# Health Consultation

PUBLIC COMMENT RELEASE

CONTINENTAL ALUMINUM EXPOSURE INVESTIGATION:
AIR MONITORING RESULTS

NEW HUDSON, OAKLAND COUNTY, MICHIGAN

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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# HEALTH CONSULTATION

**PUBLIC COMMENT RELEASE**

CONTINENTAL ALUMINUM EXPOSURE INVESTIGATION:
AIR MONITORING RESULTS

New Hudson, Oakland County, Michigan

Prepared by

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

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# Abbreviations and Acronyms

| | |
|---|---|
| µg | microgram |
| µm | micron (micrometer) |
| AEGL | Acute Exposure Guideline Level |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| CaREL | California Reference Exposure Level |
| CCAM | congenital cystic adenomatoid malformation |
| DNA | deoxyribonucleic acid |
| EI | exposure investigation |
| EMEG | Environmental Media Evaluation Guide |
| EPA | U.S. Environmental Protection Agency |
| ERPG | Emergency Response Planning Guideline |
| HCl | hydrochloric acid (hydrogen chloride) |
| HF | hydrofluoric acid (hydrogen fluoride) |
| MATES-II | Multiple Air Toxics Exposure Study II |
| MDCH | Michigan Department of Community Health |
| MDEQ | Michigan Department of Environmental Quality |
| $mg/m^3$ | milligrams per cubic meter |
| NAAQS | National Ambient Air Quality Standard |
| $ng/m^3$ | nanograms per cubic meter |
| $PM_{2.5}$ | particulate matter less than 2.5 microns diameter |
| $PM_{10}$ | particulate matter less than 10 microns diameter |
| ppb | parts per billion |
| ppm | parts per million |
| RfC | Reference Concentration |
| SPM | Single Point Monitor (acid monitor) |
| TEEL | Temporary Emergency Exposure Limit |
| TSP | Total Suspended Particulates |
| VOC | volatile organic compound |

# Summary

Continental Aluminum is an aluminum recycling smelter in Lyon Township, Oakland County, Michigan. In response to a petition for a public health assessment, the Michigan Department of Community Health (MDCH) conducted a three-month exposure investigation (EI) from March through May 2004, looking at chemicals in the air near the smelter. MDCH investigated the presence of acidic aerosols; concentrations of airborne metal particulates, elemental mercury, and volatile organic compounds (VOCs); and certain meteorological parameters to determine what chemicals were present at what concentrations and if Continental Aluminum could be considered a potential source. The results of the EI indicated the concentrations of chemicals in the air were below health-based comparison values. Assuming that the air samples were representative of current conditions, MDCH and the Agency for Toxic Substances and Disease Registry (ATSDR) conclude that there is no apparent current public health hazard.

# Purpose and Health Issues

The purpose of this document is to report and interpret the results obtained from an EI conducted by MDCH in response to a public health assessment petition regarding Continental Aluminum. Residents in Lyon Township, where the aluminum recycling smelter is located (Figure 1), believe that emissions from the plant have caused various adverse health effects. Specific complaints are discussed in the Community Health Concerns section of this document. MDCH sampled the air for the most likely contaminants to be found around secondary aluminum refineries (acidic aerosols, airborne metal particulates, and VOCs), as well as for mercury, to determine which chemicals were present and in what quantities. To determine if there was a scientifically plausible link between exposure and health effects, the agency then compared the findings to established comparison values and to the reported health effects,.

# Background

In February 2002, the federal Agency for Toxic Substances and Disease Registry (ATSDR) received a letter from two state environmental groups and the supervisor of Lyon Township, in southwest Oakland County, Michigan, petitioning for a public health assessment. The petitioners were concerned that air, water, and soil emissions from the Continental Aluminum plant in New Hudson, in the northern part of the township, were causing the adverse health effects claimed by area residents. ATSDR and MDCH, which conducts public health assessments for the federal agency at sites of environmental contamination in Michigan, conducted a site visit and reviewed stack test and available environmental data. In a public health consultation issued March 12, 2003, the agencies concluded that the health hazard posed by the plant's emissions was indeterminate. ("Indeterminate" means that a conclusion regarding the level of health hazard cannot be made because information critical to such a decision, such as extent of exposure, is lacking or insufficient.) The agencies recommended that an exposure investigation be conducted to better ascertain any current public health impact of emissions from Continental Aluminum (ATSDR 2003).

MDCH and ATSDR developed a protocol for the EI, involving residents, township officials, and plant representatives in the planning process, and released a document outlining the EI to the stakeholders in February 2004 (MDCH 2004a). Appendix A contains the protocol. The EI began March 1, 2004 and ended May 31, 2004 (92 days).

# Discussion

Environmental Sampling and Data

The Michigan Department of Environmental Quality (MDEQ), under an agreement with MDCH to provide technical support for the EI, set up two air-monitoring trailers in the parking lot of Dolsen Elementary School, about one-half mile north-northeast of Continental Aluminum, during the week of February 23, 2004. (MDCH received approval from the local school district, South Lyon Community Schools, before placement of the trailers.) One trailer contained a Single Point Monitor acid monitor (SPM), meteorological equipment, and high-volume sampling pumps. The second trailer housed two Tekran Model 2537A Ambient Mercury Vapour Analyzers (Tekran). (The EI protocol did not include air monitoring for mercury. The addition of this parameter had been tentative and only occurred shortly before the investigation began. Mercury emissions from other secondary aluminum smelters have been reported [EPA 1995a].) MDCH chose the Dolsen site for the trailers based on prevailing winds making the school predominantly downwind from Continental Aluminum. This site also presented an ideal scenario to determine rates of exposure of air emissions to children, considered a sensitive subgroup of the general human population.

Along with the stationary air monitoring, the investigation included grab sampling of ambient air when local residents or employees of area businesses reported odor events. MDCH convened a citizen advisory group, which discussed the logistics of who would conduct sampling and under what circumstances a sample would be taken. The advisory group agreed that township fire department personnel, a staff person from the county health department, and two local residents would attend to odor sampling events. The group also agreed upon locations of "control" air sampling sites to be paired with the sampling events (Figure 2). MDCH conducted the training of the samplers and provided them with resource folders. Appendix B contains the list of folder contents and samples of those contents (except for the laminated map, sample chain of custody form, and business card).

Table 1 shows which days yielded results for which parameters of the EI. Shaded rows indicate days that were evaluated in detail due to a parameter being noted that day. In all, 46 of the 92 days were evaluated in detail.

*Airborne Metal Particulates Data*

MDCH sampled airborne metal particulates (aluminum, barium, beryllium, cadmium, chromium, copper, lead, manganese, selenium, and zinc) every 6 days, adjusting the schedule as necessary for staff needs. MDCH chose this schedule so as not to always sample on the same day of the week. As well, MDEQ collects samples from its air monitoring stations throughout the state every 6 days and compares data collected during

the same 24-hour period between different stations. However, the particulate sampling at the EI trailer was not scheduled for the same days as the state-wide sampling. If longer-term sampling had occurred, MDCH would have adjusted the sampling schedule to coincide with that of MDEQ.

Tables 2a and 2b show the airborne metal particulates data by weight (micrograms [µg] per filter) and by concentration (milligrams per cubic meter [$mg/m^3$] of air), respectively. Note that, upon analysis, the blank filters taken for March 3 and April 26 contained aluminum, barium, chromium, cadmium, manganese, and zinc, upon analysis. (Blank filters were minimally exposed to the air. They were removed from their storage container, immediately enclosed in a resealable plastic bag, and placed in a shipping container.) The other results were not adjusted against this finding. It is likely that some of the metals found in the air samples were due to the presence of these metals in the filter substrate.

Table 2a shows the 24-hour average of each weather parameter measured on sampling days. (Air monitoring agencies use barometric pressure and temperature when determining total air volume that passes through a filter during sampling.) MDCH also recorded meteorological data by the hour and by the minute. Staff used these data when more detailed evaluation of other EI parameters was necessary. More discussion on the meteorological parameters recorded during the EI follows in the appropriate section below.

*Acid Monitor Data*

Tables 3a and 3b show when acidic aerosol detections occurred and the respective minute or hourly meteorological parameters associated with those detections. Technical difficulties occurred at the air-monitoring trailer at the beginning of the EI. Consequently, MDCH did not consider any recorded acidic aerosol values valid until March 15. Real-time acid monitoring values, checked when staff attended the trailer, appeared valid. MDCH staff, with assistance from the Oakland County Health Department, tested the monitor on March 10, to verify that the monitor was responding to the presence of acidic aerosols. The test involved holding an aqueous solution of sulfuric acid near the air intake tube for the SPM. The monitor readout changed from 0 parts per billion (ppb) to more than 100 ppb, indicating that the machine was responding.

Because Continental Aluminum's operating permit lists hydrochloric (HCl) and hydrofluoric (HF) acids as plant emissions, MDCH assumed that the acidic aerosols monitored in the EI would be one of those compounds. However, as discussed in the EI protocol, the SPM cannot differentiate between acids. The ChemCassette® tape, the "detector" component of the SPM, which changes color upon exposure to a mineral acid, simply reacts to a change of pH (measure of acidity) in the air. The user must "tell" the SPM, by means of a "key," what acid is being monitored. The machine does not verify the identity of the substance. For most of the EI, MDCH used the low-level HCl key to determine the presence of acidic aerosols. This key allowed for the longest sampling time (240 seconds) and the second-lowest detection level (30-1,200 ppb). The SPM's

sulfuric acid key has the lowest detection level (26-750 ppb) with a sampling time window of 120 seconds. (MDCH did not purchase that key.)

On the morning of May 17, MDCH changed keys in the SPM so that the machine was interpreting acidic concentrations as being HF aerosols. The sampling time window for the HF key was 30 seconds, with a detection limit of 0.6-9 parts per million (ppm), which equals 600-9,000 ppb. This detection limit significantly exceeded several of the comparison values for the chemical (Appendix A – Table 3). If the acidic aerosol detected was indeed HF, MDCH reasoned, being detected at the SPM's specified limits would indicate that odors should be present and at least transient adverse health effects would be expected. As indicated in Table 1, the acid monitor showed detections for 10 days after the HCl key was replaced with the HF key. However, there was only one odor complaint reported during that time. On the basis of this information, MDCH concluded that the acidic aerosols detected by the SPM likely were not HF. However, it cannot be determined from these data what compound or compounds triggered the detections in the SPM.

Not all detections by the SPM coincided with odor detections at the trailer (Table 1). Occasionally, field staff attending to the air-monitoring trailer reported detecting odors there. Some of the odors were associated with operations at Continental Aluminum; other odors were attributed to other sources. These odors are discussed further in the Confounders/Notes section below.

*Mercury Vapor Data*

The Tekran Model 2537A Mercury Vapour Analyzer provides continuous analysis of elemental mercury in air at sub-nanogram-per-cubic-meter ($ng/m^3$) levels. (A nanogram is 1 billionth of a gram or 1 millionth of a milligram.) The instrument samples air and traps mercury vapor into a cartridge containing an ultra-pure gold adsorbent. The trapped mercury is then desorbed and detected using atomic fluorescence spectrometry. A dual cartridge design allows alternate sampling and desorption, resulting in continuous measurements of the air stream. The instrument is able to produce a reading every 5 minutes (MDEQ 2004). Results for a specific sample are produced 10 minutes after the sample is taken. This includes 5 minutes for the collection and 5 minutes for the analysis to be completed (A. Robinson, MDEQ-Detroit District Air Quality Division, personal communication, 2004).

Due to technical difficulties and the time needed to calibrate the equipment, only data collected March 28 through May 31 (65 days) were considered valid. While two Tekrans were used within the mercury-monitoring trailer, one unit had operation difficulties and much of the data collected on that unit consequently was not used. Therefore, the average concentration calculated was from the operation of one of the Tekrans. The average mercury air concentration at the site was $3.6 \pm 1.2$ $ng/m^3$ (n = 17,908 samples). There were six days on which concentration spikes greater than 10 $ng/m^3$ were detected (see Table 4).

There is evidence that suggests that this site is being impacted by a source, as yet unidentified, that is emitting elemental mercury:

1. Researchers have found elemental mercury concentrations that are not impacted by industrial sources and considered "background" to be approximately 1.5 ng/m$^3$ (Keeler 2003, Malcolm et al. 2003, Bullock 2004).
2. Data collected in Michigan using the Tekran and a Lumex® 915+ Mercury Analyzer (a portable unit capable of detecting mercury vapors in the ng/m$^3$ range) demonstrated that levels of elemental mercury monitored upwind from a source ranged from 1-4 ng/m$^3$ whereas levels measured downwind from various sources ranged from 1-200 ng/m$^3$ (Taylor Morgan 2001, Taylor Morgan et al. 2003).
3. The MDEQ Air Quality Division is partnering with the University of Michigan Air Quality Laboratory on the "Michigan Mercury Monitoring Network." There are six sites in this network where mercury is being analyzed in precipitation. Two of these sites, in Dexter (Washtenaw County) and Detroit, are collecting speciated mercury measurements, including elemental mercury. (Dexter is considered an upwind site for Detroit.) Comparison of the data collected at these two sites during the same time period when the Continental Aluminum EI was conducted indicated that the mean value for elemental mercury was lower at the network sites than in New Hudson: for January through June 2004, the network data showed an average of 2.4 ± 1.4 ng/m$^3$ at Detroit (n = 1,428 readings) and 1.5 ± 0.7 ng/m$^3$ at Dexter (n = 1,343 readings) (Keeler et al. 2004).
4. In 2001-2002, the MDEQ conducted an ambient air toxics monitoring study at seven sites in the Detroit area. Two of these sites were monitored for mercury concentrations, the averages at these sites being 1.9 ng/m$^3$ and 2.4 ng/m$^3$ (A. Robinson, MDEQ-Detroit District Air Quality Division, personal communication, 2004).

Therefore, the average value of 3.6 ± 1.2 ng/m$^3$ reported for the Continental Aluminum EI as well as the numerous spikes in elemental mercury concentrations suggest that the area is being impacted. The identity of the source cannot be determined from these data, however, and may not be Continental Aluminum. MDCH has referred this matter to MDEQ for follow-up.

*Odor Complaint Data*

There were 18 days for which odors were reported during the EI (Table 5). Of those 18 days, nine resulted in sampling events. On two other occasions, samplers went to the odor event site but did not detect an odor and therefore did not sample. The remaining odor complaint reports did not include notification of samplers.

The odors were most often described as "metallic" and "burning wire" or "hot wire". Odor intensity ranged from "just detectable" to "can't smell anything else." The range of descriptor and intensity parameters recorded during the EI was similar to odors reported before and after the investigation. Usually, a person would use the same descriptor and intensity score in subsequent odor complaints. (To protect the identities of complainants, these data are not shown.)

Comparing when (minute) and where the odor was detected and wind direction to the location of Continental Aluminum from the odor usually indicated a potential connection. (It is difficult to compare the hourly average wind direction provided for the last three complaints, as winds can shift substantially over time.) The aluminum smelter cannot be eliminated as a potential source of the odors.

Some complaints, received before the EI, reported that odors were at their worst on "still, heavy" days (days with low wind speeds and high relative humidity). It is difficult to determine from the data in Table 5 if this is necessarily the case. Most of the odor intensity scores were "2" ("can't smell anything else"), regardless of meteorological parameters. The olfactory organ is the most sensitive system in the body. There are many factors, both subjective and objective, that determine the severity of and reaction to an odor event (Schiffman et al. 2000, Hirsch 2002). One person's sensitivity to odor stimuli may be affected by meteorological conditions, another person may perceive no difference when the weather changes.

*Odor Sampling Data*

Figure 3 shows where each of the odor event samples was taken. Figures 4-13 detail individual sampling events. Mileage from Continental Aluminum to each sample site is listed in each figure. Mileage from the plant to each control site (1-8) ranged from 0.34-1.0 mile.

Table 6a shows the list of analytes and their respective detection limits for which odor samples were tested. Not all analytes were detected in the samples. Therefore, only those chemicals detected in at least one sample are shown in Table 6b.

Several chemicals were detected in blank samples. The blanks were not opened in the field. It is unlikely they had leaky valves, otherwise the low detection levels for the TO-15 analytes would have resulted in more detections of more chemicals. The detections in the blanks may have been caused by canister artifacts, possibly due to the canisters reaching the limit of their shelf life (J. Swift, Eastern Research Group, personal communication, 2004). Although the EI protocol had indicated that canisters nearing the end of their shelf life would be replaced, Eastern Research Group later informed MDCH that the older canisters would perform just as well so long as the vacuum was holding. Pre-sampling vacuum testing indicated that all canisters maintained a vacuum during storage. On the basis of this information, MDCH chose not to exchange canisters and potentially miss a sampling opportunity. When the elapsed time between cleaning and being brought to atmospheric pressure was compared to the analytical results for each sampling event, "age" of canister did not seem to have an effect on a chemical's presence or concentration. Low-level laboratory techniques are sensitive and finding minimal amounts is not uncommon in analytical work. In addition, some TO-15 chemicals are common field blank or laboratory contaminants (e.g., acetone, methyl ethyl ketone, methylene chloride).

*Meteorological Data*

At 2 AM on April 4, Eastern Standard Time switched to Daylight Saving Time. The clocks on the air monitoring equipment did not make this change. Therefore, the meteorological parameters recorded after the switch have been adjusted to the appropriate time.

Technical difficulties occurred at the air monitoring trailer during the start-up of the EI. Minute data (data recorded every minute) for all parameters were not reliable until March 15. Hourly data were not available for barometric pressure and relative humidity until March 22. As necessary, MDCH used hourly data from the MDEQ meteorological station in Ypsilanti (about 20 miles south). These instances are noted in the various tables and figures.

Additionally, a power outage occurred May 9. Although the machines in the trailer came back on-line when power was restored and displayed real-time data, minute data on and after this date were unavailable. Hourly data were available only intermittently. Again, as necessary, MDCH used hourly data from the MDEQ Ypsilanti station. These instances are noted in the various tables and figures.

When wind speeds decrease below 3 mph, wind direction becomes less and less reliable (E. Hansen, MDEQ Air Monitoring Unit, personal communication, 2004). As necessary when using minute data, MDCH omitted wind direction when wind speed was 2 mph or less. These instances are noted in the various tables and figures.

The wind direction value indicates from which direction the wind is originating. When the weathervane crosses north, going clockwise, wind direction changes from 359° to 0°. (North is at 0°, or 360°.) As necessary when using minute data, MDCH subtracted 360° from a west-of-north wind direction, or added 360° to an east-of-north wind direction, to indicate when the weathervane crossed north. (Otherwise, it might be assumed that weathervane made a nearly-complete counterclockwise circle going from, for instance, 355° to 5°, when it actually only rotated clockwise 10°.) These instances are noted in the various tables and figures.

*Confounders/Notes*

"Confounders" are other activities that can cause data to be misrepresentative of an event of interest. Several potentially confounding events occurred during the EI. Some of these occurred on days when specific air monitoring parameters were recorded, others occurred on "non-parameter" days.

There was a fire in Green Oak Township in Livingston County, immediately west of Lyon Township, the night and early morning of March 5 and 6. The fire occurred about 8.5 miles southwest of Dolsen Elementary School. The site of the fire was far enough from the air-monitoring trailer to make it unlikely that any soot or ash from the fire affected the particulate sampling results for March 7.

On March 15, field staff noticed a burning-leaf odor while at the trailer. The staff person did not associate the smell with Continental Aluminum and did not notify a sampler. The length of time between this date and the particulate sampling on March 19 makes it unlikely that any ash from brush burning on March 15 affected the particulate sampling results.

The staff person at the trailer the morning of March 24 detected a faint odor associated with Continental Aluminum and notified a sampler. That person was unable to detect an odor upon arrival at the trailer, so they did not take a sample. However, later in the day, another person contacted the sampler regarding an odor event, which resulted in a sample being taken. The acid monitor also recorded detections of acidic aerosols this day, although later than the sampled odor event.

In the early evening on April 5, field staff noticed a burning paper/burning brush smell while at the trailer. The staff person did not associate the smell with Continental Aluminum and did not notify a sampler. The acid monitor detected acidic aerosols that day, but earlier in the afternoon, before staff arrived at the trailer.

On April 6, field staff noticed a hot wire or metal odor while at the trailer. The staff person chose not to notify a sampler, although she did associate the smell with Continental Aluminum. She filled out an odor surveillance form (odor complaint) for MDCH and the township files.

Upon arriving at the air-monitoring trailer the morning of April 13, field staff noticed a street sweeper machine cleaning the parking lot at the school. A particulate sample was to be taken this day. Staff were concerned that dust generated by the street sweeper would confound the sampling results, making them higher than otherwise would be expected. Instead, the weight and concentration of particulate matter collected were the second lowest values in their respective tables (Tables 2a and 2b).

On April 17 and 18, MDCH and MDEQ field staff witnessed the neighbor immediately to the north of the trailer location burning cardboard and scrap wood in his burn barrel. A particulate sample was collected, as scheduled, on April 18. It is likely that ash and soot generated by the burning near the trailer (about 30 feet away) confounded the sampling results, as the weight and concentration of particulate matter collected on April 18 were the highest values in their respective tables (Tables 2a and 2b). Although the 24-hour average wind direction during the sampling event was 163° (about south-southeast), wind direction fluctuated during this time (data not shown).

A fire occurred on South Hill Road, east of the air-monitoring trailer, on April 19. It is unlikely, however, that any ash or soot from the fire affected the particulate sampling. Several days had passed and prevailing winds were from the southwest.

As mentioned in the Meteorological Parameters section, a power outage occurred in the area on May 9.

On May 10 and 13, field staff noticed a sewer gas-like odor while attending to the trailer. The odor apparently was emanating from grates located about 50 feet south of the trailer, between the parking lot and the playground. According to the school district's director of operations, these grates cover the pumps that are part of the school's septic system (M. Casey, South Lyon Community Schools, personal communication, 2004). Septic systems may generate stronger odors following rain events. Field staff recalled that it had rained in the area around the dates that these odors were noticed. The staff person remembered the air feeling humid those days, which could also cause odors not to dissipate and to be more noticeable. It is possible that the combination of the septic odors (which are commonly caused by hydrogen sulfide) and the high humidity caused hydrogen sulfate (sulfuric acid) concentrations in the air to increase (ATSDR 1999). This chemical change could have caused the acid monitor to detect the acidic aerosols that were recorded on those days.

A nearby resident mowed his lawn on May 17. The particulate sampling portion of the EI already had been completed, so the activity could not have confounded results for that test. It is unlikely that the engine exhaust contained acidic aerosols that would have been detected by the acid monitor.

Also on May 17, MDCH switched keys in the acid monitor, as discussed in the Acid Monitor Data section.

Comparison of Results to Comparison Values

*Airborne Metal Particulates*

Table 2b lists the concentrations of metals detected in collected air samples. The EI Protocol (see Appendix A - Table 3) shows the lowest comparison value for each metal measured. When the detected concentrations and comparison values are compared, it is apparent that the analytical results are all below the respective screening levels, in some cases by several orders of magnitude. (An "order of magnitude" is a multiple of 10. For example, "three orders of magnitude" equals 10 x 10 x 10 or 1,000.)

The chemical that came closest to its respective lowest comparison value was chromium. Most of the detections for chromium should be considered estimates. They fell between the limit of detection (when the machine recognizes a chemical and differentiates it from background "noise") and the limit of quantitation (when a machine can reliably determine the amount of the chemical, usually up to five times the detection limit). However, the March 19 chromium concentration approached, though was still less than, the Reference Concentration (RfC) for that metal.

Chromium exists in several valence (physical-chemical) states. The most commonly seen valences are (0), (III), and (VI). Chromium (0), or elemental, is the pure form of the metal. Chromium (III), or trivalent, is an essential micronutrient. Chromium (VI), or hexavalent, is a human carcinogen.

Analytical data are not available to indicate what portion of the chromium detected in the sample is the hexavalent form (P. Pope, DataChem Laboratories Inc., personal

communication, 2004). The California Environmental Protection Agency (CalEPA) conducted a comprehensive air-monitoring program called the Multiple Air Toxics Exposure Study (MATES-II). In that study, the agency collected air samples from 10 stationary sites in California for 1 year and 14 temporary sites for 1 month each. Study results showed that total chromium concentrations consisted of 3.7% chromium (VI) (South Coast AQMD 2000). In Michigan, MDEQ conducted an ambient air toxics monitoring study at seven sites in the Detroit area in 2001-2002. The data included analysis of total chromium and hexavalent chromium at four sites. Analytical results indicated that only 1%-2.4% of total chromium was in the hexavalent form (R. Sills, MDEQ Air Quality Division, personal communication, 2004). Judging from the MATES-II and MDEQ's findings, the chromium in the particulate samples taken at Dolsen Elementary School was probably a mixture of valences. In that mixture, the chromium (VI) concentration probably made up less than 10-15% of total chromium. To be protective, MDCH used the comparison values for chromium (VI). MDCH does not expect there to be an increased risk of adverse health effects (cancer or non-cancer) due to exposure to the concentrations of airborne metal particulates found in the EI.

