Sheet Regarding Blood Lead Testing

SCREENING/TESTING

The Statewide Screening/Testing Plan for Childhood Lead Poisoning Prevention recommends/requires:

All children in the Medicaid program are **required** by Medical Services Administration to be tested at 12 and 24 months of age; between 36 and 72 months if not tested previously. **There are no exceptions or waivers. MIChild-enrolled children should be tested if any risk factors exist (or at health care provider's discretion).**

All children within designated "high risk" ZIP code areas should have a blood lead test at 12 months and 24 months of age, or between 36 and 72 months if not tested previously.

Parents/guardians of children under age six (not in the previous 2 categories) should be asked questions concerning the child's potential sources of exposure. (See list below).

Health care providers always have the option of testing a client for lead if he/she determines the client to be at risk, **or if the client or parent/guardian requests a blood lead test.**

POSSIBLE SOURCES OF EXPOSURE

OCCUPATIONAL & HOBBY RELATED

Auto/boat repair
Auto parts/accessories manufacture
Radiator repair
Battery manufacture/repair
Bridge/tunnel/elevated highway repair
Plumber, pipe fitter (older buildings)
Wrecking and Demolition
Glass manufacturing,
Brass/copper/aluminum processing
Chemical manufacturing
Plastics manufacturing
Rubber products manufacturing
Steel welding and cutting
Renovate/remodel older homes
Furniture refinishing
Art/painting supplies
Jewelry and pottery making
Stained glass making
Lead soldering (e.g., electronics)
Lead shot, bullets, and fishing sinkers
Brass/copper/bronze/lead/iron foundries
Power washing of pre-1978 home/bldg.
Scrap metal handling
Paint manufacture (non-residential paint)
Machining/grinding/melting lead alloys
Bronze polishing
Leaded glass manufacturing
Burning lead-painted wood

OTHER

IMPORTED COSMETICS - Kohl, Surma
FOLK REMEDIES - Albayalde, Alkohl, Ayurvedoc, Azarcon (also called Alarcon, Coral, luiga, maria luisa and rueda), Greta, Ba Bow Sen, Bali Goli, Cebagin, Cordyceps, Ghasard, Hai ge fen, Kandu, Kushta, Mai ge fen, Pay-loo-ah, Poying tan, X-yoo-Fa
FOOD ADDITIVES - Lozeena

ENVIRONMENTAL

Lead dust from deteriorating paint
Ceramics/pottery
Lead-crystal
Lead-soldered cans (imported)
Burning lead-painted wood
Use of water from lead pipes
Living near lead-related industries
Soil/dust near industries/smelters and heavily traveled roadways
Miniblinds
Candles with lead wicks
Some imported painted toys

Michigan Department of Community Health
MDCH

TESTING TIPS

- **"TESTING"** requires a **blood** specimen.
- "**SCREENING"** (asking exposure-related questions) is appropriate **only** when a child is **NOT** in the **Medicaid** program and does **NOT** live in a **high-risk ZIP** code.

- There is **NO** requirement that the initial blood test for a child be a venous specimen. A capillary specimen is acceptable.
- If the capillary result is below the CDC "level of concern" (9mcg/dL or less), no other procedure is necessary until the next recommended testing time.
- If elevated ($\geq$ 10) then confirmatory sample should be obtained. This need not be done in the primary care provider's office.
- If the capillary (or venous) specimen is collected in the provider's office and packaged for mailing, CLIA certification in the office is NOT required.
- Specimens may be sent through the U.S. Post Office.

DIAGNOSTIC TESTING

NO level of lead in the blood is "normal".
Diagnostic testing is required for capillary BLL's $\geq$ 10 μg/dL.