*Acid Monitor Data*

As discussed earlier in this document and in the EI protocol document, MDCH could not verify the identity of the compound or compounds that triggered the detections on the SPM. The acid monitor can be set up to read for six mineral acids: HCl, HF, sulfuric acid, nitric acid, hydrogen iodide, or hydrogen bromide. Of these, HCl and HF are common emissions from secondary aluminum smelters (EPA 1986, 1995). As concluded earlier in this document, it is unlikely that the acidic aerosol was HF. For this discussion, MDCH is assuming that the acidic aerosol detected by the SPM up to the morning of May 17 was HCl.

Tables 3a and 3b show minute and hourly-average data, respectively, for the assumed-HCl concentrations and meteorological parameters. The maximum assumed-HCl concentration detected exceeded only the RfC for HCl. However, the RfC addresses 24-hour (continuous) exposure. The detections of acidic aerosols at the air-monitoring trailer at Dolsen Elementary School were not continuous. The shortest event during the EI lasted 8 minutes and the longest lasted almost 34 hours. (MDCH considered an acidic-aerosol detection a new event if at least 60 minutes had elapsed since the last detection.) The intermittent nature of these events indicates that exposure to acidic aerosols in the area near Continental Aluminum is sporadic. It is more appropriate to compare the detection results to short-term, or acute, comparison values, such as the California Reference Exposure Level (CaREL) and the Acute Exposure Guideline Levels (AEGLs). The CaREL for HCl is 290 ppb, over a 1-hour averaging time (averaging all readings taken within 1 hour) (CalEPA 1999a). The maximum assumed-HCl minute concentration in Table 3a was 46 ppb. It is likely that the highest 1-hour average of the assumed-HCl concentrations would be less than 46 ppb, which is less than one-fifth the CaREL for HCl. The maximum assumed-HCl hourly concentration in Table 3b was 37 ppb, also well below the CaREL for HCl. MDCH does not expect adverse health effects to occur as a result of exposure to assumed-HCl concentrations recorded during the EI.

*Mercury Vapor Data*

The inhalation comparison values for mercury vapor are:

| | |
|---|---|
| CaREL | 1.8 µg/m$^3$ (1,800 ng/m$^3$) (CalEPA 1999b) |
| AEGLs | none reported |
| ERPG/TEEL | Level 0 = 0.025 mg/m$^3$ (25,000 ng/m$^3$) |
| | Level 1 = 0.1 mg/m$^3$ (100,000 ng/m$^3$) |
| | Level 2 = 2.05 mg/m$^3$ (2,050,000 ng/m$^3$) |
| | Level 3 = 4.10 mg/m$^3$ (4,100,000 ng/m$^3$) (DOE 2004) |
| EMEG | Chronic = 0.2 µg/m$^3$ (200 ng/m$^3$) |
| | (no acute or intermediate EMEGs) (ATSDR 2004a) |
| RfC | 0.3 µg/m$^3$ (300 ng/m$^3$) (EPA 1995b) |

ERPG = Emergency Response Planning Guideline.
TEEL = Temporary Emergency Exposure Limit.
EMEG = Environmental Media Evaluation Guide.
Definitions for comparison values are in the EI protocol (Appendix A).

The highest concentration detected by the Tekran analyzer was 511 ng/m$^3$, which exceeded the RfC and chronic EMEG but only in one 5-minute sample. As discussed earlier, the RfC for a chemical addresses 24-hour, lifetime exposure. The chronic EMEG addresses an exposure duration longer than one year. Note that the wind direction at the time of this peak sample, and during the second highest recording measured 20 minutes later, was from the northeast, eliminating Continental Aluminum as a potential source for those two samples.

Elemental mercury vapor, such as that detected by the Tekran, tends to travel greater distances than does particulate mercury. When investigating a potential local source, a second upwind analyzer would provide information on whether detected mercury originated locally or at a distant source (J. Taylor-Morgan, MDEQ Air Quality Division, personal communication, 2004). The second Tekran analyzer was not working properly to deploy it to an upwind site for comparison. Therefore, it is unknown if the mercury detected during the EI was from a local or a distant source. MDCH has referred this matter to MDEQ.

Mercury has no odor. Therefore, any odors detected during the times when the Tekran reported above-normal concentrations were not due to elemental mercury.

Elevated detections of elemental mercury during the Continental Aluminum EI demonstrate that the area is being impacted by a source of elemental mercury. However, the concentrations detected do not pose a health risk through exposure by inhalation. The average concentration detected (3.6 ng/m$^3$) is more than 50 times below ATSDR's comparison value (200 ng/m$^3$).

*Odor Sampling Data*

All of the detected chemicals sampled during odor events fell well below their respective comparison values (Table 6b). The only chemicals that came to within an order of

magnitude (one-tenth) of their respective lowest comparison values were 1,3-butadiene, at about one-sixth its RfC, and benzene, not quite one-half its intermediate EMEG. The maximum concentration of 1,3-butadiene detected (0.15 ppb) was from a control sample. The rest of the detections for this chemical occurred only at odor event sampling sites. 1,3-Butadiene is found in petroleum products and engine exhausts and is used in making plastics. The maximum concentration of benzene (1.67 ppb) occurred at an odor event sampling site. Benzene was found in all field samples (control as well as odor samples) and two blank samples. Benzene commonly is found in gasoline and exhaust fumes and is used in the manufacture of rubber and lubricants. While it is possible that the scrap being processed by Continental Aluminum, despite being inspected for impurities, included plastics, rubber, or solvents that contained 1,3-butadiene or benzene, it is also possible that the detections of these chemicals were due to nearby vehicular traffic.

The only chemical to exceed its odor threshold was toluene, with an odor threshold of 0.27 ppb and a maximum detected concentration of 1.81 ppb. The odor of toluene, a common solvent, is described as "sweet, pungent, benzene-like" (HSDB 2004). (Benzene causes the odor one smells in gasoline.) Toluene is present in paints, lacquers, rubber, and automobile exhaust. While it is possible that the scrap being processed by Continental Aluminum contained rubber (any solvent in paints or lacquers would have evaporated when the paint dried on the new product), it is also possible that the detections of toluene were due to nearby vehicular traffic.

Note that none of the odor descriptions for the chemicals tested for in the odor-sampling portion of the EI (Appendix A – Table 1) matched the most common descriptors for odor events that were sampled: "metallic" or "burning wire" (Table 5). This might lead to the argument that the compounds causing the odors were not tested for in the EI. A metallic odor is to be expected near an operating smelter. Ten metals, including aluminum, were tested for in the airborne-particulate testing. MDCH tested for VOCs during odor events because of the possibility of paint or solvents adhered to scrap entering the furnace, being volatilized, and entering ambient air as odors. As well, historic odor complaints included "chemical," "plastic," and "paint" as descriptors (Appendix C), suggesting VOCs might have been present.

Because the detected VOCs fell well below their respective comparison values, it is unlikely that these concentrations would cause adverse health effects following acute (short-term) or chronic (long-term) exposure.

Plausibility of Link to Reported Health Effects

Most health complaints reported by residents of Lyon Township were of a respiratory nature. The ATSDR *Toxicological Profile for Aluminum* (1999) discusses lung effects in workers exposed to fine aluminum dust or to alumina (aluminum hydroxide). These effects, also seen in research animals, are suggestive of dust overload. Dust overload occurs when the volume of dust in the lungs markedly impairs pulmonary clearance mechanisms. This condition is not dependent on the toxicity of the compound. Dust overloading has been shown to modify both the dosimetry (what actual dose is delivered) and toxicological effects of the compound. When excessive amounts of widely

considered benign dusts are persistently retained in the lungs, the resultant lung effects are similar to those observed following exposure to highly toxic dusts. It is unclear whether the observed respiratory effects might be related to aluminum toxicity or dust overload. It should be noted that complainants in Lyon Township have reported odors, smoke, and noise, but not excess dust in the air.

Particulate matter, or PM, is one of the criteria pollutants listed in the Clean Air Act and its Amendments for which EPA has listed National Ambient Air Quality Standards (NAAQS). Beginning in 1987, EPA restricted the standard from Total Suspended Particulates (TSP) to the mass concentration of inhalable particles less than or equal to 10 microns (micrometers), 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). The current NAAQS 24-hour value for $PM_{10}$ is 150 $\mu g/m^3$ and for $PM_{2.5}$ is 65 $\mu g/m^3$. All of the values for $PM_{10}$ in Table 2b are below both criteria. (One milligram [mg] equals 1,000 micrograms [µg].) Although the health effects described by Bascom et al. (1996) have been reported by some Lyon Township residents, adverse health effects related to particle burden toxicity would not be expected following exposure to the levels of $PM_{10}$ found during the EI.

The individual chemical data collected during the EI indicated that the chemicals investigated did not exceed their respective comparison values outlined in the EI protocol. 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 (additive effect) 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). The concentrations of the detected chemicals were, for the most part, more than one order of magnitude lower than their respective lowest comparison values. Current exposure-based assessment of joint toxic action of chemical mixtures (ATSDR 2002) suggests that the mixtures presented in the EI data would not be expected to cause adverse health effects.

Schiffman et al. (2000) discuss three paradigms, or examples, in which ambient odors may produce health symptoms in a community. Any or all of these paradigms might be occurring in Lyon Township. In the first paradigm, an odor-producing chemical (or mixture) occurs at a level that also causes irritation or other effects. Therefore, it is the irritation, not the odor itself, causing the effects, with the odor serving as an exposure marker. The irritation generally occurs at a concentration three to 10 times higher than when the odor is first detectable (the odor threshold). Although the concentration of each individual compound identified in the odorous air may not exceed the concentration known to cause irritation, the combined load of the complex mixture can exceed the irritation threshold. As already discussed, the concentrations of the chemicals detected in the air samples from the EI are all below their respective lowest comparison values. It cannot be said with certainty that the combination of these chemicals may be causing health effects, especially since the data do not identify or quantify the same chemicals consistently.

In the second paradigm, health symptoms appear at concentrations that would not be expected to be irritating. Concentrations exceed the odor threshold but fall well below irritant thresholds. Sulfur gases and organic amines can cause such scenarios. Symptoms can include nausea, vomiting, and headaches. The mechanism by which these symptoms are induced, when the potency of the odor far exceeds the potency of its irritancy, is not well understood. The degree of unpleasantness of the odor, the exposure history (previous experience with the odor), doubts about whether or not the odor is safe, and emotional status may play a role in inducing health symptoms. Noxious odors that are neither irritating nor toxic can set up a series of events, such as stress or nutritional problems (from failure to eat if one is feeling nauseous), that can lead to health effects. In Lyon Township, historic odor complaints and anecdotal evidence indicate that experiencing these odors is stressful to many residents. This stress can exacerbate or cause symptoms when people are exposed to the odors.

The third paradigm occurs when the odor-causing chemical is part of a mixture that contains a co-pollutant that is responsible for the reported health effects. Similar to the first example, the odor serves as an exposure marker, however a different chemical or air contaminant (such as dust or an allergen) is causing the effects. The body may become physically conditioned to reacting to the odor, regardless of whether the actual irritant is present in the future. It is difficult to determine if this might be the case in Lyon Township because emotional reaction to the odor, as discussed in the second paradigm, is likely also a factor in how a person reacts to an odor.

Specific concerns voiced by the community are addressed in the Community Health Concerns section.

Adequacy of Environmental Data

Anecdotal evidence from the community reports that the odors associated with Continental Aluminum were much worse when the plant first started operating in 1998. Several complainants reported that children playing outside were ushered indoors during odor events. MDCH reviewed odor complaints submitted to MDEQ and to Lyon

Township from 1998 to 2002 (Appendix C). Complaints have diminished over time, but it is unknown whether this reflects a decline in the number of odor events or community members losing interest or becoming apathetic ("burn-out"). It is unknown whether emissions from the plant were higher when it first started operating because air data for that time are unavailable. (Stack-testing at the plant addresses only emissions going through the furnace stacks or the pollution control equipment and not potential fugitive emissions.) However, as discussed in the next paragraph, additional environmental sampling would not likely provide this information with any degree of certainty.

Air samples provide a "snapshot" of conditions happening at a specific time. The samples may or may not be representative of long-term conditions. Extrapolation of air data may not be appropriate for historic exposure assessment. Soil samples might provide information helpful in determining potential sources in non-attainment situations regarding particulate matter (PM). However, it would be difficult, if not impossible, to determine the degree of exposure during past odor events, when people reported health effects (acute events), from soil data. Models for this type of exposure assessment have yet to be developed and validated. Additionally, other components of the air emissions expected from aluminum recycling smelters, such as VOCs and acidic aerosols, would be more likely to undergo chemical reactions while still airborne and might not even deposit locally. Thus, this type of exposure assessment would contain a high degree of uncertainty due to lack of site-specific data. It would not be prudent to attempt to use soil data to estimate past exposure to acute events or chronic exposure.

Several community members have expressed interest in knowing "everything" that is in the air around Continental Aluminum. MDCH and ATSDR limited the chemicals investigated in the EI to those expected to be emitted from secondary aluminum smelters (EPA 1986, 1995). The EI further focused on those chemicals that could cause the reactions noted historically by odor complainants, and those of particular concern to the petitioners. If these "sentinel" chemicals were problematic, then further detailed analyses of the air might be warranted. However, the data indicated that the chemicals did not exceed health-based standards. Therefore, at this time, it is not necessary to investigate the presence of other chemical classes.

ATSDR Child 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 found 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 to toxicants in soil, water, or air than adults can.

Children residing in Lyon Township may live upwind or downwind from Continental Aluminum. They likely have varying rates of exposure to airborne chemicals dependent on their location relative to the source and meteorological conditions. Children attending Dolsen Elementary School, which is about 1/2 mile north-northeast of the plant, would be exposed to airborne chemicals emitted by Continental Aluminum when prevailing winds blow from the southwest. The comparison values used in this EI are based on the most sensitive toxic endpoints determined by laboratory or epidemiological studies. As discussed previously, concentrations of the chemicals investigated in the EI fell well below their respective comparison values. It is not likely that children's health was adversely affected as a result of exposure to airborne chemicals tested for in the EI.

Deposition of airborne chemicals to the earth can lead to exposure via skin contact and ingestion. Continental Aluminum has been in operation in Lyon Township for almost 7 years. This relatively short time span should not have resulted in significant deposition. In 2001, two private citizens had the soil in their respective yards analyzed for various metals and anions (Table 7). The samples were taken 3 years after the plant began operations in the area. No earlier soil data are available for these addresses. These residences are predominantly downwind of Continental Aluminum and closer to the plant than is Dolsen Elementary School. While concentrations of a few metals exceeded the default value for Michigan background (an average value for unimpacted soil), overall results were less than the MDEQ Part 201 Generic Clean-up Criteria for residential soils (MDEQ 2002) and the ATSDR chronic EMEG for children (ATSDR 2004b). It is not likely that concentrations of chemicals associated with emissions from Continental Aluminum in the soil at Dolsen Elementary School, or in the area around the smelter, are at levels that should warrant concern regarding skin contact and ingestion.

# Community Health Concerns

General Health Complaints

Residents of Lyon Township, and people who work there, have reported many and diverse health effects that they associate with exposure to emissions from Continental Aluminum. (This information was self-reported. MDCH did not conduct a health survey.) These effects include: irritation of mucous membranes (eyes, nose, throat), nosebleeds, breathing difficulties, asthma attacks, sinus infections, headaches, migraines, and nausea. The township building inspector suffered corneal abrasions when he was investigating a report of smoke and odor coming from the plant. These health effects can occur as a result of exposure to airborne irritants, such as acidic aerosols, or odors. According to the samplers and the citizen who notified them, the May 18 odor event was the strongest odor experienced during the EI and was reminiscent of historical odor events. The analytical data reported for this odor event showed that concentrations of chemicals of interest were below health-based comparison values. Nonetheless, as discussed earlier, health effects from irritating odors could occur below acute and chronic health criteria.

Asthma Incidence

At the request of a Lyon Township resident, an asthma epidemiologist at MDCH reviewed the incidence of asthma hospitalizations, using the primary discharge diagnosis code, for the years 1990 through 2001 for Oakland County (MDCH 2003). Although inpatient hospitalization and mortality represent the most severe consequences of asthma, MDCH routinely uses this information to explore the impact asthma has on communities. New diagnoses cannot be determined from these data. The epidemiologist condensed the data for zip code area 48165 (New Hudson) into three equal periods (1990-1993, 1994-1997, and 1998-2001), due to the small number of events. The asthma hospitalization rate per 10,000 people for these time periods in the area were 3.6, 3.1, and 2.3, respectively. The downward trend was not statistically significant. In 2000, the asthma hospitalization rate for New Hudson, South Lyon (zip code 48178), and Milford (zip codes 48380 and 48381) combined was 7.46 per 10,000, according to a database compiled by Wayne State University. As a comparison, for that same year, the asthma hospitalization rates for Oakland County and the state of Michigan were 11.8 and 15.8 per 10,000, respectively.

Aluminum Levels in Blood

One set of parents concerned about allegations regarding Continental Aluminum's emissions had the blood aluminum level checked in their elementary school-age child. Although they live in the prevailing upwind direction from the plant, the child would be attending Dolsen Elementary School and the parents wanted to establish a baseline to which they could compare future levels. Test results indicated that the child had levels of aluminum in his blood above the laboratory-reported reference levels (data not shown). (The *Merck Manual*, 17th Edition [1999], reports normal adult serum aluminum levels as 3-10 micrograms per liter.) The child was *not* showing symptoms associated with aluminum toxicosis (neurologic, bone, or lung effects). The parents consulted with the Michigan Poison Control Center regarding potential household sources of aluminum (private well water, antacids, soda cans, some cookware), but no likely source could be found. The parents plan to have the child tested annually.

Another set of parents also had their children tested for blood aluminum levels. The family moved to the area about 15 years ago and lives a couple of miles east of the plant. One child currently attends Dolsen Elementary School and the other finished attending the school last year. Both children's results were above the laboratory-provided reference range. Neither child was symptomatic. The parents and the pediatrician's office contacted MDCH for guidance on what the levels meant and what actions might be necessary. In response, MDCH researched the subject and compiled information into factsheets for both the public and healthcare providers. (These factsheets have been posted on the MDCH website at http://www.michigan.gov/mdch-toxics, under the "Health assessments and related documents" link for Continental Aluminum.) MDCH is advising that people not have their blood analyzed for aluminum since exposure is common. (Aluminum is present in many foods, over-the-counter medicines, and hygiene products.) People concerned about exposure should be aware that the majority of aluminum intake is not absorbed, that which is absorbed being excreted by the kidneys. The primary population of concern, then, is those persons with kidney disorders, such as

dialysis patients. MDCH conferred further with the ATSDR Division of Toxicology, the ATSDR Regional Office, the Pediatric Environmental Health Specialty Unit at Chicago's Cook Hospital, and the Michigan Poison Control Center to determine acceptable reference ranges for aluminum in serum or urine (there is little consensus between laboratories). As a result of these discussions, MDCH updated the factsheets, providing the information to stakeholders and posting it on the agency's website.

Mutagenicity or Tumorgenicity

Other persons have expressed concerns that emissions from Continental Aluminum could have mutagenic (changing DNA) or tumorigenic (causing benign or malignant tumors) effects. In one family, both children were diagnosed with noncancerous tumors defined as "aneurismal bone cysts." The children were born before the family moved to Lyon Township but were diagnosed after they had lived in the area for 4 years. (They had moved to the township before Continental Aluminum started production there, and diagnoses occurred after the plant had been in operation for at least 1 year.) The family lives in the predominant upwind direction from Continental Aluminum. According to the medical literature, it is not unusual for these cysts to occur randomly, but it is unusual for the cysts to occur in related individuals. The parents report that there is no genetic basis for both children to have these tumors. One child has developed asthma and recently has been diagnosed with Crohn's disease. The results of the EI air testing show no exceedances of comparison values of the detected chemicals. Given this information and the lack of data regarding etiology of aneurismal bone cysts, MDCH cannot conclude that there is any link between the diagnoses and emissions from Continental Aluminum.

In another family, living in the area since 1996 and residing predominantly upwind of Continental Aluminum, the mother exercised daily during her pregnancy by walking along the bike trail (a former railroad) that goes through the community and behind the plant (Figure 1). She claims that on occasion she would smell odors emanating from the plant. She recalls one day when the odor was particularly strong, for which MDEQ subsequently cited Continental Aluminum. (Continental Aluminum received a Letter of Violation from MDEQ on December 8, 1999 in response to strong odors verified December 3, 1999 [see Significant Date Chronology in ATSDR 2003]). The woman remembers suddenly feeling ill during her walk on that particular day. Following several prenatal tests, doctors diagnosed the unborn child with a "level 3 CCAM," a congenital cystic adenomatoid malformation of the left lung. The woman brought the pregnancy to term. Doctors removed the infant's lung several days after birth. The child has had several surgeries since. Similar to the discussion regarding the bone cysts, MDCH cannot conclude that there is a link between maternal exposure to the emissions of Continental Aluminum and mutagenic or teratogenic (birth deformities) effects.

Another woman contacted MDCH and asked whether her husband's brain tumor could be a result of exposure to emissions from Continental Aluminum. The couple lives outside of the township but has operated a business just south of the plant for more than 20 years. Although predominantly upwind, their business could be affected by fugitive emissions or wind eddies from the plant due to its proximity. The husband was diagnosed with the tumor about 2 or 3 years after Continental Aluminum began operations in the township.

It cannot be determined from the EI data whether the tumor could have been caused by something in the air.

Noise

Members of the community also had been concerned about noise, especially at night, coming from Continental Aluminum. In February 2004, the company added mufflers to the baghouse stacks in an attempt to reduce noise and vibration generated by the pollution control equipment. Anecdotal evidence indicates that this step has improved the situation for most residents. Due to the nature of operations at the plant, there continue to be occasional loud sounds, such as metal hoppers being moved about and semi trucks entering and leaving the premises. In the 1978 report *Noise: A Health Problem*, EPA's Office of Noise Abatement and Control concluded that unwanted noise can be more than just an annoyance. Noise can contribute to stress, interfere with learning, and pose a public health hazard (EPA 1978). (The Office of Noise Abatement and Control lost its funding in 1982 and has yet to be reestablished [ HR4308 1996]). While MDCH and MDEQ have no authority to regulate noise issues, it is addressed here because, as a stressor, noise might be contributing to the health effects reported by some residents of Lyon Township.

# Conclusions

MDCH and ATSDR conclude that the concentrations of chemicals detected in the air during the exposure investigation in Lyon Township posed no apparent health hazard by inhalation. Exposure is occurring but not at levels at which adverse health effects could be expected. Assuming that air samples taken March 1 through May 31, 2004 were representative of average conditions in the township, **air concentrations of the detected chemicals pose no apparent current public health hazard.**

As discussed earlier in this document, further environmental sampling likely will *not* help determine the hazards of past exposures. Soil data from 2001, three years after Continental Aluminum began operations in Lyon Township, indicated that soil concentrations did not exceed health-based comparison values and suggested that emissions from Continental Aluminum were not depositing significantly to area soils.

Because the air data from the EI do not indicate that there are significant emissions and the soil data from 2001 do not show an impact from deposition, there is no scientific evidence supporting further study of this site.

# Recommendations

None at this time.

Public Health Action Plan

►MDCH and ATSDR will provide a brief summary of this report to Lyon Township residents, which they can provide to their private physicians when seeking medical care relating to respiratory complaints.

►MDEQ will investigate further mercury concentrations in the area around Continental Aluminum and provide regulatory guidance, as needed, to suspected sources.

If any citizen has additional information or health concerns regarding this health consultation, please contact the Michigan Department of Community Health, Environmental and Occupational Epidemiology Division, at 1-800-648-6942.

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**Table 1. MDCH Exposure Investigation Results Matrix for Air Parameters near Continental Aluminum, Lyon Township, Oakland County, March 1 - May 31, 2004. (See text for discussion.)**

| Month | Day | PM[A] Filter Taken | Acid Monitor Detections | Mercury Peaks | Odor Complaint(s) | Odor Sampled | Met. Station Used[B] | Confounders/Notes |
|---|---|---|---|---|---|---|---|---|
| March | 1 | | | | | | | |
| March | 2 | X | | | | | Both | |
| March | 3 | | | | | | | |
| March | 4 | | | | | | | |
| March | 5 | | | | | | | Green Oak Twp fire |
| March | 6 | | | | | | | Green Oak Twp fire |
| March | 7 | X | | | | | Both | |
| March | 8 | | | | | | | |
| March | 9 | | | | | | | |
| March | 10 | | | | | | | |
| March | 11 | | | | | | | |
| March | 12 | | | | | | | |
| March | 13 | | | | | | | |
| March | 14 | X | | | | | Both | |
| March | 15 | | | | | | | burning leaf odor at trailer |
| March | 16 | | | | X | X | Both | |
| March | 17 | | | | | | | |
| March | 18 | | | | | | | |
| March | 19 | X | | | | | Both | |
| March | 20 | | | | | | | |
| March | 21 | | | | | | | |
| March | 22 | | | | | | | |
| March | 23 | | | | X | | Local | |
| March | 24 | | X | | X (2) | X | Local | faint odor at trailer |
| March | 25 | X | X | | | | Local | |
| March | 26 | | X | | | | Local | |
| March | 27 | | X | | | | Local | |
| March | 28 | | | | | | | |
| March | 29 | | | | | | | |
| March | 30 | | | X | | | Local | |
| March | 31 | X | | | X | X | Local | |
| April | 1 | | | | | | | |
| April | 2 | | | | X (2) | X (2) | Local | |
| April | 3 | | | | | | | |
| April | 4 | | | | | | | |
| April | 5 | | X | | | | Local | burning paper/brush odor |
| April | 6 | X | | | X | | Local | hot wire/metal odor at trailer |
| April | 7 | | | | | | | |
| April | 8 | | | | | | | |
| April | 9 | | | | | | | |
| April | 10 | | | | | | | |
| April | 11 | | | | | | | |
| April | 12 | | | | X | X | Local | |
| April | 13 | X | | | X | | Local | street sweeper at Dolsen |
| April | 14 | | | | X | | Local | |
| April | 15 | | | | | | | |
| April | 16 | | | | X (2) | | Local | |
| April | 17 | | X | X | | | Local | burn barrel near trailer |
| April | 18 | X | X | | | | Local | burn barrel near trailer |
| April | 19 | | | | | | | South Hill Road fire |
| April | 20 | | | | | | | |
| April | 21 | | X | X | X | | Local | |
| April | 22 | | | | X | X | Local | |
| April | 23 | | | | | | | |

**Table 1. MDCH Exposure Investigation Results Matrix for Air Parameters near Continental Aluminum, Lyon Township, Oakland County, March 1 - May 31, 2004. (See text for discussion.)**

| Month | Day | PM[A] Filter Taken | Acid Monitor Detections | Mercury Peaks | Odor Complaint(s) | Odor Sampled | Met. Station Used[B] | Confounders/Notes |
|---|---|---|---|---|---|---|---|---|
| April | 24 | X | | | | | Local | |
| April | 25 | | X | | | | Local | |
| April | 26 | | | | | | | |
| April | 27 | | | | X (2) | X | Local | |
| April | 28 | | | | X (4) | X | Local | |
| April | 29 | | | | | | | |
| April | 30 | | X | | | | Local | |
| May | 1 | | X | | | | Local | |
| May | 2 | | | | | | | |
| May | 3 | | | | | | | |
| May | 4 | | | | | | | |
| May | 5 | | | | | | | |
| May | 6 | | X | X | X | | Local | |
| May | 7 | | | | | | | |
| May | 8 | | | | | | | |
| May | 9 | | X | | | | Both | power outage |
| May | 10 | | X | | X | | Both | septic odor at trailer |
| May | 11 | | X | | X | | Both | |
| May | 12 | | X | | | | Both | |
| May | 13 | | X | | | | Both | septic odor at trailer |
| May | 14 | | X | X | | | Both | |
| May | 15 | | | | | | | |
| May | 16 | | | | | | | |
| May | 17 | | X | | | | Both | lawn mower at trailer; HF key |
| May | 18 | | X | | X | X | Both | |
| May | 19 | | | | | | | |
| May | 20 | | X | | | | Both | |
| May | 21 | | X | | | | Both | |
| May | 22 | | X | | | | Local | |
| May | 23 | | X | | | | Local | |
| May | 24 | | X | | | | Local | |
| May | 25 | | | | | | | |
| May | 26 | | X | | | | Local | |
| May | 27 | | X | | | | Local | |
| May | 28 | | | | | | | |
| May | 29 | | | | | | | |
| May | 30 | | | | | | | |
| May | 31 | | X | X | | | Local | |

Notes:

A. PM = particulate matter

B. When local meteorological data were not available, Ypsilanti meteorological data were used.

**Table 2a. MDCH Exposure Investigation at Continental Aluminum: NIOSH Method 7300 (Elements by ICP) Results - Weights**

| Sample Number | Sample Date | Weight Analysis Date | Weights (ug/filter)[A,B] PM10 | Al | Ba | Be | Cd | Cr | Cu | Pb | Mn | Se | Zn | Meteorological Parameters (24-hr avg)[C] WS (mph) | WD (°) | PRESS (mm Hg) | HUM (%) | T (°C) | Total Air Volume ($m^3$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7370087 | 3/2/2004 | 3/9/2004 | 23,000 | 590 | 150 | ND | ND | (7) | 81 | ND | 6.4 | (20) | 43 | 6 | 255 | 741[D] | 743 | 9[D] | 1795.2 |
| 7370088 | (blank)[G] | 3/9/2004 | ND | 530 | 150 | ND | ND | (5) | (3) | ND | 1.5 | ND | 22 | (not applicable for blank) | | | | | (blank, no sample) |
| 7370089 | 3/7/2004 | 3/15/2004 | 9,300 | 720 | 170 | ND | ND | (3) | 81 | ND | 3.4 | ND | 33 | 7 | 227 | 731 | 81[D] | 2 | 1775.16 |
| 7370090 | 3/14/2004 | 3/18/2004 | 26,000 | 650 | 170 | ND | ND | (7) | 14 | (9) | 8.2 | ND | 49 | 8 | 212 | 735 | 73[D] | 1 | 1739.70 |
| 7370091 | 3/19/2004 | (not given) | 47,000 | 820 | 190 | ND | (0.4) | 9.5 | 32 | (7) | 8.4 | ND | 57 | 4 | 199 | 741 | 79[D] | 1 | 1730.35 |
| 7370092 | 3/25/2004 | 4/1/2004 | 48,000 | 700 | 160 | ND | ND | (5) | 40 | (10) | 11 | ND | 84 | 6 | 205 | 739 | 78 | 14 | 1807.03 |
| 7370093 | 3/31/2004 | 4/6/2004 | 21,000 | 840 | 190 | ND | ND | (7) | 19 | (10) | 11[E] | ND | 49 | 8 | 12 | 734 | 76 | 5 | 1759.86 |
| 7370094 | 4/6/2004 | 4/13/2004 | 55,000 | 990 | 180 | ND[F] | (2) | (8) | 84 | 20 | 29 | (20) | 120 | 4 | 222 | 734 | 57 | 7 | 1796.18 |
| 7370095 | 4/13/2004 | 4/22/2004 | 17,000 | 670 | 160 | ND | ND | (4) | 15 | (10) | 8.5 | ND | 29 | 6 | 69 | 733 | 71 | 5 | 1787.31 |
| 7370096 | 4/18/2004 | 4/22/2004 | 68,000 | 1,000 | 160 | ND | ND | (7) | 21 | (20) | 21 | ND | 58 | 8 | 163 | 736 | 52 | 22 | 1891.55 |
| 7370097 | 4/24/2004 | 5/4/2004 | 29,000 | 550 | 120 | ND | (2) | (8) | 15 | ND | 12 | ND | 47 | 4 | 113 | 740 | 55 | 10 | 1779.38 |
| 7370098 | (blank)[G] | 5/4/2004 | ND | 400 | 110 | ND | ND | (6) | (2) | ND | 1.2 | ND | 170 | (not applicable for blank) | | | | | (blank, no sample) |
| Reporting Limit (ug) | | | 8 | | | | | | | | | | | | | | | | |
| Limit of Detection (LOD; ug) | | | | 5 | 0.6 | 0.05 | 2 | 3 | 1 | 8 | 0.1 | 20 | 1 | | | | | | |
| Limit of Quantitation (LOQ; ug) | | | | 20 | 2 | 0.2 | 7 | 9 | 4 | 30 | 0.4 | 80 | 4 | | | | | | |

Reference: DataChem Laboratories, Salt Lake City, UT.

Notes:

A. Elements listed are: PM10 = particulate matter less than 10 microns in diameter, Al = aluminum, Ba = barium, Be = beryllium, Cd = cadmium, Cr = chromium, Cu = copper, Pb = lead, Mn = manganese, Se = selenium, Zn = zinc

B. Values in parentheses fall between the LOD and LOQ and are laboratory estimates. ND = not detected.

C. Meteorological parameters listed are: WS = wind speed, in miles per hour; WD = wind direction, in degrees clockwise from North; PRESS = barometric pressure, in mm mercury; HUM = relative humidity, in percent; T = temperature, in degrees Celsius. (Continental Aluminum position relative to trailer = 190-200°.) Adjustment for Daylight Saving Time not required here as "24-hr avg" is for when pump ran.

D. These parameters were unavailable from the New Hudson trailer site on that date and, instead, taken from Ypsilanti data.

E. LOD = 0.3 ug and LOQ = 1.0 ug

F. LOD = 0.06 ug and LOQ = 2.0 ug

G. Blank samples were sent for analysis on 3/3/2004 and 4/26/2004, respectively.

| Table 2b. MDCH Exposure Investigation at Continental Aluminum: NIOSH Method 7300 (Elements by ICP) Results - Concentrations | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | |
| **Sample** | **Sample** | **Concentration** | **Concentrations (mg/m$^3$)[A,B,C,D]** | | | | | | | | | | | |
| **Number** | **Date** | **Analysis Date** | **PM10** | **Al** | **Ba** | **Be** | **Cd** | **Cr** | **Cu** | **Pb** | **Mn** | **Se** | **Zn** |
| 7370087 | 3/2/2004 | 3/12/2004 | 0.013 | 0.00033 | 0.000084 | <0.000000028 | <0.0000011 | (0.000004) | 0.000045 | <0.0000045 | 0.0000036 | (0.000012) | 0.000024 |
| 7370088 | (blank)[F] | 3/12/2004 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 7370089 | 3/7/2004 | 3/16/2004 | 0.0052 | 0.00040 | 0.000097 | <0.00000011 | <0.0000039 | (0.0000019) | 0.000046 | <0.000017 | 0.0000019 | <0.000045 | 0.000018 |
| 7370090 | 3/14/2004 | 3/23/2004 | 0.015 | 0.00037 | 0.000096 | <0.000000029 | <0.0000011 | (0.0000041) | 0.0000082 | (0.0000053) | 0.0000047 | <0.000011 | 0.000028 |
| 7370091 | 3/19/2004 | 3/30/2004 | 0.027 | 0.00047 | 0.00011 | <0.000000023 | (0.0000002) | 0.0000055 | 0.000018 | (0.0000042) | 0.0000048 | <0.0000035 | 0.000033 |
| 7370092 | 3/25/2004 | 4/2/2004 | 0.027 | 0.00039 | 0.000086 | <0.000000028 | <0.0000011 | (0.0000025) | 0.000022 | (0.0000068) | 0.0000061 | <0.000011 | 0.000047 |
| 7370093 | 3/31/2004 | 4/8/2004 | 0.012 | 0.00048 | 0.00011 | <0.000000028 | <0.0000011 | (0.0000037) | 0.000011 | (0.0000057) | 0.0000062 | <0.000011 | 0.000028 |
| 7370094 | 4/6/2004 | 4/16/2004 | 0.030 | 0.00055 | 0.00010 | <0.000000033 | (0.0000013) | (0.0000044) | 0.000047 | (0.000013) | 0.000016 | (0.000012) | 0.000064 |
| 7370095 | 4/13/2004 | 4/26/2004 | 0.0096 | 0.00038 | 0.000089 | <0.000000028 | <0.0000011 | (0.0000021) | 0.0000083 | (0.0000068) | 0.0000047 | <0.000011 | 0.000016 |
| 7370096 | 4/18/2004 | 4/26/2004 | 0.036 | 0.00055 | 0.000086 | <0.000000026 | <0.0000011 | (0.0000035) | 0.000011 | (0.00001) | 0.000011 | <0.000011 | 0.000031 |
| 7370097 | 4/24/2004 | 5/5/2004 | 0.016 | 0.00031 | 0.000070 | <0.000000028 | (0.0000012) | (0.0000042) | 0.0000083 | <0.0000045 | 0.0000067 | <0.000011 | 0.000026 |
| 7370098 | (blank)[F] | 5/5/2004 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| | | | | | | | | | | | | | |
| Lowest Comparison Value | | | 0.15 | 15 | 0.5 | 0.002 | 0.005 | 0.000006 | 100 (1 hr) | 0.05 | 0.00004 | 0.2 | 10 |
| Source of Comparison Value[E] | | | NAAQS | TEEL-0 | TEEL-0 | TEEL-0 | TEEL-0 | EPA RfC | CaREL | TEEL-0 | EMEGc | TEEL-0 | TEEL-0 |
| | | | | | | | | | | | | | |
| Reference: DataChem Laboratories, Salt Lake City, UT. | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Acronyms: | | | | | | | | | | | | | |
| ICP | Inductively Coupled Plasma | | | | | | | | | | | | |
| NIOSH | National Institute of Occupational Safety and Health | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| Notes: | | | | | | | | | | | | | |
| A. Elements listed are: PM10 = particulate matter less than 10 microns in diameter, Al = aluminum, Ba = barium, Be = beryllium, Cd = cadmium, Cr = chromium, Cu = copper, Pb = lead, Mn = manganese, Se = selenium, Zn = zinc | | | | | | | | | | | | | |
| B. Values preceeded by "<" were not detected (see Table 2a). The value is the limit of detection for that element divided by the total air volume of the sample. | | | | | | | | | | | | | |
| C. Values in parentheses fall between the LOD and LOQ and are laboratory estimates. | | | | | | | | | | | | | |
| D. NR = not reportable (field blank, zero air volume). | | | | | | | | | | | | | |
| E. Comparison Values listed are: NAAQS = US EPA National Ambient Air Quality Standard (24-hr avg), TEEL-0 = Temporary Emergency Exposure Level - threshold concentration, EPA RfC = US EPA Reference Concentration, CaREL = California Reference Exposure Level, EMEGc = ATSDR chronic Environmental Media Evaluation Guide | | | | | | | | | | | | | |
| F. Blank samples were sent for analysis on 3/3/2004 and 4/26/2004, respectively. | | | | | | | | | | | | | |

**Table 3a. MDCH Exposure Investigation at Continental Aluminum: Detections of Acidic Aerosols - Minute Data**

| Start Date | Time Started | End Date | Time Ended | Elapsed Time | No. Data Pts (No. Zeros) | Concentration Range, ppb | Meteorological Parameters[A] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | WS | WD | PRESS | HUM | T |
| 3/24/2004 | 23:49 | 3/25/2004 | 1:43 | 1:54 | 115 (19) | 0-27 | 4-9 | 169-211 | 737.8-738.3 | 91-96 | 9-10 |
| 3/25/2004 | 18:08 | 3/27/2004 | 3:55 | 33:47 | 2,028 (144) | 0-32 | 3-12 | 143-434[B] | 737.5-740.2 | 79-97 | 11-16 |
| 4/5/2004 | 16:07 | 4/5/2004 | 16:16 | 0:09 | 10 (0) | 3-37 | 3-7 | 268-372[B] | 737.4-737.5 | 21-25 | 5-6 |
| 4/17/2004 | 9:46 | 4/17/2004 | 9:54 | 0:08 | 9 (0) | 6-27 | 0-2 | NR[C] | 735.3 | 74-77 | 16 |
| 4/17/2004 | 11:49 | 4/17/2004 | 15:58 | 4:09 | 250 (146) | 0-46 | 3-12 | 225-338 | 736.4-737 | 48-71 | 18-23 |
| 4/18/2004 | 10:18 | 4/18/2004 | 12:42 | 2:24 | 145 (21) | 0-27 | 3-13 | 135-231 | 736.3-737.1 | 52-74 | 18-24 |
| 4/21/2004 | 4:37 | 4/21/2004 | 7:05 | 2:28 | 149 (67) | 0-27 | 3-9 | 152-202 | 727.5-728.3 | 76-92 | 11-15 |
| 4/21/2004 | 9:37 | 4/21/2004 | 9:49 | 0:12 | 13 (3) | 0-27 | 10-17 | 194-222 | 727.7-727.8 | 68-70 | 17-18 |
| 4/25/2004 | 12:01 | 4/25/2004 | 17:01 | 5:00 | 301 (31) | 0-32 | 3-13 | 146-235 | 730-732 | 63-95 | 10-21 |
| 5/1/2004 | 0:57 | 5/1/2004 | 5:53 | 4:56 | 297 (4) | 0-27 | 3-8 | 122-320 | 731.8-733 | 91-96 | 12-16 |
| 5/6/2004 | 19:35 | 5/6/2004 | 21:59 | 2:24 | 145 (19) | 0-27 | 3-5 | 339-365[B] | 733-734.2 | 54-72 | 21-25 |

A. Meteorological parameters listed are: WS = wind speed, in miles per hour; WD = wind direction, in degrees clockwise from North; PRESS = barometric pressure, in mm mercury; HUM = relative humidity, in percent; T = temperature, in degrees Celsius. (Continental Aluminum position relative to trailer = 190-200$^{o}$.)

B. The weathervane crossed North during the elapsed time. When crossing North clockwise, compass direction changes from 359 to 0 (versus 360). To indicate this, MDCH added 360 to compass readings that were east of north.

C. Wind speeds were less than 3 mph, making wind direction unreliable. Therefore, wind direction is not reported here.

**Table 3b. MDCH Exposure Investigation at Continental Aluminum: Detections of Acidic Aerosols - Hourly Data**

| Start Date | Start Hour | End Date | End Hour | Elapsed Hours | Concentration Range, ppb | Meteorological Parameters[A,B] | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | WS | WD | PRESS | HUM | T |
| 5/9/2004 | 10 | 5/9/2004 | 10 | 1 | 2 | 4 | 140 | NA | NA | 17 |
| 5/9/2004 | 17 | 5/9/2004 | 17 | 1 | 20 | 4 | 101 | NA | NA | 21 |
| 5/9/2004 | 19 | 5/10/2004 | 12 | 18 | 11-33 | 6 | 94-237 | NA | NA | 16-27 |
| 5/10/2004 | 18 | 5/11/2004 | 5 | 12 | 16-33 | 1-4 | 11-305 | NA | NA | 14-20 |
| 5/11/2004 | 20 | 5/12/2004 | 17 | 22 | 2-33 | 2-8 | 144-204 | NA | NA | 16-28 |
| 5/12/2004 | 19 | 5/14/2004 | 22 | 52 | 12-37 | 0-11 | 24-286 | NA | NA | 16-26 |
| 5/17/2004 | 7 | 5/17/2004 | 9 | 3 | 1-11 | 3-6 | 174-183 | NA | NA | 13-17 |

A. Meteorological parameters listed are: WS = wind speed, in miles per hour; WD = wind direction, in degrees clockwise from North; PRESS = barometric pressure, in mm mercury; HUM = relative humidity, in percent; T = temperature, in degrees Celsius. (Continental Aluminum position relative to trailer = 190=200$^{o}$.)

B. Local barometric pressure and relative humidity were not available for these dates.

**Table 4. MDCH Exposure Investigation at Continental Aluminum - Mercury Detections Above Average as Identified by MDEQ**

| | Reporting | Sampling | Concentration | Meteorological Parameters[A,B,C] | | | | |
|---|---|---|---|---|---|---|---|---|
| **Date** | **Time** | **Time** | **(ng/m$^3$)** | **WS** | **WD** | **PRESS** | **HUM** | **T** |
| 3/30/2004 | 15:35 | 15:25 | 511.828 | 6 | 54 | 734.6 | 88 | 8 |
| 3/30/2004 | 15:55 | 15:45 | 120.279 | 4 | 52 | 734.6 | 90 | 8 |
| 4/17/2004 | 12:35 | 12:25 | 12.554 | 5 | 274 | 736.6 | 66 | 20 |
| 4/17/2004 | 12:40 | 12:30 | 12.436 | 7 | 286 | 736.5 | 65 | 20 |
| 4/17/2004 | 12:55 | 12:45 | 10.003 | 7 | 258 | 736.5 | 65 | 20 |
| 4/21/2004 | 18:15 | 18:05 | 14.159 | 7 | 202 | 728.2 | 74 | 18 |
| 5/6/2004 | 21:10 | 21:00 | 10.255 | 1 | NR[D] | 733.5 | 68 | 22 |
| 5/14/2004 | 10:05 | 9:55 | 25.902 | 5 | 194 | 762.3 | 87 | 21 |
| 5/14/2004 | 10:10 | 10:00 | 34.234 | 5 | 194 | 762.3 | 87 | 21 |
| 5/31/2004 | 23:05 | 22:55 | 13.979 | 4 | 204 | 728 | 80 | 15 |
| 5/31/2004 | 23:10 | 23:00 | 14.160 | 4 | 204 | 728 | 80 | 15 |
| 5/31/2004 | 23:25 | 23:15 | 10.026 | 4 | 204 | 728 | 80 | 15 |
| 5/31/2004 | 23:30 | 23:20 | 12.426 | 4 | 204 | 728 | 80 | 15 |

Reference: MDEQ 2004

Notes:

A. Meteorological parameters listed are: WS = wind speed, in miles per hour; WD = wind direction, in degrees clockwise from North; PRESS = barometric pressure, in mm mercury; HUM = relative humidity, in percent; T = temperature, in degrees Celsius. (Continental Aluminum position relative to trailer = 190-200$^o$.)

B. Values shown are 5-minute averages except for 5/14 and 5/31 values, which are hourly averages, due to technical difficulties at the air monitoring trailer.

C. Local barometric pressure and relative humidity data were unavailable for 5/14 and therefore were taken from the MDEQ Ypsilanti air monitoring station.

D. Wind speeds were less than 3 mph, making wind direction unreliable. Therefore, wind direction is not reported here.

Table 5. MDCH Exposure Investigation at Continental Aluminum - Odor Complaint Information

| Date of Complaint | Time Odor Noticed[E] | Odor Descriptor | Odor Intensity[F] | CA Location from Odor (approx. degrees, N=0)[A] | Meteorological Parameters[B,C] | | | | | Sample Taken |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | WS | WD | PRESS | HUM | T | |
| 3/16/2004 | 18:45 | plastic, burning leaves/brush, metallic | 2 | 0 | 6 | 20 | NA | NA | -3 | X |
| 3/23/2004[D] | 6:30 | plastic, cleaning agent, burning wire | 2 | 180 | 4 | 210 | 738.9 | 60 | -1 | |
| 3/23/2004[D] | 11:30-14:00 | plastic, cleaning agent, burning wire | 2 | 180 | 3-14 | 193-275 | 738.3-739 | 30-34 | 6-10 | |
| 3/23/2004[D] | 20:30 | plastic, cleaning agent, burning wire | 2 | 180 | 0 | 209 | 739.1 | 52 | 4 | |
| 3/24/2004 | 9:05 | metallic, hot wire | 0 | 202.5 | 5 | 191 | 738.5 | 95 | 5 | |
| 3/24/2004 | 10:40 | metallic | NR | 180 | 7 | 202 | 738.2 | 92 | 6 | X |
| 3/31/2004 | 15:30 | metallic, plastic | 1 | 0 | 8 | 17 | 734 | 70 | 6 | X |
| 4/2/2004 | 8:50 | metallic, chemical | 2 | 0 | 7 | 1 | 733.6 | 76 | 4 | X |
| 4/2/2004 | 13:30 | metallic, chemical | 1-2[G] | 0 | 9 | 358 | 733.6 | 59 | 9 | X |
| 4/6/2004 | 11:45 | metallic, hot wire | 1 | 202.5 | 4 | 179 | 734.6 | 44 | 8 | |
| 4/12/2004 | 13:45 | metallic | 1 | 180 | 10 | 41 | 737.6 | 35 | 8 | |
| 4/12/2004 | 14:00 | metallic, chemical | NR | 90 | 9 | 43 | 737.5 | 34 | 8 | X |
| 4/13/2004 | 10:30 | metallic | 1 | 0 | 8 | 2 | 733.3 | 82 | 3 | |
| 4/14/2004 | 15:50 | sharp, pungent | NR | 0 | 5 | 314 | 735.7 | 29 | 13 | |
| 4/16/2004 | 8:00 | burnt wire | 2 | 180 | 4 | 150 | 737.2 | 63 | 9 | |
| 4/16/2004 | 9:50 | metallic | NR | 180 | 7 | 191 | 736.9 | 51 | 13 | |
| 4/21/2004 | 16:00 | metallic, swimming pool | 2 | 180 | 6 | 199 | 727.6 | 67 | 20 | |
| 4/22/2004 | 14:00 | metallic | NR | 67.5 | 4 | 81 | 737.4 | 48 | 13 | X |
| 4/27/2004 | 9:00 | burning styrene/vinyl | 2 | 0 | 6 | 310 | 733 | 85 | 0 | |
| 4/27/2004 | 15:25 | metallic | NR | 0 | 9 | 311 | 734.3 | 52 | 3 | X |
| 4/28/2004 | 16:05 | metallic, burning plastic/paint | 1 | 157.5 | 12 | 187 | 733 | 30 | 20 | X |
| 4/28/2004 | 19:50 | paint thinner, burning hair | 1 | 202.5 | 9 | 198 | 732.3 | 31 | 21 | |
| 4/28/2004 | 21:00 | chlorine, pungent | 2 | 180 | 6 | 199 | 732.7 | 33 | 20 | |
| 5/6/2004 | 6:30-11:15 | burning wire | 2 | 180 | 0-10 | 165-222 | 733.3-734.8 | 43-59 | 10-21 | |
| 5/10/2004 | 15:35 | NR[G] | 1 | 0 | 10 | 242 | NA | NA | 28 | |
| 5/11/2004 | 17:00 | acid | 2 | 157.5 | 4 | 159 | NA | NA | 23 | |
| 5/18/2004 | 1:50 | metallic | 2 | 180 | 3 | 199 | NA | NA | 19 | X |

Acronyms:

CA Continental Aluminum

NA not available

NR not reported

Notes:

A. To determine whether Continental Aluminum was a potential source of the odor, MDCH drew a vector from the odor site to the smelter and determined approximate direction to the smelter (in degrees, with North = 0, proceeding clockwise). This value was then compared to wind direction. (Continental Aluminum position relative to trailer = 190-200°.)