If the screening test is:	obtain a venous test within:
10-19 μg/dL	3 months
20-44 μg/dL	1 month – 1 week*
45-59 μg/dL	48 hours
60-69 μg/dL	24 hours
$\geq$70 μg/dL	Immediately as an emergency test

***The higher the BLL, the more urgent the need for a diagnostic test.**

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PHYSICIAN **AND** ***HEALTH DEPARTMENT*** **FOLLOW-UP ACCORDING TO DIAGNOSTIC BLOOD LEAD LEVEL**

(μg/dL	ACTION
<10	Reassess and test again (if needed) in 1 year. Provide anticipatory guidance (at appropriate language and reading level) to eliminate exposure sources.
10-14	Confirm test results with a venous blood lead level (BLL). Provide lead poisoning prevention pamphlets and anticipatory guidance to prevent further exposure to lead. Venous BLL again in 3 months.
15-19	Confirm test results with a venous blood lead level (BLL). Refer to local PH for family nursing visits for lead assessment & education. (Time frame determined by local resources, suggested within 2 weeks). Provide or refer for follow-up venous BLL in 3 months. Refer for social services as needed. If BLL's persist (i.e., 2 venous BLL's in this range at least 3 months apart), proceed according to actions for BLLs 20-44.
20-44	Confirm test results with a venous blood lead level (BLL). Physician to provide thorough physical assessment and clinical management and refer to local PH for coordination of care as soon as possible. Refer other children under age 6 and pregnant women who live or spend time at this residence for blood lead tests. Local PH staffs provide nursing and environmental investigations in the home within 5 working days of the referral. (Recommend joint visit if possible). **EBL Environmental Investigation:** **NOTE:** EBL investigations require a trained and certified Inspector/Risk Assessor. Refer for lead hazard control as needed.
45-69	Confirm test results with a venous blood level (BLL). Clinical management includes chelation therapy. Refer ASAP to local PH for nursing and environmental investigation, to be done within 48 hours of the referral. **Lead hazard control should be completed before the child returns to residence.****
≥70	Confirm test results with a venous blood lead level (BLL). Hospitalize child immediately and begin medical management, including chelation therapy. Refer immediately to local PH for nursing and environmental investigation (to be done within 24 hours of referral). **Lead hazard control should be completed before the child returns to residence.**

Continuing follow-up care is needed until the child has **two consecutive BLLs (at least three months apart) less than 10 μg/dL (MDCH).** At that time, the child may be discharged from care. Blood lead levels may remain high for extended periods of time, depending upon the length of time and severity of exposure. During this time, encourage family to continue the prescribed food plan.

THE CHILD (LESS THAN 6 YEARS OLD) WITH A VENOUS BLL ≥ 20 SHOULD RECEIVE A THROUGH EVALUATION BY HIS/HER PRIMARY CARE PROVIDER.

CLINICAL EVALUATION COMPONENTS ARE:

1. MEDICAL HISTORY

- Symptoms?
- Developmental history – Include mouthing activities and pica
- Previous BLL measurements?
- Family history of lead poisoning?

2. ENVIRONMENTAL HISTORY

- **Age, condition,** and ongoing **remodeling** or **repairing** of primary residence and other places where the child spends time (including secondary homes and day-care centers). Determine whether the **child may be exposed** to lead-based paint hazards at any or all of these places.
- Occupational and hobby histories of adults with whom the child spends time. Determine whether the child is being exposed to lead from an adult's workplace or hobby.
- Other local sources of potential lead exposure. (See "Sources List" on front).

3. NUTRITIONAL HISTORY

- Evaluate the child's daily diet and nutritional status using 24-hour recall.
- Evaluate the child's iron status using appropriate laboratory tests.
- Ask about the need for food stamps and WIC participation.

4. PHYSICAL EXAMINATION

- Pay particular attention to the neurologic examination and to the child's psychosocial and language development. This should be re-evaluated on a regular basis. Refer to Early On*. (Automatic referral for "Toxic Exposure").

*MDCH Advisory Committee recommendations included.
**Screening Young Children for Lead Poisoning, CDC, Nov. 1997

G:FergusonRe/Laminated Card/Providers Guideance-2
Revised April 2004

Certification

This **Hillman Power Company** 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. Editorial review was completed by the Cooperative Agreement partner.

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

Team Leader, Cooperative Agreement Team, Superfund and Program Assessment Branch, Division of Health Assessment and Consultation, ATSDR