B. Meteorological parameters listed are: WS = wind speed, in miles per hour; WD = wind direction, in degrees clockwise from North; PRESS = barometric pressure, in mm mercury; HUM = relative humidity, in percent; T = temperature, in degrees Celsius

C. Local minute data were not available for 5/10, 5/11, and 5/18. Available local hourly data are shown.

D. The 3/23 complaints were submitted by the same complainant on one form. It is not clear whether the descriptors applied to all instances of odor or to certain times.

E. The majority of odor complaints only indicated when the odor was noticed or first detected and did not indicate duration of odor.

F. Odor intensity scores: 0 = just detectable; 1 = easily noticed but can detect other smells/odors; 2 = can't smell anything else

G. Two separate reports received for this date and time.

**Table 6a. MDCH Exposure Investigation at Continental Aluminum - Analytes screened for in EPA Method TO-15 and respective detection limits (DLs) at ERG[A] lab.**

| Analyte | DL (ppbv)[B] | Analyte | DL (ppbv) |
|---|---|---|---|
| 1,1,1-Trichloroethane | 0.05 | Dibromochloromethane | 0.07 |
| 1,1,2,2-Tetrachloroethane | 0.05 | Dichlorodifluoromethane | 0.03 |
| 1,1,2-Trichloroethane | 0.08 | Dichloromethane | 0.08 |
| 1,1-Dichloroethane | 0.05 | Dichlorotetrafluoroethane | 0.03 |
| 1,1-Dichloroethene | 0.05 | Ethyl acrylate | 0.06 |
| 1,2,4-Trichlorobenzene | 0.18 | Ethyl tert-butyl ether | 0.05 |
| 1,2,4-Trimethylbenzene | 0.06 | Ethylbenzene | 0.04 |
| 1,2-Dibromoethane | 0.05 | Hexachloro-1,3-butadiene | 0.16 |
| 1,2-Dichloroethane | 0.06 | m,p-Xylene | 0.05 |
| 1,2-Dichloropropane | 0.07 | m-Dichlorobenzene | 0.07 |
| 1,3,5-Trimethylbenzene | 0.04 | Methyl ethyl ketone | 0.15 |
| 1,3-Butadiene | 0.06 | Methyl isobutyl ketone | 0.08 |
| Acetonitrile | 0.13 | Methyl methacrylate | 0.11 |
| Acetylene | 0.05 | Methyl tert-butyl ether | 0.07 |
| Acrylonitrile | 0.08 | n-Octane | 0.06 |
| Benzene | 0.05 | o-Dichlorobenzene | 0.04 |
| Bromochloromethane | 0.09 | o-Xylene | 0.04 |
| Bromodichloromethane | 0.04 | p-Dichlorobenzene | 0.06 |
| Bromoform | 0.06 | Propylene | 0.07 |
| Bromomethane | 0.05 | Styrene | 0.04 |
| Carbon tetrachloride | 0.06 | tert-Amyl methyl ether | 0.07 |
| Chlorobenzene | 0.04 | Tetrachloroethylene | 0.05 |
| Chloroethane | 0.1 | Toluene | 0.05 |
| Chloroform | 0.04 | trans-1,2-Dichloroethylene | 0.05 |
| Chloromethane | 0.05 | trans-1,3-Dichloropropene | 0.05 |
| Chloromethylbenzene | 0.05 | Trichloroethylene | 0.05 |
| Chloroprene | 0.05 | Trichlorofluoromethane | 0.04 |
| cis-1,2-Dichloroethylene | 0.06 | Trichlorotrifluoroethane | 0.04 |
| cis-1,3-Dichloropropene | 0.05 | Vinyl chloride | 0.04 |

Notes:

A. ERG = Eastern Research Group

B. ppbv = parts per billion by volume

Table 6b. MDCH Exposure Investigation at Continental Aluminum - Concentrations of chemicals detected in TO-15 tests (Summa canister sampling). All values in ppbv.

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID (MDCH):** | | | | Field Blank 1 | | | Field Blank 2 | | | Field Blank 3 | | | Field Blank 4 | | | Travis Rd 1 | | | Control SQ3 | | | Milford Rd 1 | | | Control SQ6 | |
| **Sample ID (Lab):** | | | | Field Blank | | | 4040714-01 | | | 4041408-01 | | | 4061605-01 | | | 4031801-02 | | | 4031801-01 | | | 4032605-01 | | | 4032505-01 | |
| **Date sampled:** | | | | not sampled | | | not sampled | | | not sampled | | | not sampled | | | 3/16/2004 | | | 3/16/2004 | | | 3/24/2004 | | | 3/24/2004 | |
| **Date analyzed:** | | | | 3/18/2004 | | | 4/14/2004 | | | 4/21/2004 | | | 7/14/2004 | | | 3/30/2004 | | | 3/30/2004 | | | 4/1/2004 | | | 3/31/2004 | |
| **Days from cleaning to pressurization:** | | | | 50 | | | 85 | | | 15 | | | 128 | | | 74 | | | 74 | | | 55 | | | 56 | |
| | **Lowest** | **Source of** | | | | | | | | | | | | | | | | | | | | | | | | |
| | **Comparison** | **Lowest** | **ERG** | | | | | | | | | | | | | | | | | | | | | | | |
| **Analyte** | **Value (CV)** | **CV** | **DL** | | | | | | | | | | | | | | | | | | | | | | | |
| **1,1,1-Trichloroethane** | 700 | EMEGi | 0.05 | | | | | | | | | | | | | | | | | | | | | | | |
| **1,2,4-Trimethylbenzene** | 25,000 | TEEL-0 | 0.06 | | | | | | | | | | | | | 0.05 | U | | 0.04 | U | | | | | | |
| **1,3,5-Trimethylbenzene** | 25,000 | TEEL-0 | 0.04 | | | | | | | | | | | | | 0.02 | U | | | | | | | | | |
| **1,3-Butadiene** | 0.89 | EPA RfC | 0.06 | | | | | | | | | | | | | | | | | | | | | | | |
| **Acetonitrile** | 36 | EPA RfC | 0.13 | | | | | | | | | | | | | | | | | | | | | | | |
| **Acetylene** | 2,500,000 | TEEL-0 | 0.05 | | | | | | | | | | | | | 0.54 | | | 0.7 | | | 1.07 | | | 0.61 | |
| **Benzene** | 4 | EMEGi | 0.05 | 0.04 | U | | | | | | | | 0.05 | | | 0.36 | | | 0.27 | | | 0.42 | | | 0.24 | |
| **Carbon tetrachloride** | 50 | EMEGi | 0.06 | | | | | | | | | | | | | 0.08 | | | 0.09 | | | 0.11 | | | 0.09 | |
| **Chloromethane** | 44 | EPA RfC | 0.05 | | | | | | | | | | | | | 0.47 | | | 0.46 | | | 0.53 | | | 0.48 | |
| **Dichlorodifluoromethane** | 1,000,000 | TEEL-0 | 0.03 | | | | | | | | | | | | | 0.49 | | | 0.48 | | | 0.59 | | | 0.49 | |
| **Dichloromethane (Methylene chloride)** | 300 | EMEGi,c | 0.08 | | | | | | | | | | | | | | | | | | | 0.16 | | | 0.13 | |
| **Ethylbenzene** | 230 | EPA RfC | 0.04 | | | | | | | | | | 0.01 | U | | 0.06 | | | 0.06 | | | 0.05 | | | 0.05 | |
| **m,p-Xylene** | 100 (total) | EMEGc | 0.05 | | | | | | | | | | 0.01 | U | | 0.12 | | | 0.13 | | | 0.1 | | | 0.1 | |
| **m-Dichlorobenzene (1,3-dichlorobenzene)** | 750 | TEEL-0 | 0.07 | | | | | | | | | | | | | | | | | | | | | | | |
| **Methyl ethyl ketone** | 340 | EPA RfC | 0.15 | 0.11 | U | | | | | | | | 0.58 | | | 0.47 | | | 0.53 | | | 0.43 | | | 0.59 | |
| **Methyl isobutyl ketone** | 75,000 | TEEL-0 | 0.08 | | | | | | | | | | | | | | | | | | | | | | | |
| **Methyl methacrylate** | 100,000 | TEEL-0 | 0.11 | | | | 0.17 | | | 0.17 | | | | | | | | | | | | | | | | |
| **Methyl tert-butyl ether** | 700 | EMEGi,c | 0.07 | | | | | | | | | | | | | | | | | | | | | | | |
| **o-Xylene** | 100 (total) | EMEGc | 0.04 | | | | | | | | | | | | | 0.06 | | | 0.05 | | | 0.05 | | | 0.05 | |
| **p-Dichlorobenzene (1,4-dichlorobenzene)** | 100 | EMEGc | 0.06 | 0.19 | | | 0.07 | | | 0.05 | U | | | | | | | | | | | | | | 0.26 | |
| **Propylene** | 24,000,000 | TEEL-0 | 0.07 | | | | | | | | | | 0.21 | | | 0.16 | | | 0.25 | | | 0.24 | | | 0.25 | |
| **Styrene** | 60 | EMEGc | 0.04 | | | | | | | | | | 0.06 | | | 0.05 | | | | | | | | | | |
| **Toluene** | 80 | EMEGc | 0.05 | 0.05 | | | 0.06 | | | | | | 0.07 | | | 0.26 | | | 0.33 | | | 1.14 | | | 0.24 | |
| **Trichlorofluoromethane** | 500,000 | TEEL-0 | 0.04 | | | | 0.07 | | | | | | 0.07 | | | 0.22 | | | 0.22 | | | 0.82 | | | 0.24 | |
| **Trichlorotrifluoroethane** | 1,000,000 | TEEL-0 | 0.04 | | | | 0.03 | U | | | | | | | | 0.11 | | | 0.1 | | | 0.11 | | | 0.1 | |

Reference: Eastern Research Group (ERG), Morrisville, NC.

Acronyms:

DL detection limit

ppbv parts per billion by volume

Notes:

U = value reported is less than the detection limit

Table 6b. MDCH Exposure Investigation at Continental Aluminum - C

| | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample ID (MDCH):** | | Travis Rd 2 | | Control SQ4 | | Travis Rd 3 | | Control SQ3 | | Travis Rd 4 | | Control SQ3 | | Travis Rd 5 | | Control SQ4 | | Travis Rd 6 | | Control SQ4 | |
| **Sample ID (Lab):** | | 4040204-01 | | 4040204-02 | | 4040503-01 | | 4040503-03 | | 4040503-02 | | 4040503-04 | | 4041304-02 | | 4041304-01 | | 4042306-01 | | 4042306-02 | |
| **Date sampled:** | | 3/31/2004 | | 3/31/2004 | | 4/2/2004 | | 4/2/2004 | | 4/2/2004 | | 4/2/2004 | | 4/12/2004 | | 4/12/2004 | | 4/22/2004 | | 4/22/2004 | |
| **Date analyzed:** | | 4/6/2004 | | 4/7/2004 | | 4/8/2004 | | 4/8/2004 | | 4/8/2004 | | 4/7/2004 | | 4/15/2004 | | 4/14/2004 | | 4/24/2004 | | 4/24/2004 | |
| **Days from cleaning to pressurization:** | | 42 | | 42 | | 65 | | 64 | | 36 | | 21 | | 6 | | 35 | | 16 | | 16 | |
| | **Lowest** | | | | | | | | | | | | | | | | | | | | |
| | **Comparison** | | | | | | | | | | | | | | | | | | | | |
| **Analyte** | **Value (CV)** | | | | | | | | | | | | | | | | | | | | |
| **1,1,1-Trichloroethane** | 700 | | | | | | | | | | | | | | | | | | | | |
| **1,2,4-Trimethylbenzene** | 25,000 | 0.04 | U | 0.04 | U | 0.03 | U | 0.1 | | 0.1 | | 0.08 | | 0.03 | U | 0.03 | U | 0.03 | U | 0.04 | U |
| **1,3,5-Trimethylbenzene** | 25,000 | 0.02 | U | | | | | 0.04 | | 0.04 | | 0.03 | U | | | | | | | | |
| **1,3-Butadiene** | 0.89 | 0.14 | | | | | | | | 0.13 | | | | | | | | | | | |
| **Acetonitrile** | 36 | 0.18 | | | | | | | | | | | | | | | | | | | |
| **Acetylene** | 2,500,000 | 1.23 | | 0.41 | | 2.07 | | 0.36 | | 0.11 | | 0.75 | | 0.7 | | 0.48 | | 0.33 | | 0.39 | |
| **Benzene** | 4 | 0.31 | | 0.17 | | 0.49 | | 0.33 | | 0.48 | | 0.29 | | 0.18 | | 0.15 | | 0.12 | | 0.14 | |
| **Carbon tetrachloride** | 50 | 0.1 | | 0.08 | | 0.08 | | 0.1 | | 0.09 | | 0.09 | | 0.08 | | 0.08 | | 0.08 | | 0.11 | |
| **Chloromethane** | 44 | 0.62 | | 0.51 | | 0.61 | | 0.52 | | 0.56 | | 0.5 | | 0.49 | | 0.47 | | 0.52 | | 0.53 | |
| **Dichlorodifluoromethane** | 1,000,000 | 0.6 | | 0.48 | | 0.49 | | 0.5 | | 0.48 | | 0.49 | | 0.49 | | 0.55 | | 0.49 | | 0.51 | |
| **Dichloromethane (Methylene chloride)** | 300 | 0.05 | U | | | 0.05 | U | | | 0.21 | | 0.05 | U | 0.05 | U | 0.11 | | 0.05 | U | | |
| **Ethylbenzene** | 230 | 0.04 | | 0.03 | U | 0.05 | | 0.08 | | 0.19 | | 0.06 | | | | 0.04 | | 0.03 | U | 0.06 | |
| **m,p-Xylene** | 100 (total) | 0.08 | | 0.08 | | 0.06 | | 0.23 | | 0.49 | | 0.18 | | 0.04 | U | 0.07 | | 0.06 | | 0.11 | |
| **m-Dichlorobenzene (1,3-dichlorobenzene)** | 750 | | | | | | | | | | | 0.25 | | | | | | | | | |
| **Methyl ethyl ketone** | 340 | 0.54 | | 0.37 | | 0.82 | | 0.62 | | 0.55 | | 0.31 | | 0.53 | | 0.41 | | 0.34 | | 0.52 | |
| **Methyl isobutyl ketone** | 75,000 | | | | | | | | | 0.09 | | | | | | | | | | | |
| **Methyl methacrylate** | 100,000 | | | | | | | | | | | | | | | | | | | | |
| **Methyl tert-butyl ether** | 700 | | | | | | | | | | | | | | | | | | | | |
| **o-Xylene** | 100 (total) | 0.03 | U | 0.04 | | 0.03 | U | 0.1 | | 0.22 | | 0.07 | | | | 0.04 | | 0.03 | U | 0.05 | |
| **p-Dichlorobenzene (1,4-dichlorobenzene)** | 100 | 0.08 | | 0.04 | U | 0.04 | U | 0.08 | | 0.07 | | | | 0.14 | | | | 0.03 | U | 0.1 | |
| **Propylene** | 24,000,000 | 1.19 | | 0.17 | | 0.42 | | 0.32 | | 2.82 | | 0.3 | | 0.26 | | | | 0.07 | | 0.13 | |
| **Styrene** | 60 | 0.03 | U | | | 0.09 | | | | 0.19 | | | | | | | | | | | |
| **Toluene** | 80 | 0.19 | | 0.14 | | 0.18 | | 0.49 | | 1.81 | | 0.48 | | 0.14 | | 0.79 | | 0.16 | | 0.45 | |
| **Trichlorofluoromethane** | 500,000 | 0.25 | | 0.24 | | 0.23 | | 0.23 | | 0.21 | | 0.25 | | 0.22 | | 0.82 | | 0.23 | | 0.28 | |
| **Trichlorotrifluoroethane** | 1,000,000 | 0.1 | | 0.12 | | 0.1 | | 0.12 | | 0.12 | | 0.12 | | 0.1 | | 0.08 | | 0.1 | | 0.11 | |

Reference: Eastern Research Group (ERG), Morrisville, NC.

Acronyms:

DL detection limit ppbv parts

Notes:

U = value reported is less than the detection limit

Table 6b. MDCH Exposure Investigation at Continental Aluminum - C

| Sample ID (MDCH): | | Milford Rd 2 | | Control SQ3 | | Cash St | | Control SQ6 | | Milford Rd 3 | | Control SQ6 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sample ID (Lab): | | 4042902-01 | | 4042902-02 | | 4043004-02 | | 4043004-01 | | 4051902-02 | | 4051902-01 | | | | |
| Date sampled: | | 4/27/2004 | | 4/27/2004 | | 4/28/2004 | | 4/28/2004 | | 5/18/2004 | | 5/18/2004 | | | | |
| Date analyzed: | | 5/18/2004 | | 5/18/2004 | | 5/7/2004 | | 5/4/2004 | | 5/26/2004 | | 5/26/2004 | | | | |
| Days from cleaning to pressurization: | | 116 | | 133 | | 91 | | 90 | | 13 | | 13 | | | | |
| | Lowest | | | | | | | | | | | | | | | |
| | Comparison | | | | | | | | | | | | | All Samples except blanks | | |
| Analyte | Value (CV) | | | | | | | | | | | | | MIN | MAX | MAX as % of CV |
| 1,1,1-Trichloroethane | 700 | | | | | | | 0.02 | U | | | | | 0.02 | 0.02 | 0.00286 |
| 1,2,4-Trimethylbenzene | 25,000 | 0.03 | U | 0.07 | | 0.02 | U | | | 0.05 | U | 0.05 | U | 0.02 | 0.1 | 0.00040 |
| 1,3,5-Trimethylbenzene | 25,000 | | | 0.03 | U | | | | | | | | | 0.02 | 0.04 | 0.00016 |
| 1,3-Butadiene | 0.89 | 0.07 | | 0.15 | | 0.06 | | | | | | | | 0.06 | 0.15 | 16.85393 |
| Acetonitrile | 36 | | | | | 0.27 | | | | | | | | 0.18 | 0.27 | 0.75000 |
| Acetylene | 2,500,000 | 0.9 | | 8.25 | | 3.07 | | 0.56 | | 3.35 | | 0.32 | | 0.11 | 8.25 | 0.00033 |
| Benzene | 4 | 0.36 | | 0.52 | | 0.94 | | 0.12 | | 1.67 | | 0.14 | | 0.12 | 1.67 | 41.75000 |
| Carbon tetrachloride | 50 | 0.02 | U | 0.09 | | 0.08 | | 0.08 | | 0.08 | | 0.09 | | 0.02 | 0.11 | 0.22000 |
| Chloromethane | 44 | 0.56 | | 0.52 | | 0.57 | | 0.61 | | 0.62 | | 0.56 | | 0.46 | 0.62 | 1.40909 |
| Dichlorodifluoromethane | 1,000,000 | 0.54 | | 0.53 | | 0.5 | | 0.54 | | 0.52 | | 0.53 | | 0.48 | 0.6 | 0.00006 |
| Dichloromethane (Methylene chloride) | 300 | 0.08 | | 0.1 | | 0.05 | U | 0.03 | U | 0.07 | U | | | 0.03 | 0.21 | 0.07000 |
| Ethylbenzene | 230 | 0.04 | | 0.09 | | 0.03 | U | 0.02 | U | 0.05 | | 0.04 | | 0.02 | 0.19 | 0.08261 |
| m,p-Xylene | 100 (total) | 0.04 | U | 0.23 | | 0.05 | | 0.04 | U | 0.11 | | 0.09 | | 0.04 | 0.49 | 0.49000 |
| m-Dichlorobenzene (1,3-dichlorobenzene) | 750 | | | | | | | | | | | | | 0.25 | 0.25 | 0.03333 |
| Methyl ethyl ketone | 340 | 2.77 | | 1.06 | | 0.59 | | 0.26 | | | | 0.65 | | 0.26 | 2.77 | 0.81471 |
| Methyl isobutyl ketone | 75,000 | | | 0.11 | | | | | | | | | | 0.09 | 0.11 | 0.00015 |
| Methyl methacrylate | 100,000 | | | | | | | | | | | | | 0 | 0 | 0.00000 |
| Methyl tert-butyl ether | 700 | | | | | | | | | 0.23 | | | | 0.23 | 0.23 | 0.03286 |
| o-Xylene | 100 (total) | | | 0.11 | | | | 0.02 | U | 0.05 | | 0.04 | | 0.02 | 0.22 | 0.22000 |
| p-Dichlorobenzene (1,4-dichlorobenzene) | 100 | | | 0.04 | | | | | | 0.05 | U | 0.05 | U | 0.03 | 0.26 | 0.26000 |
| Propylene | 24,000,000 | 0.91 | | 1.84 | | 0.66 | | 0.1 | | 0.45 | | 0.46 | | 0.07 | 2.82 | 0.00001 |
| Styrene | 60 | 0.05 | | 0.03 | U | 0.04 | | | | 0.07 | | 0.05 | | 0.03 | 0.19 | 0.31667 |
| Toluene | 80 | 0.13 | | 0.7 | | 0.21 | | 0.1 | | 0.29 | | 0.26 | | 0.1 | 1.81 | 2.26250 |
| Trichlorofluoromethane | 500,000 | 0.24 | | 0.26 | | 0.23 | | 0.27 | | 0.25 | | 0.43 | | 0.21 | 0.82 | 0.00016 |
| Trichlorotrifluoroethane | 1,000,000 | 0.11 | | 0.11 | | 0.11 | | 0.09 | | 0.11 | | 0.1 | | 0.08 | 0.12 | 0.00001 |

Reference: Eastern Research Group (ERG), Morrisville, NC.

Acronyms:

DL detection limit ppbv parts

Notes:

U = value reported is less than the detection limit

**Table 7. MDCH Exposure investigation at Continental Aluminum: 2001 Soil Data from Two Private Residences in the Predominantly Downwind Direction from and within 1/4 Mile of Continental Aluminum[A,B,C]**

| Chemical | 0-6" Sampling Results | 6-12" Sampling Results | Michigan Default Background | Michigan Background Range | MDEQ R/C1 DCC | ATSDR Child Chronic EMEG |
|---|---|---|---|---|---|---|
| Ammonia - Nitrogen | 70 - 170 | 38 - 130 | NA | NA | ID | NA |
| Chloride | 11 - 28 | 8 - 15 | NA | NA | 500 | NA |
| Fluoride | 6.2 - 10 | 6.9 - 9.6 | NA | NA | 9,000 | NA |
| Sulfate | 7 - 14 | 5 - 6 | NA | NA | ID | NA |
| Aluminum | 4,700 - 8,500 | 4,400 - 8,000 | 6,900 | 2,603 - 16,324 | 50,000 | NA |
| Antimony | < 0.05 | < 0.05 | NA | NA | 180 | NA |
| Arsenic | 5.1 - 5.4 | 4.1 - 4.5 | 5.8 | NA | 7.6 | 20 |
| Beryllium | 0.36 - 0.42 | 0.34 - 0.42 | NA | 0.2 - 1.8 | 410 | 100 |
| Cadmium | < 0.05 - 0.6 | < 0.05 - 0.47 | 1.2 | 0.5 - 2.5 | 550 | 10 |
| Copper | 9.8 - 21 | 7.9 - 19 | 32 | 1 - 58 | 20,000 | NA |
| Chromium[D] | 12 - 14 | 12 - 14 | NA | NA | 2,500 | NA |
| Cobalt | 2.9 - 4.2 | 2.6 - 4.2 | 6.8 | NA | 2,600 | NA |
| Lead | 17 - 43 | 6.7 - 35 | 21 | 1 - 45 | 400 | NA |
| Manganese | 160 - 580 | 160 - 450 | 440 | 14 - 1,391 | 25,000 | NA |
| Mercury | < 0.1 - 0.1 | < 0.1 | 0.13 | NA | 160 | NA |
| Molybdenum | 1.3 - 2.6 | 0.82 - 1.7 | NA | NA | 2,600 | NA |
| Nickel | 9 - 11 | 8.8 - 13 | 20 | NA | 40,000 | NA |
| Selenium | 0.22 - 0.58 | 0.19 - 0.48 | 0.41 | 0.05 - 1.2 | 2,600 | 300 |
| Silver | < 0.05 - 0.15 | < 0.05 - 0.12 | 1 | NA | 2,500 | NA |
| Zinc | 65 - 150 | 41- 120 | 47 | 2.5 - 75 | 170,000 | 20,000 |

Acronyms/Abbreviations:

| | |
|---|---|
| R/C1 DCC | Residential/Commercial 1 Direct Contact Criteria |
| EMEG | Environmental Media Evaluation Guide |
| NA | not available (criterion not established) |
| ID | insufficient data to determine criterion |

Notes:

A. Analysis performed by Ann Arbor Technical Services Inc., Ann Arbor, Michigan. Data obtained through Wayne County Court public records.

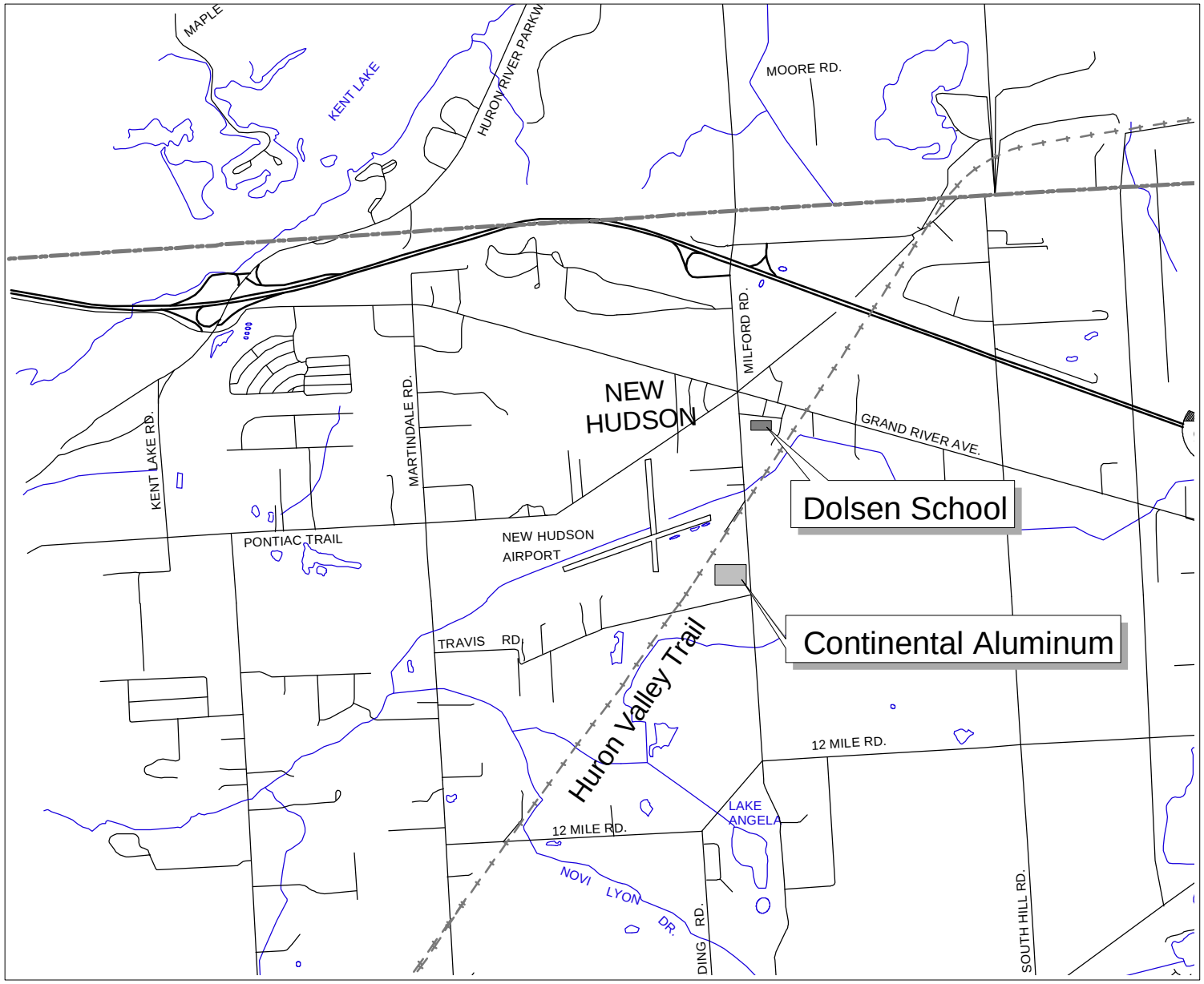
B. All values given in parts per million (ppm).

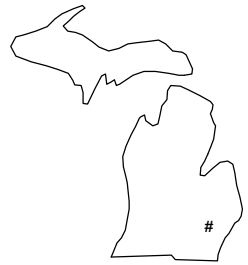
C. Values preceeded by "<" indicate the sample result was below the detection limit. The detection limit is the value following "<".

D. Samples were not speciated. Therefore, sampling resulsts represent total chromium. To be protective, the criteria for hexavalent chromium were used.

# CONTINENTAL ALUMINUM

## Oakland County, Michigan




LOCATION

LEGEND

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

N

Figure 1.

Figure 2. Semiquadrant Numbering and Control Sample Locations (●) for MDCH/ATSDR Exposure Investigation at Continental Aluminum

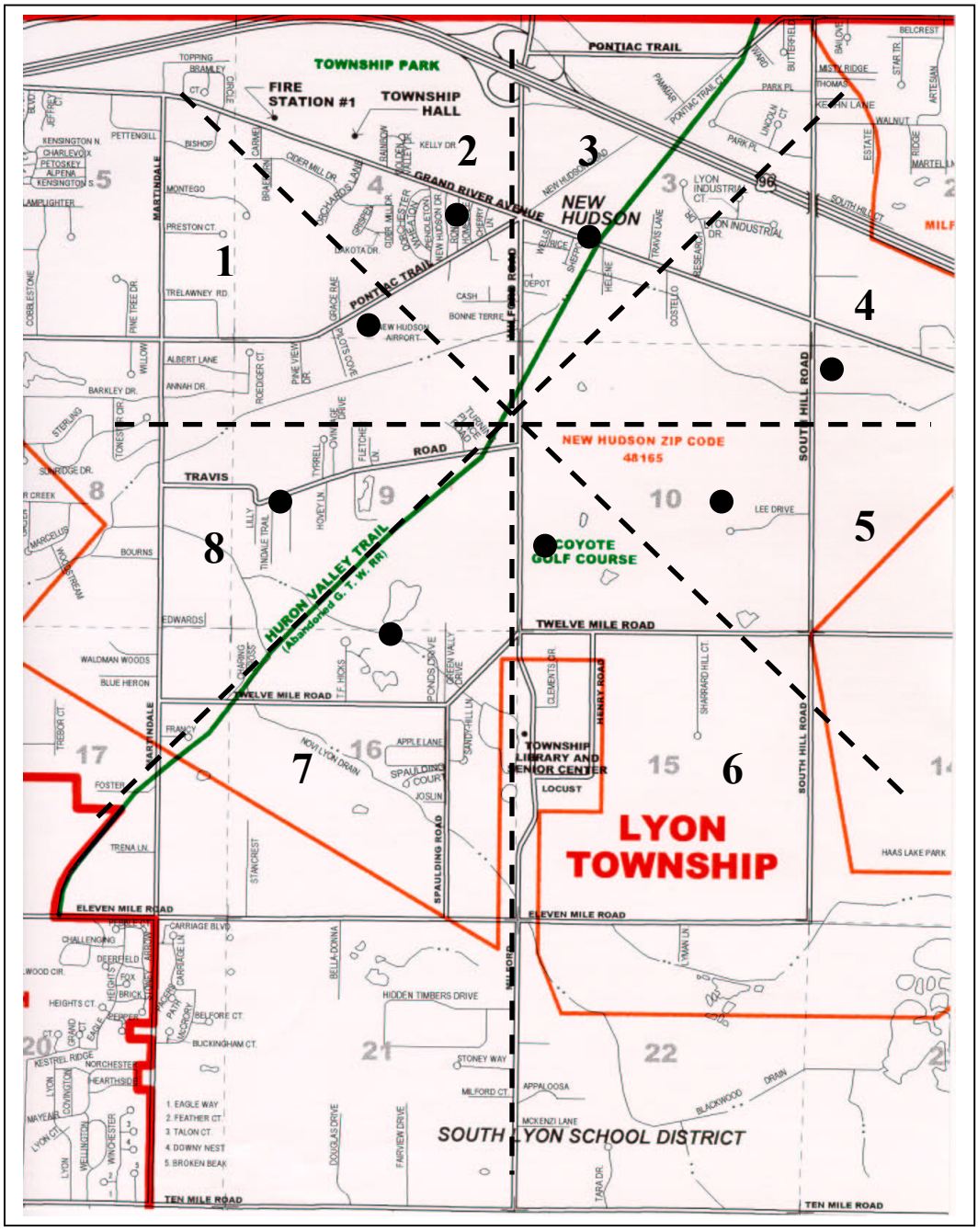


Figure 3. Odor Event Sampling Locations (▲) for MDCH/ATSDR Exposure Investigation at Continental Aluminum ( ☆ )

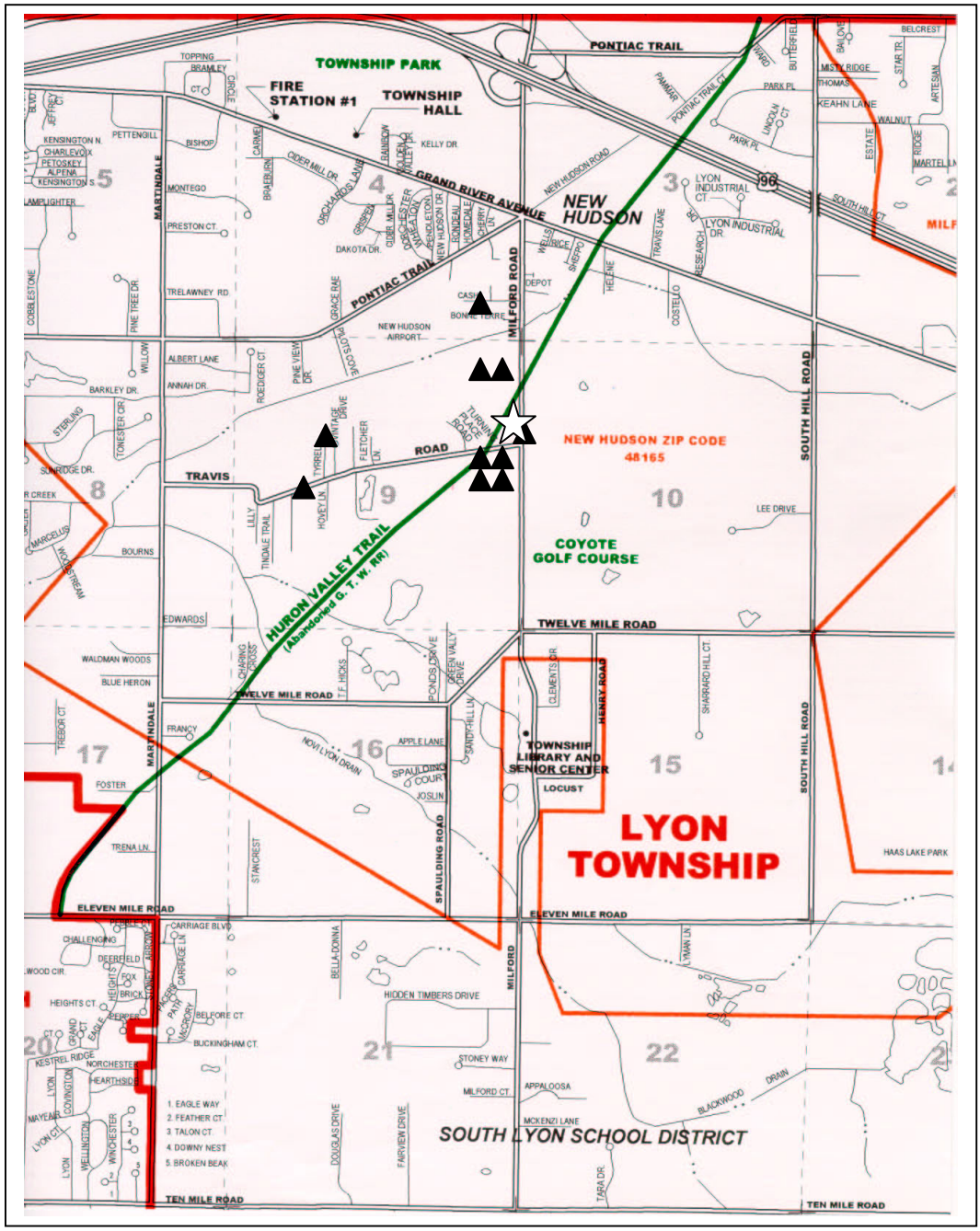
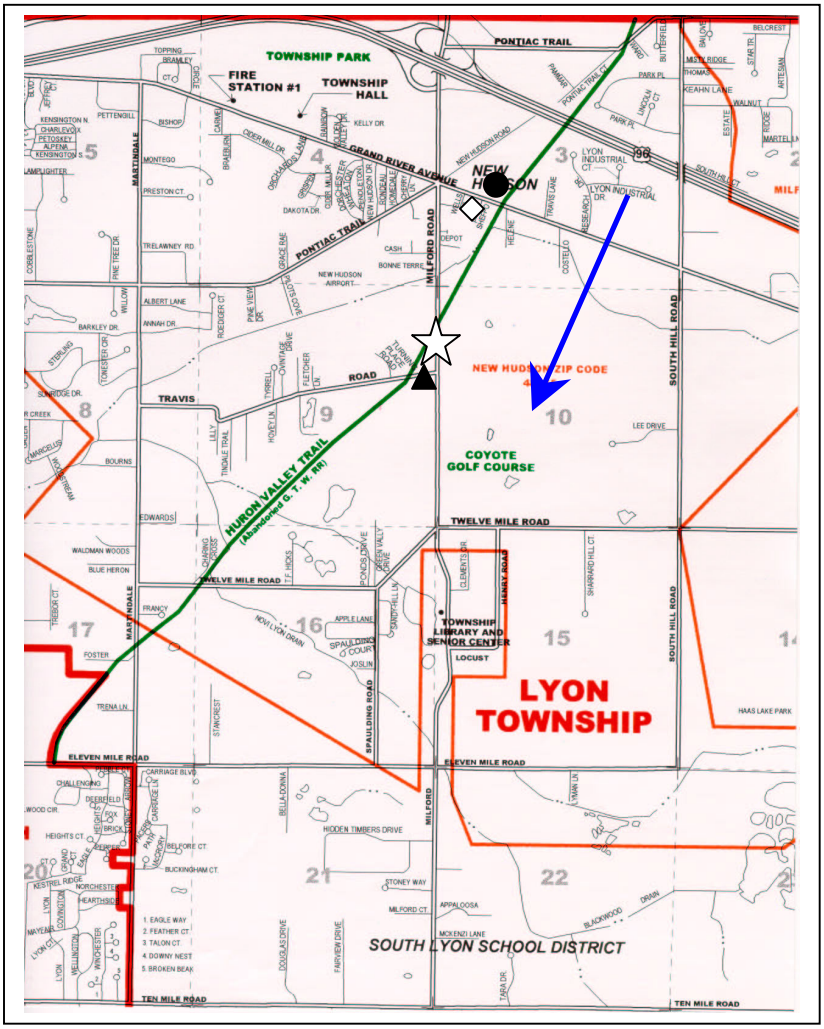


Figure 4. Details of Summa canister sampling conducted 3/16/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Travis Rd 1
0.23 mi from Continental Aluminum
**Sample Date**: 3/16/2004
**Sample Times** (military):
Odor = 18:50
Control = 18:57
**Meteorological Parameters** (from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 5-12
Wind Direction (°) = 13-27
Pressure (mm Hg) = NA (see note)
Humidity (%) = NA (see note)
Temperature (°C) = -3

**Odor Semiquadrant** = 7
**Control Semiquadrant** = 3
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

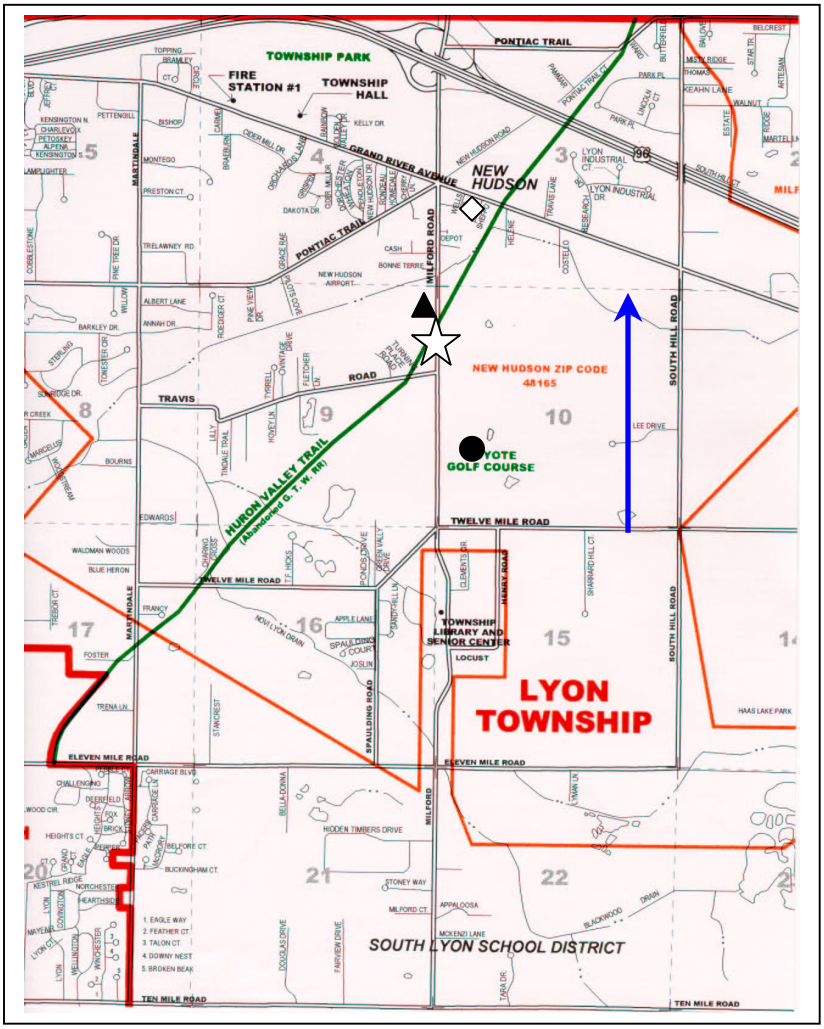
**Notes**:
Due to mechanical difficulties, barometric pressure and relative humidity were not available from the air-monitoring trailer at Dolsen Elementary School in New Hudson for this date. The 18:00-19:00 averages for those parameters at the MDEQ Ypsilanti monitoring station on this date were 762.76 and 83, respectively. (In general, pressure at Ypsilanti ran about 30 mm Hg greater than that at New Hudson.)

Figure 5. Details of Summa canister sampling conducted 3/24/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Milford Rd 1
0.15 mi from Continental Aluminum
**Sample Date**: 3/24/2004
**Sample Times** (military):
Odor = 11:03
Control = 11:06
**Meteorological Parameters**
(from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 4-8
Wind Direction (°) = 177-193
Pressure (mm Hg) = 738.0-738.1
Humidity (%) = 92-93
Temperature (°C) = 6

**Odor Semiquadrant** = 2
**Control Semiquadrant** = 6
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*Somewhat.*
If yes, did SPM detect any acidic aerosols?
*No.*




Odor sample location = ▲; control sample location = ●; Continental Aluminum = ☆; air monitoring trailer = ◇; approximate wind direction = ⟶

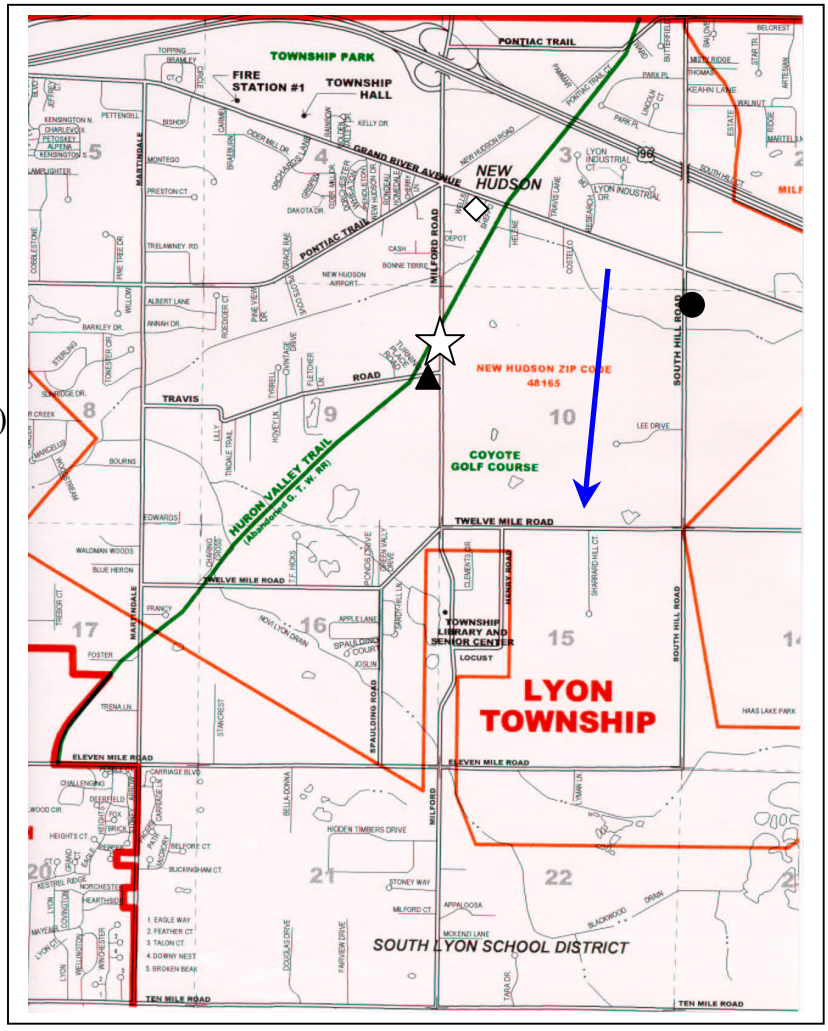
**Notes**:
None.

Figure 6. Details of Summa canister sampling conducted 3/31/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Travis Rd 2
0.24 mi from Continental Aluminum
**Sample Date**: 3/31/2004
**Sample Times** (military):
Odor = 16:09
Control = 16:20
**Meteorological Parameters**
(from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 7-12
Wind Direction (°) = -6-18 (see note)
Pressure (mm Hg) = 734.1-734.2
Humidity (%) = 69-71
Temperature (°C) = 5

**Odor Semiquadrant** = 8 (see note)
**Control Semiquadrant** = 4 (see note)
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●; Continental Aluminum = ☆; air monitoring trailer = ◇; approximate wind direction = ⟶

**Notes**:
The weathervane crossed north during the elapsed time. When crossing north clockwise, compass direction changes from 359° to 0° (versus 360°). Most of the wind direction readings during the elapsed time for this sampling event were east of north (in the teens). Therefore, for the single west-of-north direction, MDCH subtracted 360° from the reading, 354° (= -6°), to indicate that the weathervane rotated only a few degrees in a minute's time.

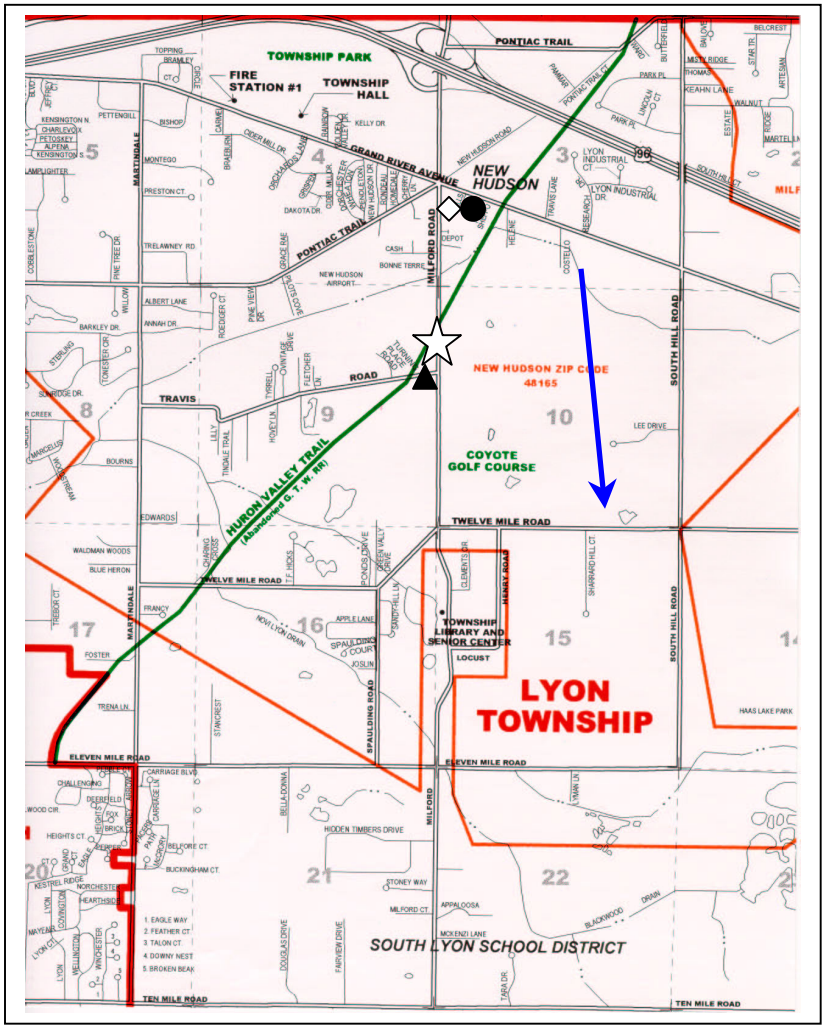
Odor Semiquadrant should have been recorded 7 (and the Control, therefore, 3), to match the delineations in Figure 2. However, the odor event site was located near the division between semiquadrants 7 and 8. MDCH considers the data still to be valid.

Figure 7. Details of first Summa canister sampling conducted 4/2/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Travis Rd 3
0.24 mi from Continental Aluminum
**Sample Date**: 4/2/2004
**Sample Times** (military):
Odor = 9:06
Control = 9:17
**Meteorological Parameters** (from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 3-11
Wind Direction (°) = 342-361 (see note)
Pressure (mm Hg) = 733.6-733.7
Humidity (%) = 77-79
Temperature (°C) = 3-4

**Odor Semiquadrant** = 7
**Control Semiquadrant** = 3 (see note)
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

**Notes**:
The weathervane crossed north during the elapsed time. When crossing north clockwise, compass direction changes from 359° to 0° (versus 360°). Most of the wind direction readings during the elapsed time for this sampling event were west of north (340°s-350°s). Therefore, for the single east-of-north direction, MDCH added the reading, 1°, to 360° (= 361°), to indicate that the weathervane rotated only a few degrees in a minute's time.

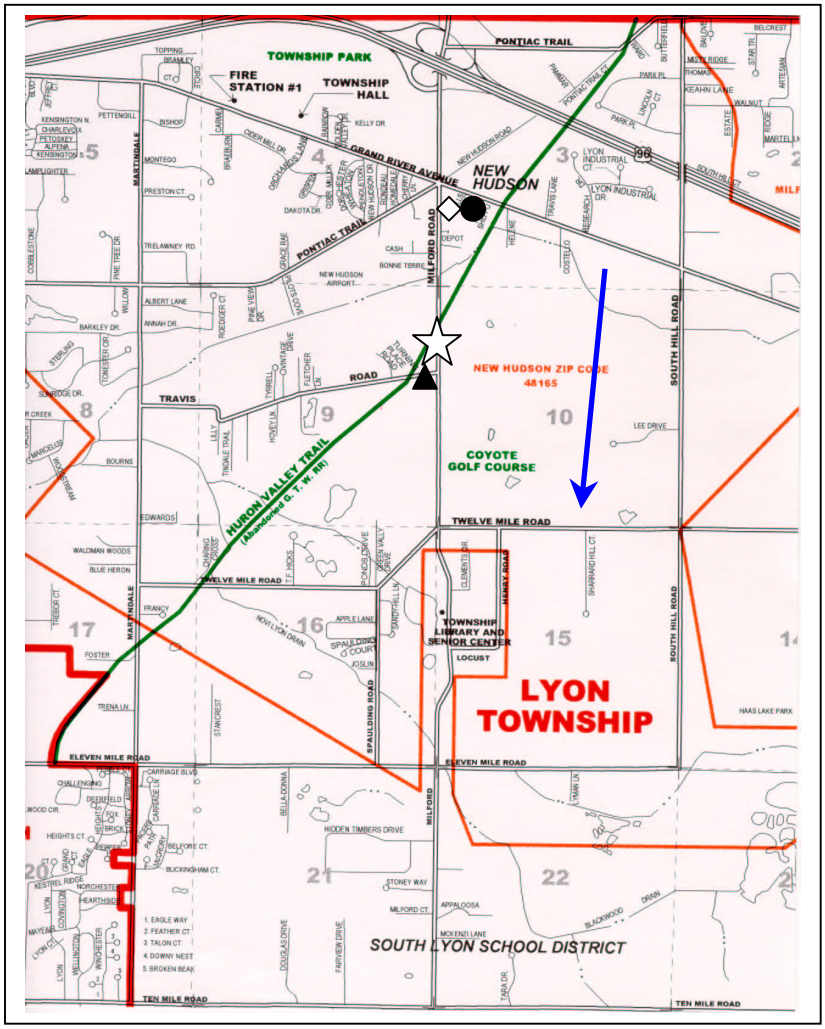
The Control Semiquadrant 3 sampling location was at the parking area on the north side of Grand River Avenue where the Huron Valley Trail crosses the road. The samplers mistakenly took the control sample for this event at Dolsen Elementary School, nearby and in the same semiquadrant. MDCH considers the data still to be valid.

Figure 8. Details of second Summa canister sampling conducted 4/2/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Travis Rd 4
0.24 mi from Continental Aluminum
**Sample Date**: 4/2/2004
**Sample Times** (military):
Odor = 13:41
Control = 13:44
**Meteorological Parameters** (from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 5-10
Wind Direction (°) = 330-378 (see note)
Pressure (mm Hg) = 733.5-733.6
Humidity (%) = 58-59
Temperature (°C) = 9-10

**Odor Semiquadrant** = 7
**Control Semiquadrant** = 3 (see note)
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

**Notes**:
The weathervane crossed north during the elapsed time. When crossing north clockwise, compass direction changes from 359° to 0° (versus 360°). Most of the wind direction readings during the elapsed time for this sampling event were west of north (330°s-340°s). Therefore, for the highest east-of-north direction, MDCH added the reading, 18° degrees, to 360° (= 378°), to indicate that the weathervane rotated only a few degrees in a minute's time.

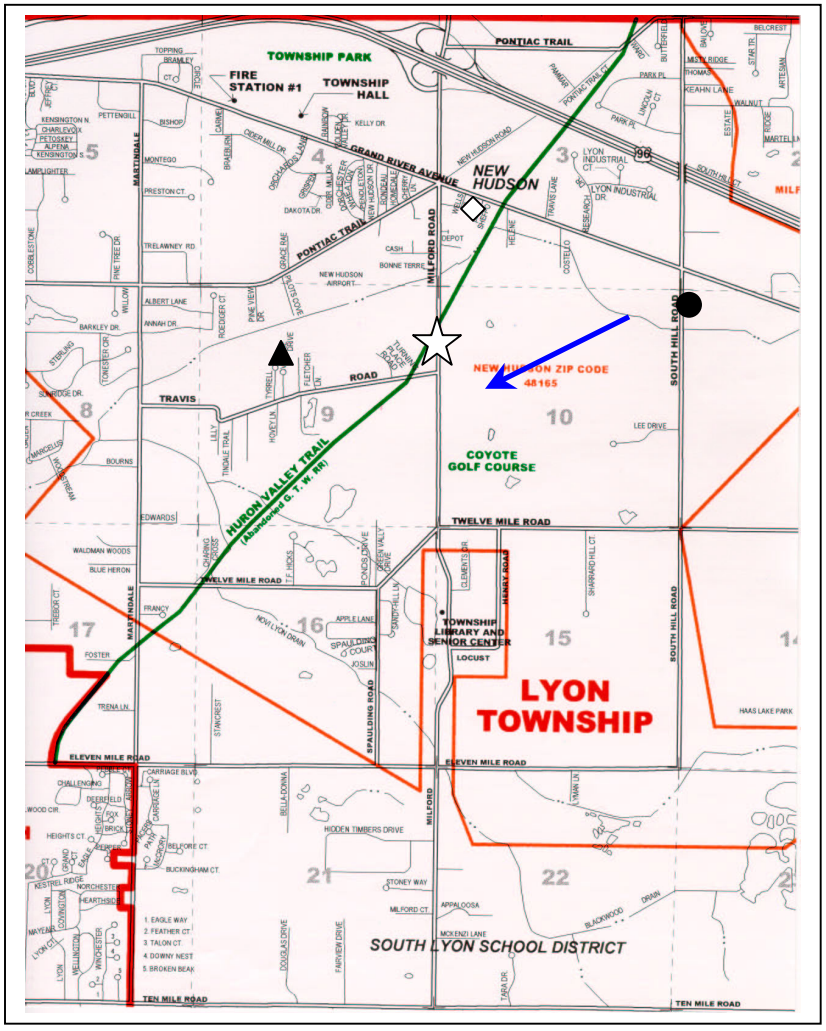
The Control Semiquadrant 3 sampling location was at the parking area on the north side of Grand River Avenue where the Huron Valley Trail crosses the road. The samplers mistakenly took the control sample for this event at Dolsen Elementary School, nearby and in the same semiquadrant. MDCH considers the data still to be valid.

Figure 9. Details of Summa canister sampling conducted 4/12/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Tyrrell Ln
0.67 mi from Continental Aluminum
**Sample Date**: 4/12/2004
**Sample Times** (military):
Odor = 13:20
Control = 13:31
**Meteorological Parameters**
(from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 5-10
Wind Direction (°) = 46-73
Pressure (mm Hg) = 737.5-737.7
Humidity (%) = 35-37
Temperature (°C) = 7-9

**Odor Semiquadrant** = 8
**Control Semiquadrant** = 4
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

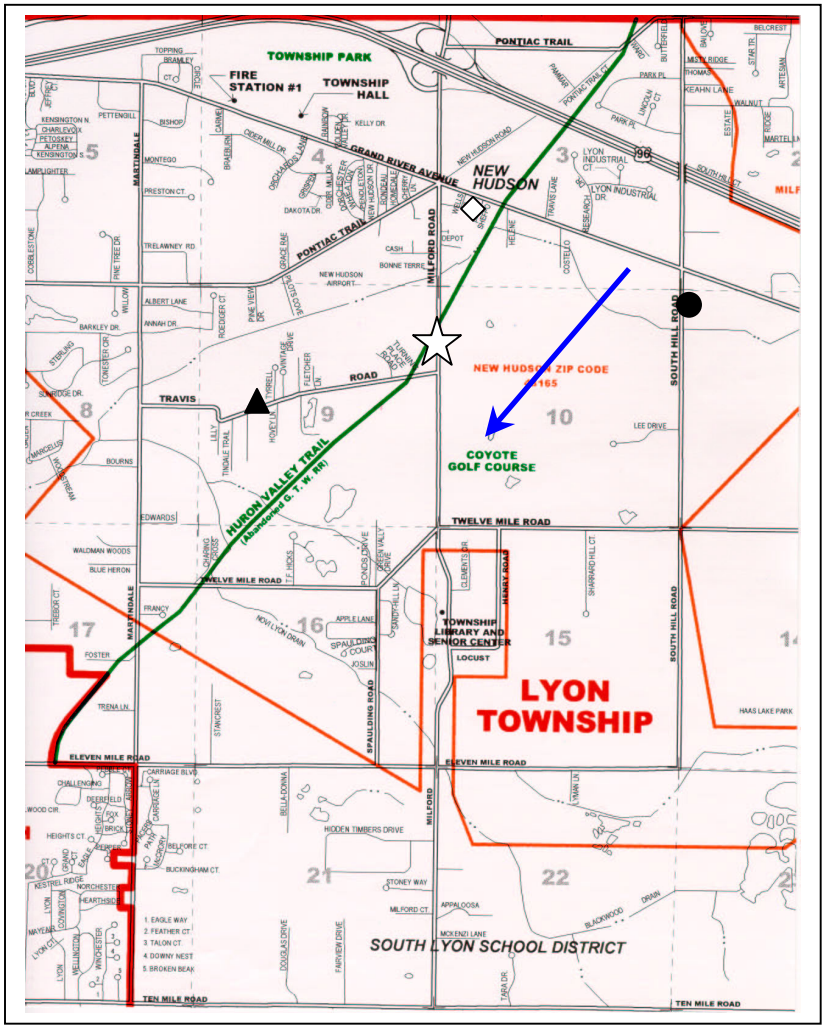
**Notes**:
None.

Figure 10. Details of Summa canister sampling conducted 4/22/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Travis Rd 6
0.71 mi from Continental Aluminum
**Sample Date**: 4/22/2004
**Sample Times** (military):
Odor = 14:07
Control = 14:15
**Meteorological Parameters**
(from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 3-6
Wind Direction (°) = -28-73
(see note)
Pressure (mm Hg) = 737.4
Humidity (%) = 47-50
Temperature (°C) = 13

**Odor Semiquadrant** = 8
**Control Semiquadrant** = 4
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

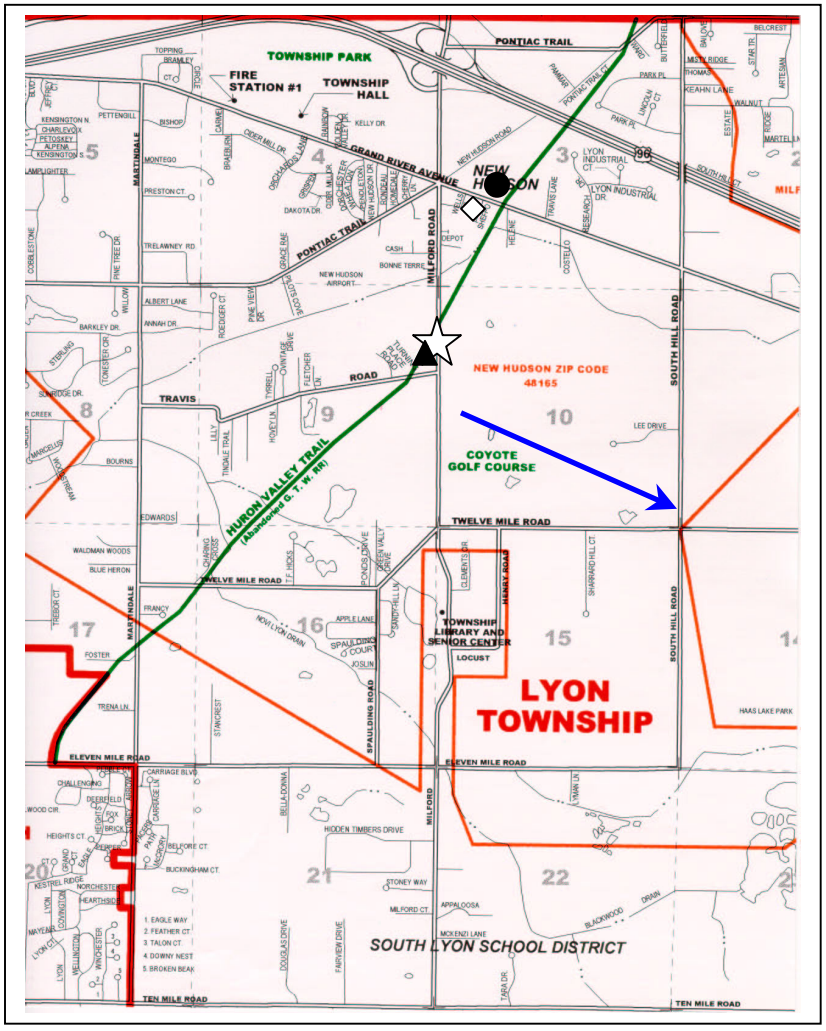
**Notes**:
The weathervane crossed north during the elapsed time. When crossing north clockwise, compass direction changes from 359° to 0° (versus 360°). Most of the wind direction readings during the elapsed time for this sampling event were east of north. Therefore, for the west-of-north directions, MDCH subtracted 360° from the westernmost reading, 332° (= -28°), to indicate that the weathervane rotated only a few degrees in a minute's time.

Figure 11. Details of Summa canister sampling conducted 4/27/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Milford Rd 2
0.13 mi from Continental Aluminum
**Sample Date**: 4/27/2004
**Sample Times** (military):
Odor = 15:25
Control = 15:35
**Meteorological Parameters**
(from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 4-13
Wind Direction (°) = 284-318
Pressure (mm Hg) = 734.3-734.4
Humidity (%) = 51-52
Temperature (°C) = 2-3

**Odor Semiquadrant** = 7
**Control Semiquadrant** = 3
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*No.*
If yes, did SPM detect any acidic aerosols?
*(not applicable)*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

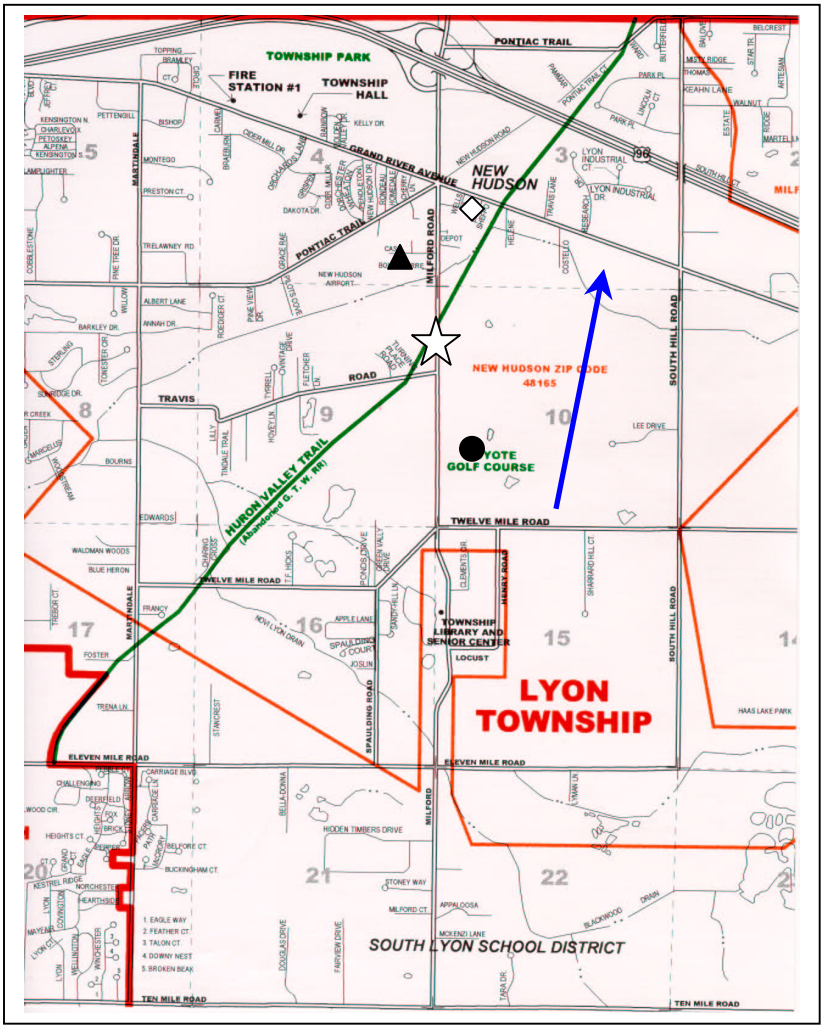
**Notes**:
None.

Figure 12. Details of Summa canister sampling conducted 4/28/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Cash St
0.31 mi from Continental Aluminum
**Sample Date**: 4/28/2004
**Sample Times** (military):
Odor = 16:20
Control = 16:35
**Meteorological Parameters**
(from 5 minutes before odor sample to time of control sample):
Wind Speed (mph) = 9-17
Wind Direction (°) = 179-201
Pressure (mm Hg) = 732.7-732.9
Humidity (%) = 29-30
Temperature (°C) = 20

**Odor Semiquadrant** = 2
**Control Semiquadrant** = 6
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*Yes.*
If yes, did SPM detect any acidic aerosols?
*No.*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

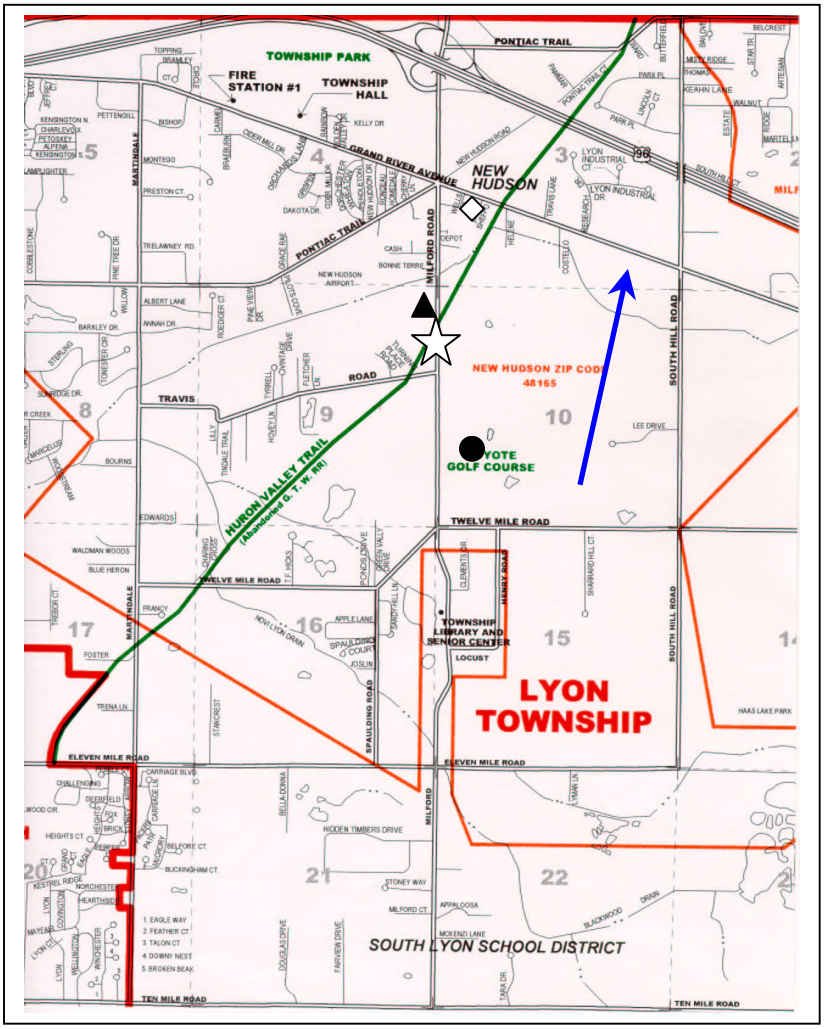
**Notes**:
None.

Figure 13. Details of Summa canister sampling conducted 5/18/2004 for MDCH/ATSDR Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan.

**Sample ID** (MDCH): Milford Rd 3
0.15 mi from Continental Aluminum
**Sample Date**: 5/18/2004
**Sample Times** (military):
Odor = 2:07
Control = 2:11
**Meteorological Parameters** (see note):
Wind Speed (mph) = 3-4
Wind Direction (°) = 199-205
Pressure (mm Hg) = NA (see note)
Humidity (%) = NA (see note)
Temperature (°C) = 19

**Odor Semiquadrant** = 2
**Control Semiquadrant** = 6
(refer to Figure 2 for semiquadrant layout)

Was air-monitoring trailer downwind from odor event?
*Yes.*
If yes, did SPM detect any acidic aerosols?
*Yes (see text).*




Odor sample location = ▲; control sample location = ●;
Continental Aluminum = ☆; air monitoring trailer = ◇;
approximate wind direction = ⟶

**Notes**:
The minute data for the meteorological parameters were not available from the air monitoring trailer at Dolsen Elementary School for this event, due to an overloaded database. Hourly averages for 1:00-3:00 are shown for wind speed, wind direction, and temperature. Local pressure and humidity were not available, likely for the same reason. The 2:00-3:00 averages for those parameters at the MDEQ Ypsilanti monitoring station on this date were 762.5 mm Hg and 90%, respectively. (In general, pressure at Ypsilanti ran about 30 mm Hg greater than that at New Hudson.)

# Exposure Investigation Protocol: The Identification of Air Contaminants Around the Continental Aluminum Plant in New Hudson, Michigan

## Conducted by ATSDR and MDCH

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# Acronyms and Abbreviations

| | |
|---|---|
| AEGL | Acute Exposure Guideline Level |
| ATSDR | Agency for Toxic Substances and Disease Registry |
| CalEPA | California Environmental Protection Agency |
| CaREL | California Reference Exposure Level |
| CASRN | Chemical Abstract Service Registration Number |
| DOE | Department of Energy |
| EMEG | Environmental Media Evaluation Guide |
| ERG | Eastern Research Group |
| ERPG | Emergency Response Planning Guideline |
| ICP | Inductively Coupled Plasma |
| LOAEL | Lowest Observed Adverse Effect Level |
| MDCH | Michigan Department of Community Health |
| MDEQ | Michigan Department of Environmental Quality |
| mg | milligrams |
| $mg/m^3$ | milligrams per cubic meter |
| NIOSH | National Institute of Occupational Safety and Health |
| NOAEL | No Observed Adverse Effect Level |
| ppb | parts per billion |
| ppbv | parts per billion of volume |
| RfC | Reference Concentration |
| SOP | Standard Operating Procedure |
| SPM | Single Point Monitor |
| TEEL | Temporary Emergency Exposure Limit |
| TSP | Total Suspended Particulates |
| U.S. EPA | U.S. Environmental Protection Agency |
| VOC | volatile organic compound |

## OBJECTIVE/PURPOSE

The Michigan Department of Community Health (MDCH), under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR), will monitor ambient concentrations of selected volatile organic compounds (VOCs), mineral acids, and metals in Lyon Township, Michigan. Analytical results will be compared to meteorological data and odor complaint information to determine if there is a scientifically plausible link between community health concerns and concentrations of certain air contaminants. Results and interpretations will be shared with residents, governmental, and industrial stakeholders.

The primary objective of this Investigation is to determine what chemicals at what concentrations are in the air when odor events are reported. The questions to be answered are:

1. What VOCs, at what concentrations, are detected in the air during odor events? Are the concentrations above background, or control, levels?
2. Is hydrogen chloride or hydrogen fluoride detectable in the air during odor events? Is there a temporal (time) trend to the detection of these acids?
3. What metals (airborne particulates), at what concentrations, are in the air?
4. Is it plausible that the earlier reported health effects are associated with detected chemicals and concentrations?
5. When an odor event occurs, do meteorological data indicate that the Continental Aluminum plant is upwind of the odor detection (i.e., is it plausible that Continental Aluminum is the source of the odor)?

ATSDR and MDCH reserve the right to amend this Protocol if the agencies deem such action necessary in order to complete this Exposure Investigation. Any modification is not expected to change the protocol significantly.

## RATIONALE

This Exposure Investigation is being conducted in response to a petition to ATSDR for a public health assessment of the emissions from Continental Aluminum, a secondary aluminum refinery located in New Hudson in Lyon Township, Michigan. Local residents and off-site workers have complained of odors from the facility and of various health effects which they associate with the plant's emissions. Although stack test data are available for hydrogen chloride, hydrogen fluoride, chlorine, particulate matter, dioxins, furans, and total VOCs, there are no data available for ambient air concentrations of any chemicals during odor events. Stack test data and air dispersion modeling indicate that off-site concentrations of the chemicals mentioned would be below state action levels. However, there is concern that there may be a significant amount of fugitive emissions, which would not be represented by stack test data. Also, air modeling of the stack emissions may underestimate actual conditions if fugitive emissions are indeed present. Therefore, MDCH and ATSDR will conduct ambient air sampling and monitoring to evaluate the public health impact of the air quality.

## BACKGROUND

A. Site Description

Continental Aluminum recycles scrap aluminum, providing alloys for the automotive industry and deoxidizing products to the steel industry. Scrap is visually inspected when it arrives at the plant and may be shredded. Iron scrap and non-metallics are separated out before the scrap is placed in the furnace. Emissions from the charge wells of each reverberatory furnace and from the rotary furnace are routed through lime-injected baghouses before being released to the atmosphere. Emissions from the main combustion chambers of the furnaces are released directly to the atmosphere (ATSDR 2002, 2003).

Residential communities are located north, northeast, and southwest of the plant. The Oakland Southwest Airport is northwest of the site, and several businesses and light industry are immediately to the south. Dolson Elementary School is located one-half mile northeast of the site. To the east, southeast, and west of the plant is agricultural/open land.

B. Reported Health Effects

The most frequently reported health effects are irritation to the mucous membranes: nose bleeds, sore throat, coughing, difficulty in breathing, and burning eyes. During odor events attributed to the facility, a “tin can” or “varnish” taste in the mouth and a “burnt plastic” odor have been reported. Many residents reported that they would leave their homes in order to avoid the ill effects associated with the odors. Noise and odor are especially bothersome at night (ATSDR 2002, 2003).

C. Public Health Assessment Activities

In December 2001, ATSDR received a petition requesting a public health assessment for Lyon Township, focusing on air, water, and soil contamination. The source of the alleged contamination was thought to be Continental Aluminum. In March 2002, ATSDR and MDCH staff traveled to New Hudson to conduct a site visit at the facility and to meet informally with several community members. After reviewing stack testing data and air dispersion modeling results, ATSDR and MDCH concluded in a Health Consultation that the health hazard presented by emissions from Continental Aluminum was indeterminate and that an Exposure Investigation might provide more information (ATSDR 2002, 2003). A public meeting was held in November 2002 to gather and respond to public comments on the Health Consultation.

## AGENCY ROLES

MDCH is the lead agency for this Investigation and is responsible for:

- defining what constitutes an "odor event" so that a grab air sample may be taken;
- choosing or establishing health-based comparison values to which environmental data will be compared;
- acquiring the monitoring and meteorological equipment needed through the Michigan Department of Environmental Quality (MDEQ), Michigan District Health Department #4, Eastern Research Group, Zellweger Analytics, and DataChem Laboratories, Inc.;
- coordinating the location of monitoring and meteorological equipment with MDEQ, Lyon Township, property owners or managers, and any necessary utility companies;
- arranging for training of samplers in taking a grab sample with a Summa canister;
- coordinating monitoring/sampling activities between MDCH, the Lyon Township Fire Department, the Oakland County Sheriff's Department, and the Oakland County Health Department;
- collecting odor complaint information submitted to Lyon Township;
- comparing analytical results to meteorological data and odor complaint information, interpreting the findings and reporting them to the stakeholders;
- addressing stakeholder comments and questions.

## ESTABLISHING CRITERIA

### "Odor Events"

The Michigan Department of Environmental Quality (MDEQ) Air Division investigates odor complaints to determine if a Rule 901(b) violation is occurring. This rule falls under R336.1901 of the Air Pollution Control Rules, Part 9, Emission Limitations and Prohibitions – Miscellaneous, as amended May 28, 2002, and states:

> "….A person shall not cause or permit the emission of an air contaminant or water vapor in quantities that cause, alone or in reaction with other air contaminants ... (b) Unreasonable interference with the comfortable enjoyment of life and property."

As phrased, it is difficult to ascertain what would be generally recognized or defined as an "unreasonable interference." Both terms are subjective.

For the purposes of this Investigation, an "odor event" will be defined as "the occurrence or detection of an odor that is associated, by the person(s) detecting and reporting it, with emissions from Continental Aluminum." According to MDEQ compliance personnel who investigate odor complaints, the criteria they consider when determining if a Rule 901(b) violation is occurring are **frequency, duration, and intensity** of the odor (2003, R. Pinga, MDEQ-Southeast District Air Division, personal communication). Regarding the **frequency** of an "odor event", if odors occur sporadically, it would likely be ineffective to alert sampling personnel to the event. Therefore, the **duration** of an "odor event" should be such that the odor would likely still be present if sampling personnel were to arrive at least 15 minutes after the odor is detected. It is understood that this is a subjective determination and involves guesswork on the part of the person who detects the odor and reports it. It will be required, prior to a sample being taken, that the person taking the air sample can detect the odor, at the sampling location for the odor event, as well. (If a representative for Continental Aluminum is present at the sampling event, it is not required that the plant's designee be able to detect an odor for a sample to be taken.) Thus, the **intensity** of the odor should be such that more than one person can detect the odor. It is not necessary that those detecting the odor have the same reaction to it (e.g., mucous membrane irritation, nausea, no reaction).

A Sampling Event Documentation form (Appendix A) will be filled out each time a sampler attends to an odor event, regardless of whether a sample is ultimately taken. A detailed description of the sampling protocol is listed in the Methods section.

### Comparison Values

The Comparison (Screening Level) Values to be used in the Exposure Investigation for Continental Aluminum are described below and listed in order of preference. The values for Volatile Organic Compounds (VOCs) detected by U.S. EPA Method TO-15, mineral

acids that can be monitored by the Single Point Monitor, and selected metals detected by NIOSH Method 7300 are listed in Tables 1, 2, and 3, respectively. Sampling protocols are described in the Methods section.

**California Reference Exposure Levels** (CaRELs), as developed by the California Environmental Protection Agency (CalEPA), are based on the most appropriate and sensitive adverse health effects. CalEPA places a heavy emphasis on available human data when developing these values, as evidenced by 34 of the 51 CaRELs developed being based on observed human health outcomes. The agency adjusts traditional 10-fold default values for uncertainty factors in specific cases due to scientific improvements in considering the extrapolation of the LOAEL (lowest observed adverse effect level) to a NOAEL (no observed adverse effect level). The agency considers the severity of the health effects involved as well (CalEPA 1999).

These health-based values are applicable to risk characterization of air releases, defined in California's Health and Safety Code Section 44303, as "including actual or potential spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of a substance into the ambient air and that results from routine operation of a facility or that is predictable, including, but not limited to continuous and intermittent releases and predictable process upsets or leaks" (CalEPA 1999). This differentiates the CaRELs from AEGLs and ERPGs/TEELs (discussed below), which pertain to emergency releases. ATSDR/MDCH chose to use the CaRELs as the primary Screening Level in this Investigation because MDEQ odor complaint investigation reports did not indicate any emergency releases from the Continental Aluminum plant. Therefore, it is assumed that the odors reported by the community are occurring during routine operation of the facility.

CaRELs are based on a one-hour averaging time for most chemicals. Values with longer averaging times are derived from studies with a reproductive/developmental endpoint. CaRELs are designed to protect the general public, including sensitive subgroups. Exposure to a specific chemical should not exceed its CaREL more than once every two weeks over the course of a year (CalEPA 1999).

If a detected chemical does not have a corresponding CaREL, ATSDR/MDCH will compare the detected concentration to the Acute Exposure Guideline Level for that chemical. The U.S. EPA **Acute Exposure Guideline Levels** (AEGLs) are developed by the National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances. The committee has members from government, industrial, academic, and private organizations. The primary use of AEGLs is to assist organizations with emergency planning, response, and prevention programs. The values in the attached tables are not yet considered final, pending review by the National Academy of Sciences review committee (NRC 2002).

There are three levels of guidelines:

•AEGL-1 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable

discomfort, irritation, or certain asymptomatic nonsensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure. Airborne concentrations below AEGL-1 represent exposure levels that can produce mild and progressively increasing but transient and nondisabling odor, taste, and sensory irritation or certain asymptomatic, nonsensory adverse effects.

•AEGL-2 represents the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

•AEGL-3 is the airborne concentration of a substance above which it is predicted that the general population, including susceptible individuals, could experience life-threatening health effects or death.

With increasing airborne concentrations above each AEGL, there is a progressive increase in the likelihood of occurrence and the severity of effects described for that level. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma, and those with other illnesses, U.S. EPA recognizes that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL (NRC 2002).

Several averaging times are possible for all three levels: 5, 10, 30, and 60 minutes, and 4 and 8 hours (NRC 2002). Most of the chemicals to be tested for in this Investigation do not have AEGLs for the 5-minute averaging time. Therefore, the minimum averaging time for AEGLs used in this Investigation will be 10 minutes.

If a detected chemical does not have a corresponding CaREL or AEGL, ATSDR/MDCH will compare the detected concentration to the Emergency Response Planning Guideline or Temporary Emergency Exposure Level for that chemical. The American Industrial Hygiene Association developed the **Emergency Response Planning Guidelines** (ERPGs) and **Temporary Emergency Exposure Limits** (TEELs) for the U.S. Department of Energy (DOE) for use in evaluating the effects of accidental chemical releases on the general public. ERPGs and TEELs are estimates of concentration ranges for specific chemicals above which acute exposure would be expected to lead to adverse health effects of increasing severity for each hierarchal step. Because many chemicals of interest lack ERPGs, TEELs are used for those chemicals until ERPGs are established (Craig and Lux 1998).

Human data are given primary consideration, and rat data are preferred over that for other animal species, in deriving ERPGs and TEELS. Inhalation data are preferred over data from other routes of uptake. Approximately 754 chemicals have been evaluated, 77 of which now have official ERPGs, the remainder having TEELs (Craig and Lux 1998).

There are 3 levels of ERPGs:

•ERPG-1 represents the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing other

than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

•ERPG-2 is the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing irreversible or other serous health effects or symptoms that could impair their abilities to take protective action.

•ERPG-3 represents the maximum concentration in air below which it is believed nearly all individuals could be exposed for up to one hour without experiencing or developing life-threatening health effects.

There are 4 levels of TEELs:

•TEEL-0 is the threshold concentration below which most people will experience no appreciable risk of health effects.

•TEEL-1 is the maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

•TEEL-2 represents the maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

•TEEL-3 is the maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

The DOE recommends that, for application of TEELs, the concentration at the receptor point of interest be calculated as the peak 15-minutes time-weighted average concentration (Craig and Lux 1998).

Detected chemicals will also be compared to their respective ATSDR air Comparison Values. **ATSDR Environmental Media Evaluation Guides** (EMEGs) represent concentrations of substances in an environmental medium to which humans may be exposed during a specified period of time (acute, intermediate, or chronic) without experiencing adverse health effects. Acute exposures are defined as 14 days or less. Intermediate exposures are those lasting 15 days to 1 year. Chronic exposures last more than 1 year. For exposures to substances in soil or water, EMEGs consider dose per body weight and differ between adults and children. For exposure to substances in air, EMEGs are expressed as air concentrations and are the same for adults and children (ATSDR 2002).

EMEGs are based on toxicity information that considers noncarcinogenic toxic effects of chemicals, including their developmental and reproductive toxicity. An air EMEG is derived only from inhalation data and does not try to extrapolate data from different exposure routes (ATSDR 2002).

EMEGs are used as screening tools. Substances found at concentrations below EMEGs are not expected to pose public health hazards. Substances found at concentrations above

EMEGs require further evaluation before a public health conclusion can be drawn (ATSDR 2002).

Lastly, detected chemicals will be compared to their respective **EPA Reference Concentrations** (RfCs). An RfC is an estimate of a daily exposure to a substance in air that is likely to be without a discernable risk of adverse effects to the general human population, including sensitive subgroups, during a lifetime of exposure. RfCs are derived from the NOAEL or LOAEL of a study by application of uncertainty factors. By allowing for potential orders of magnitude of uncertainty, a protective value is derived. The EPA assumes that a threshold exists for noncarcinogens, that levels below a chemical's threshold will have no adverse effects (EPA 1989).

Of the 58 VOCs listed in Table 1, tert-amyl methyl ether (CASRN 994-05-8) and ethyl tert-butyl ether (CASRN 637-92-3) do not have any of the corresponding Screening Levels used in this Investigation. Both of these compounds are gasoline oxygenates, fuel additives that decrease carbon monoxide emissions. We do not expect to find these compounds in the aluminum scrap. Therefore, for this Investigation, we will not consider tert-amyl methyl ether and ethyl tert-butyl ether chemicals of interest unless the data indicate a concentration of greater than 50,000 ppb, the TEEL-0 for methyl tert-butyl ether, a more well-known and -characterized gasoline oxygenate.

Of the 6 mineral acids listed in Table 2, hydrogen iodide (CASRN 10034-85-2) does not have any of the corresponding Screening Levels used in this Investigation. Only recently has the U.S. EPA begun discussions on the development of AEGLs for hydrogen iodide (EPA 2003). Hydrogen iodide, along with hydrogen bromide, nitric acid, and sulfuric acid, is not listed as an expected emission from an aluminum recycling smelter such as Continental Aluminum (EPA 1986, 1995). Therefore, a Screening Level for hydrogen iodide is not necessary for this Investigation.

# METHODS

(Note: Mention of trade names or commercial products does not constitute MDCH or ATSDR endorsement or recommendation for use.)

Instantaneous ("Grab") Air Sampling

The Standard Operating Procedure (SOP) for instantaneous air sampling during this Investigation is based upon the U.S. EPA Environmental Response Team Standard Operating Procedures for Field Analytical Procedures, SOP #1704, Summa Canister Sampling (EPA 1995) and the State of Nevada Division of Environmental Protection Summa Canister Sampling SOP for the Fallon site (State of Nevada 2001).

**1.0 Scope and Application**

The purpose of this SOP is to describe a procedure for sampling of volatile organic compounds (VOCs) in ambient air. The method is based on samples collected as whole air samples in Summa stainless steel canisters. The VOCs are subsequently separated by gas chromatography (GC) and measured by mass-selective detector or multidetector techniques (EPA 1999).

This method is applicable to specific VOCs that have been tested and determined to be stable when stored in pressurized and subatmospheric pressure canisters. These compounds have been measured at the parts per billion by volume (ppbv) level. Eastern Research Group (ERG), the laboratory responsible for analysis, reports detection limits for VOCs ranging from 0.05 to 1.24 ppbv using EPA Method TO-15.

**2.0 Method Overview**

(A detailed procedure is listed in Section 8.0.)

ERG will prepare the Summa canisters and ship them to MDCH. MDCH will arrange for training of samplers in appropriate air sampling techniques and the proper handling and shipping of samples taken. After training is completed, the canisters will be placed in the custody of the samplers.

When an "odor event," as defined earlier in this document, occurs, the person detecting the odor will call the appropriate telephone number to notify samplers. Dependent on the time of day, either fire or police personnel, if not currently engaged in another call, will be dispatched to the address where the odor event is occurring and collect an air sample. If emergency personnel are attending an emergency, then a designated alternate sampler may be notified. If sampling personnel are available to proceed immediately to the scene, a representative from Continental Aluminum may be contacted so that the company can witness the sampling event. (This courtesy will be extended for half of the events.)

Subatmospheric-pressure sampling uses an initially evacuated canister. The canister has a hand valve and may have a fixed orifice to regulate flow. Alternatively, airflow into the

canister can be grossly controlled by the degree to which the sampler rotates the hand valve. For this Investigation, the samples will be grab (instantaneous) samples; therefore, a fixed orifice on the canister or gross timing of the samples is not necessary.

When taking the sample, the sampler will stand on public property (e.g., sidewalk, shoulder of road) as close to the address of the scene as possible. (Private property testing would require that the property owner sign a release form. Public property testing would not require this. Also, private property testing might be considered "human research" and be subject to agency internal review processes.) The sampler will hold the canister at the approximate breathing height of an adult, about 5 feet, open the hand valve a quarter turn until the sound changes as the vacuum diminishes, and then close the valve.

Following the sampling at the address where the odor was reported, sampling personnel will proceed to the designated control site to obtain a "control" air sample in another canister. Eight control sites will be selected before the Investigation begins. These sites will be located in separate semi-quadrants of a circle, with the Continental Aluminum property as the center of that circle. If an odor event is sampled in one semi-quadrant, samplers will take the control air sample in the semi-quadrant opposite. It is understood that the control air sample may be down-, up-, or crosswind to Continental Aluminum. The analytical data will be compared to meteorological data to determine if the plant is a potential source of the odor.

No more than one odor-sampling event will occur per 6-hour period, bounded by 6 o'clock AM, 12 noon, 6 o'clock PM, and 12 midnight, per day. This will allow for efficient use of the canisters while allowing additional data collection on especially odorous days. This Investigation allows a maximum of 10 sampling events (10 odor samples and 10 control samples, plus 1 field blank for every 6 canisters).

## 3.0 Equipment/Materials Provided

The sampling equipment provided is a VOC canister sampler – a whole-air sampler capable of filling an initially evacuated canister, by action of the hand valve, from vacuum to near atmospheric pressure. Other materials provided are the Sampling Event Documentation sheet (Appendix A), Chain of Custody form (Appendix A), and shipping containers.

## 4.0 Sample Preservation, Containers, Handling, and Storage

The sampler will complete the Sampling Event Documentation sheet, Chain of Custody form, and the sealing and packaging of the sample before leaving the scene. The sampler will then return these items to the Lyon Township offices. The Township will fax the Sampling Event Documentation sheet to MDCH and will mail the sample and Chain of Custody form to ERG (postage covered by ATSDR/MDCH).

ERG will acknowledge receipt of the canister by faxing a copy of the completed Chain of Custody form to MDCH. The sample will be analyzed in the order it was received, with expedited turnaround time being no longer than 10 business days. ERG will send the analytical results to MDCH who will interpret the results.

Canisters should be stored in a cool dry place. If a canister is in storage past its shelf-life of 30 days, it should be replaced. Canisters should not be dented or punctured. Care must be taken not to exceed 40 psi in the canister (do not heat canister above 140°F). Therefore, if the sampling takes place on a sunny or hot day, the canister should not be placed in a vehicle for an extended time but should be transported to the Lyon Township offices as soon as possible after the sample is taken.

**5.0 Health and Safety**

It is not expected that any chemical exposure occurring during odor sampling will result in long-term health effects. It is possible that sampling personnel will experience short-term irritant effects, according to past odor complaint documents submitted by local residents and businesses.

**6.0 Interferences and Potential Problems**

Contamination could occur in the sampling system if canisters are not properly cleaned before use. During this Investigation, pre-certified and clean canisters are being supplied by ERG. No cleaning of the exterior is required.

Sampling personnel should be aware of other sources of odors or VOC emissions in the immediate testing area or nearby. Examples of other sources would be an engine running (car, truck, lawn mower), smoke (cigarette, burning leaves), painting or tarring work, lawn treatments being applied. MDCH will train the samplers in recognizing these confounders. If the sampler believes that the detected odor is *not* attributable to a confounder, then the sampler should proceed with sampling and document the potential confounders. If the sampler believes that the detected odor *is* attributable to one of these confounders, the sampler should not take a sample. The decision criteria are listed on the Sampling Event Documentation sheet. It is understood that sampling personnel cannot render an expert opinion regarding confounding odors, however, for purposes of this Investigation, ATSDR and MDCH will allow this area of uncertainty.

**7.0 Quality Assurance/Quality Control**

The following quality assurance procedures apply:

7.1 All sampling information must be documented on Chain of Custody forms and Sampling Event Documentation sheets.

7.2 All equipment and materials must be used in accordance with instructions as supplied by the manufacturer, ERG, or ATSDR/MDCH.

7.3 One canister out of every six will not be used to collect an air sample. Instead, the canister will be shipped to ERG for analysis as a field blank.

7.4 Continental Aluminum is welcome and encouraged to take their own sample during odor events and to share the analytical results with ATSDR/MDCH.

**8.0 Procedure**

8.1 Upon verification of the odor event, determine if confounding odors are present and enter appropriate notes on the Sampling Event Documentation

sheet. If the decision is made to take a sample, continue with the procedure, filling in the sheet appropriately.

8.2 Before sample collection, verify vacuum condition of canister with gauge.

8.3 Standing on public property as close as possible to the address where the odor was reported, place canister at the approximate breathing height of an adult, about 5 feet.

8.4 Open the hand valve a quarter turn. Pressure will be audibly released.

8.5 As the pressure in the canister approaches atmospheric, a change in pitch or sound level is heard. Turn hand valve to shut valve. Check pressure with gauge.

8.5 Re-cap the canister, tightening slightly to seal the vacuum.

8.6 Complete the remaining information on the Sampling Event Documentation sheet for this site.

8.7 Proceed to the designated control site and take a control air sample following the previous steps (8.2-8.7).

8.8 Enter the appropriate information on the Chain of Custody form.

8.9 Place the canister and the Chain of Custody form into the box supplied for shipping and seal the box. Bring box and Sampling Event Documentation sheet to Lyon Township offices for shipping.

8.10 ERG will analyze the sample using U.S. EPA Method TO-15 and will send the results to MDCH. Expedited turnaround time is 1-2 weeks; normal turnaround time is 30 days.

8.11 ERG will ship replacement canisters for additional sampling to MDCH, who will then deliver them to the samplers.

## Continuous Air Monitoring

**1.0 Scope and Application**

This portion of the Investigation will provide only qualitative, not quantitative, information.

The purpose of this SOP is to describe a procedure for monitoring acidic emissions in ambient air. The method is based on ambient air passing over a white tape impregnated with chemicals known to specifically darken upon exposure to mineral acids (e.g., hydrogen chloride, hydrogen fluoride). At the end of each pre-determined sampling period, the monitor, equipped with a chemical-specific "key," calculates air concentrations of the chemical of interest by detecting changes in darkness on the reactive tape. The concentrations are then recorded onto a datalogger. The tape is highly selective for mineral acids, responding quickly to recent releases.

This method was used by ATSDR and MDCH in the Exposure Investigation and Exposure Evaluation for the Lafarge Corporation in Alpena, Michigan (ATSDR 2000, 2001). The chemical of interest at Lafarge was hydrogen chloride, emitted by a cement-making plant.

## 2.0 Method Overview

(A detailed procedure is listed in Section 10.0.)

Before the beginning of the Investigation, MDCH will obtain the acid monitor and order five 30-day cassettes of the reactive tape. MDCH and MDEQ will test the monitor to ensure its ability to detect the chemicals of interest. Oakland County Health Department and MDCH personnel will receive training from MDEQ in use of and maintenance checks on the monitor.

The monitor will run continuously and log data at predetermined intervals. Oakland County Health Department and MDCH personnel will be responsible for maintenance checks and tape change-outs. MDCH will download the data on a weekly basis.

## 3.0 Equipment/Materials Provided

The SPM Single Point Monitor, manufactured by Zellweger Analytics, Inc. will be used for the continuous air monitoring portion of the Exposure Investigation. The specific machine to be used is on loan from the Michigan District Health Department #4.

The features of the SPM are discussed at the company's website http://www.zelana.com/product/SPM/features_benefits.html. The detection limit ranges for hydrogen chloride and hydrogen fluoride, the chemicals of interest in this portion of the Investigation, are 30-1,200 ppb and 600-9,000 ppb, respectively. The accuracy is reported to be ± 20%. While the degree of accuracy is not ideal, the data should at least give an indication as to whether there are mineral acids present at levels of potential concern.

Other materials provided are the SPM Quality Assurance/Quality Control Checklist (Appendix A), Chemcassette® detection tapes, Chemcassette® Use Record forms (Appendix A), and the trailer in which the SPM will be housed (provided by MDEQ). Lyon Township will arrange for electrical hook-up.

## 4.0 Siting of Monitor

Before the beginning of the Investigation, MDEQ and ATSDR/MDCH will determine, based on air dispersion modeling and on site-specific data, the most appropriate location to place the monitoring station. Site-specific information (proximity to a power supply and to confounding influences such as buildings) will ultimately determine where the monitor will be placed. Also, logistics prevent the equipment from easily being moved site to site, therefore only one location will be used.

MDEQ will be responsible for transporting equipment and assembling the monitoring station. The station will house the monitor and a datalogger (computer) as well as meteorological equipment in a locked trailer. MDEQ and ATSDR will train MDCH and Oakland County Health Department personnel in proper equipment maintenance techniques.

## 5.0 Sample Preservation, Containers, Handling, and Storage

Under normal conditions, Chemcassettes® have a shelf life of three to four months. At time of manufacture, each cassette is stamped with an expiration date. A Chemcassette® should not be used after its expiration date (Zellweger Analytics 1997).

The cassettes should be stored in a cool atmosphere and kept out of direct sunlight. Although most Chemcassettes® maintain optimum sensitivity when stored at room temperature, Zellweger Analytics recommends that all cassettes be stored in a freezer (Zellweger Analytics 1997).

Chemcassettes® should not be removed from their protective packaging until ready to install. Exposure to light, ambient air, and body oils may cause the cassette to lose some of its sensitivity (Zellweger Analytics 1997).

The SPM should not be operated in direct sunlight or at elevated temperatures unless equipped with appropriate options. The operating temperature range is 0-40° C (32-104° F) (Zellweger Analytics 1997). Ideal humidity conditions are below 70% (2003, G. Franz, Zellweger Analytics, Inc., personal communication).

When a used Chemcassette® is replaced with a fresh cassette, the used cassette will be placed in a ziplocking plastic baggie and stored at the trailer until a staff person from MDCH collects it. The baggie will also contain the Chemcassette® Use Record form (Appendix A), appropriately filled out by the person(s) handling the cassette. MDCH will retain all used Chemcassettes® until the Public Health Assessment at Continental Aluminum is completed, and then discard them. (The cassettes cannot be re-used or re-analyzed.) The Chemcassette® Use Record forms will remain on-file with MDCH.

## 6.0 Health and Safety

It is not expected that any chemical exposure occurring during maintenance checks and Chemcassette® change-outs will result in long-term health effects.

## 7.0 Security of Monitor

The only persons authorized to have access to the trailer and monitor will be MDCH, MDEQ, or Oakland County Health Department personnel. There will be a temporary fence installed around the trailer to enhance security. There will be a sheet-metal lockout attached to the ladder that accesses the roof of the trailer.

If there appears to be a problem with the electrical connections, the SPM monitor, or the datalogger, MDCH will contact the appropriate agencies for assistance. Persons living or working in the area where the trailer/monitor is placed will be asked to contact MDCH with any non-emergency questions or concerns. If the trailer requires immediate attention due to an apparent emergency, local emergency responders should be alerted by dialing 9-1-1. The responders will attend to the scene and then contact MDEQ and MDCH.

## 8.0 Interferences and Potential Problems

Exposure to light, ambient air, and body oils may cause the cassette to lose some of its sensitivity. Therefore, Chemcassettes® should not be removed from their protective packaging until ready to install. (Zellweger Analytics 1997).

The SPM should not be operated in direct sunlight or at elevated temperatures unless equipped with appropriate options. The operating temperature range is 0-40° C (32-104° F) (Zellweger Analytics 1997). Ideal humidity conditions are below 70% (2003, G. Franz, Zellweger Analytics, Inc., personal communication).

The Chemcassette® for mineral acids detects hydrogen bromide, hydrogen chloride, hydrogen fluoride, hydrogen iodide, nitric acid, and sulfuric acid. The cassette does not differentiate between these individual chemicals. The chemical-specific "key" adjusts the optics of the monitor and accounts for the sampling time when calculating a concentration from the tape color. Thus, a color change on the tape will only indicate the presence of one or more mineral acids and cannot be used to determine definitively which acid is present or the concentration. Hydrogen bromide, hydrogen iodide, nitric acid, and sulfuric acid are not listed as expected emissions from an aluminum recycling smelter such as Continental Aluminum (EPA 1986, 1995). If mineral acids are determined to be in the air, then further evaluation would be necessary to verify the identity of the acids (e.g., using NIOSH Method 7903).

Proximity to buildings and trees is an important consideration when siting a monitor, as man-made and natural structures can cause wind eddies, leading to inaccurate characterization of air quality. MDCH and MDEQ will place the trailer the recommended distance (2.5 times building height), at the least, from surrounding structures.

## 9.0 Quality Assurance/Quality Control

The following quality assurance procedures apply:

- 9.1 All sampling information must be documented on Chemcassette® Use Record forms.
- 9.2 All equipment and materials must be used in accordance with instructions as supplied by the manufacturer, MDEQ, or ATSDR/MDCH.
- 9.3 The routine maintenance schedule is shown in Appendix B. A copy of the Maintenance Checklist form is provided in Appendix A.

## 10.0 Monitor Operation

- 10.1 The monitor will operate continuously for the duration of the Exposure Investigation. This will be a minimum of 30 days and projected maximum of 90 days.
- 10.2 The monitor will take measurements at 4-minute intervals for hydrogen chloride or at 30-second intervals for hydrogen fluoride. These sampling times are predetermined by the manufacturer. If an acid is detected, the tape will advance before the sampling window is complete, time-stamping when the detection was made.

10.3 Oakland County Health Department and MDCH personnel will be responsible for the change-out of the Chemcassette® detection tapes. Tapes will be checked a minimum 3 days per week. If county personnel perform the cassette change-out, they will leave the tape and its Chemcassette® Use Record form in the trailer for future pick-up by MDCH. If MDCH carries out the cassette change-out, they will bring the cassette and form back to Lansing with them.

10.4 Oakland County Health Department and MDCH personnel will be responsible for maintenance checks on the monitor, as instructed by the manufacturer. They will also conduct maintenance checks on the datalogger and meteorological equipment, as instructed by MDEQ. MDCH will retain copies of the completed SPM Quality Assurance/Quality Control Checklist and MDEQ Equipment Maintenance Checklist (Appendix A) forms.

10.5 MDCH will be responsible for downloading the data from the datalogger on a weekly basis.

## Metals (Airborne Particulates) Analysis

**1.0 Scope and Application**

The purpose of this SOP is to describe a procedure for monitoring airborne particulates in ambient air. The method is based on ambient air being drawn through a PM10 (particulate matter less than 10 microns in diameter) high-volume sampling pump and onto a pre-weighed filter. After the specified air volume has passed through the filter, the filter is removed, weighed, and analyzed using NIOSH Method 7300. This method reduces all analytes to their elemental state, thus no speciation of the elements will occur.

The estimated limit of detection is 0.001 mg per sample. The working range of this method is 0.005 to 2.0 $mg/m^3$ for each element in a 500-liter air sample. DataChem Laboratories, Inc. (DataChem) is the laboratory responsible for analysis. Elements to be analyzed in this Investigation are aluminum, barium, beryllium, cadmium, chromium, copper, lead, manganese, selenium, and zinc.

**2.0 Method Overview**

(A detailed procedure is listed in Section 10.0.)

Before the beginning of the Investigation, DataChem will pre-weigh and ship 12 filters to MDCH, who will retain the filters until use. MDCH and the Oakland County Health Department will be responsible for placing the filters into the sampling pump, removing them after the sampling period, and shipping them to DataChem for analysis.

Air is drawn through the eaves of the sampling head of a high-volume PM10 sampling pump. The total volume of air is estimated by calibrating the pump to supply a known pressure for a given volume, recording the pressure of the pump for the duration of

sampling (usually 24 hours), then multiplying the flow rate (about 40 cubic feet per minute) by the duration. Pressure to volume is checked before and after sampling.

The air passes through a pre-weighed filter, approximately 8 inches by 10 inches in size. Particulates greater than 0.8 microns in size are retained on the filter. The filter is then removed and weighed. The difference between the weights before and after sampling is the weight of PM10. The average airborne particulate concentration (all particulates captured) is determined by dividing the total loading of particulates on the filter (micrograms) by the total volume of air (liters). The filter is then analyzed according to NIOSH Method 7300, "Elements by ICP" (NIOSH 1994). Results are reported as total mass and mass fraction.

The sampling pump will be located on top of the MDEQ equipment trailer, which also will house the acid monitor and meteorological equipment.

**3.0 Equipment/Materials Provided**

MDEQ will provide the high-volume PM10 sampling pumps. DataChem will provide the pre-weighed filters, Field Data Collection/Chain of Custody Record form (Appendix A), and the High-Volume Data Record (Appendix A).

**4.0 Sample Preservation, Containers, Handling, and Storage**

Sample stability is stable for all elements. It is important that dirt and oils do not come in contact with the filter, otherwise the post-sampling weight will not represent the retained particulates accurately. Therefore, handling should occur only when necessary (inserting/removing the filter from the pump, re-packing it for shipping). The use of forceps or disposable gloves is encouraged.

The filters will remain in their shipping containers (individual envelopes in a packing box) until use. Unused filters will be stored at MDCH in Lansing until the Investigation starts, at which time they will be stored, in their containers, in the MDEQ trailer, which will have limited access. Used filters will be shipped as soon as possible to DataChem in their individual envelopes (postage covered by ATSDR/MDCH).

**5.0 Siting of Equipment**

The PM10 pump will be located on top of the MDEQ trailer, which also will house the acid monitor and meteorological equipment. Air modeling data provided by MDEQ and by ATSDR will help determine where the trailer should be placed. However, siting logistics (proximity to a power supply and to confounding influences such as buildings) will ultimately determine where the trailer will be placed.

**6.0 Health and Safety**

It is not expected that any chemical exposure occurring during the sampling will result in long-term health effects.

The sampling pump will be located on top of the MDEQ trailer, which is approximately 10.5 feet high with a railing adding an additional 3.5 feet. Staff should use every

precaution when climbing the ladder to the top of the trailer and when working on top of the trailer. Ideally, at least two persons will attend filter change-outs.

**7.0 Security of Equipment**

The only persons authorized to have access to the trailer and the equipment will be MDCH, MDEQ, or Oakland County Health Department personnel. There will be a temporary fence installed around the trailer to enhance security. There will be a sheet-metal lockout attached to the ladder that accesses the roof of the trailer.

If there appears to be a problem with the electrical connections or any of the equipment, MDCH should be notified so that they can contact the appropriate agencies for assistance. Persons living or working in the area where the trailer is placed will be asked to contact MDCH with any non-emergency questions or concerns. If the trailer requires immediate attention due to an apparent emergency, local emergency responders should be alerted by dialing 9-1-1. The responders will attend to the scene and then contact MDEQ and MDCH.

**8.0 Interferences and Potential Problems**

Exposure to body oils or handling with soiled hands may cause the filter to retain unwanted and confounding compounds. Therefore, staff should exercise care when handling the filters, using forceps or disposable gloves.

Proximity to buildings and trees is an important consideration when siting a monitor, as man-made and natural structures can cause wind eddies, leading to inaccurate characterization of air quality. MDCH and MDEQ will place the trailer the recommended distance (2.5 times building height), at the least, from surrounding structures.

**9.0 Quality Assurance/Quality Control**

The following quality assurance procedures apply:

9.1 All sampling information must be documented on Field Data Collection/Chain of Custody Record forms and High-Volume Data Record forms.

9.2 All equipment and materials must be used in accordance with instructions as supplied by DataChem, MDEQ, and ATSDR/MDCH.

9.3 Two filters will be used as field blanks. They will be brought to the sampling location but not be placed in the sampling pumps. They will not be removed from their envelopes. Instead, the envelopes will be sealed and the filters shipped to DataChem for analysis.

**10.0 Procedure**

10.1 Airborne particulates will be sampled every 6 days during the Exposure Investigation. This will be a minimum of 30 days (5 samples) and projected maximum of 90 days (no more than 10 samples). This is the sampling schedule followed by MDEQ.

10.2 Oakland County Health Department and MDCH personnel will be responsible for inserting and removing the filters, completion of the Field Data Collection/Chain of Custody Record forms, and shipping the forms and filters to DataChem for analysis.
10.3 Oakland County Health Department and MDCH personnel will be responsible for maintenance checks on the sampling pump, as instructed by MDEQ, and for completion of the High-Volume Data Record forms.
10.4 Fill in the appropriate information on the High-Volume Data Record form before the sampling begins.
10.5 Load the filter into the filter cassette and insert the cassette into the holder in the pump, clamping it in place.
10.6 Allow sampler to run for at least 5 minutes and take a flow-rate reading with the magnehelic gauge.
10.7 Set timer to chosen start time.
10.8 After the sampling period is finished, allow the sampler to run for at least 5 minutes and take a flow-rate reading with the magnehelic gauge.
10.9 Remove the cassette from the holder and remove the filter. Place the filter in a manila folder, seal in the filter's dedicated envelope, complete the Field Data Collection/Chain of Custody Record, and ship to DataChem for analysis. Complete the High-Volume Data Record form and ship to MDCH.
10.10 DataChem will acknowledge receipt of the filter by faxing a copy of the Field Data Collection/Chain of Custody Record form to MDCH.
10.11 DataChem will analyze the sample using NIOSH Method 7300 and will send the results to MDCH.

## Meteorological Data

In order to help determine if the odors experienced by individuals are coming from the direction of Continental Aluminum or if there are certain meteorological conditions under which odors seem to be more prevalent, MDEQ will provide meteorological measuring equipment and a trailer to house it in for this Investigation. MDEQ and MDCH will establish the site for the trailer based on access and surrounding vegetation and topography. Parameters to be measured include: temperature, wind speed, wind direction, relative humidity, and barometric pressure. Parameters will be measured every 15 minutes.

Oakland County Health Department and MDCH personnel will be responsible for maintenance checks on the meteorological equipment, as instructed by MDEQ. MDCH will retain copies of the completed MDEQ Equipment Maintenance Checklist (Appendix A) forms.

## Odor Complaint Information

MDCH will copy odor complaint forms submitted by citizens to Lyon Township during the Exposure Investigation. Neither MDCH nor ATSDR will prepare or distribute a formal odor "diary" form nor will either agency conduct an odor survey. Instead, the Investigation will rely on citizens who believe they detect an objectionable odor to report the odor to the Township. The community has been using forms supplied by MDEQ or individually-designed forms. Ideally, for purposes of this Investigation, the format of the forms will be consistent. Useful information would include:

- address where the odor was detected;
- time when odor was first detected;
- duration of odor;
- description of the odor, perhaps taken from a list of possible descriptors;
- intensity of the odor, rated on a 1-2-3 scale rather than a 0-to-5 scale, without fractions;
- any additional information the citizen wishes to share.

Personal identifying information on the odor complaint forms will be protected to the extent allowable by law. If any party other than MDCH or ATSDR wishes to obtain copies of submitted odor complaints through the Freedom of Information Act, MDCH will first black out identifying information such as name, address, and telephone number, to protect privacy rights.

## REPORTING OF RESULTS

MDCH will review the raw data and present a written report to the stakeholders, discussing the data, the interpretation of the results, and any health implications. The report shall address the questions posed at the beginning of this protocol document:

1. What VOCs, at what concentrations, are detected in the air during odor events? Are the concentrations above background, or control, levels?
2. Is hydrogen chloride or hydrogen fluoride detectable in the air during odor events? Is there a temporal (time) trend to the detection of these acids?
3. What metals (airborne particulates), at what concentrations, are in the air?
4. Is it plausible that the earlier reported health effects are associated with detected chemicals and concentrations?
5. When an odor event occurs, do meteorological data indicate that the Continental Aluminum plant is upwind of the odor detection (i.e., is it plausible that Continental Aluminum is the source of the odor)?

Analytical results from the Instantaneous Air Samplings will be presented as odor-event data versus control data (per event) and will be time-matched with meteorological data. Because of the nature of grab sampling, an averaging time cannot be calculated for the concentration of a detected chemical. (The concentration represents a "snapshot" in time.) Therefore, analytical results will be compared to the respective Screening Level values, which do have averaging times, and that comparison discussed as far as potential implications.

Results from the Continuous Air Monitoring will be presented as number of detections per day. Continuous Air Monitoring results for days during which Instantaneous Air Samplings occurred, or odor complaints were received, will be analyzed in more detail, comparing timing of detections and meteorological data with the findings.

Results from the Metals Analysis will be presented as per-sample data. Chemicals above their respective Screening Levels will be evaluated further and any public health implications determined.

Odor complaints and the Sampling Event Documentation sheets (from Instantaneous Air Samplings) will be reviewed and compared to meteorological data to determine if occurrences of odor events happened downwind of Continental Aluminum. Meteorological data for odor event days will be compared to determine if there are certain atmospheric conditions that could increase the likelihood of odors occurring.

Statistical analysis of the findings cannot be conducted with any assurance of statistical power. Therefore, findings will be interpreted without this analysis.

## CONFIDENTIALITY

Monitoring data and analytical results are not confidential. This information will be shared with other federal, state, and local agencies, as well as with the stakeholders.

The Sampling Event Documentation form (for Summa canister sampling) contains lines for the address of the reported odor event and the control sample location as well as for the name of the person reporting the odor. Although the sample is to be taken on public property, the rights of individuals who live or work near that location should be protected. In report documents, rather than identify the address, MDCH will indicate approximate distance and direction from Continental Aluminum. Identifying information will be protected to the extent allowable by law.

As mentioned previously, if any party other than MDCH or ATSDR wishes to obtain copies of submitted odor complaints through the Freedom of Information Act, MDCH will first black out identifying information such as name and address.

## FOLLOW-UP ACTIVITIES

MDCH may provide periodic updates during the Exposure Investigation. Raw data (data not yet validated or interpreted) will not be released to the public. When the Investigation is complete, MDCH and ATSDR will present validated data and the agencies' interpretations, conclusions regarding any health-related impacts, and follow-up recommendations to the stakeholders, other agencies, and the community in the form of a health consultation or health assessment document. If necessary, MDCH will host a public meeting to discuss the results of this Investigation and what any next steps might be.

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## TABLES

1. US EPA Method TO-15 VOCs – Comparison Values
2. Single Point Monitor Mineral Acids – Comparison Values
3. NIOSH 7300 Selected Metals – Comparison Values

Table 1. US EPA Method TO-15 VOCs - Comparison Values

| Chemical | CASRN | Odor description | Odor Threshold | | California REL | | AEGL-1 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 10 min | 30 min | 60 min | 4 hrs | 8 hrs |
| | | | ppb | Ref. | ppb | Avg. time (hr) | ppb | ppb | ppb | ppb | ppb |
| **acetone** | 67-64-1 | Mildly pungent and aromatic; fragrant, mint-like odor; fruity | 37 | 1 | | | | | | | |
| **acetonitrile** | 75-05-8 | Aromatic, ether-like | 170,000 | 2 | | | | | | | |
| **acetylene** | 74-86-2 | Faint, ethereal odor. [Commercial grade has a garlic-like odor.] | | | | | | | | | |
| **acrylonitrile** | 107-13-1 | Pungent (onion, garlic); unpleasant odor. | 3,700 | 3 | | | | | | | |
| **tert-amyl methyl ether** | 994-05-8 | | | | | | | | | | |
| **benzene** | 71-43-2 | Aromatic, gasoline-like | 160 | 4 | 410 | 6 | | | | | |
| **benzyl chloride** | 100-44-7 | Pungent, aromatic odor | 41 | 3 | 46 | 1 | | | | | |
| **bromochloromethane** | 74-97-5 | Sweet, chloroform-like odor | 400,000 | 3 | | | | | | | |
| **bromodichloromethane** | 75-27-4 | | 250,000 | 3 | | | | | | | |
| **bromoform** | 75-25-2 | Sweet, similar to chloroform | 1,300 | 5 | | | | | | | |
| **bromomethane** | 74-83-9 | Chloroform-like | 20000 | 5 | 1,000 | 1 | | | | | |
| **1,3-butadiene** | 106-99-0 | Mildly aromatic or gasoline-like odor | 25 | 5 | | | | | | | |
| **2-butanone** | 78-93-3 | Acetone-like; moderately sharp; fragrant, mint | 250 | 3 | 4,400 | 1 | 100,000 | 100,000 | 100,000 | 100,000 | 100,000 |
| **carbon tetrachloride** | 56-23-5 | Aromatic, sweet; characteristic ether-like odor | 1,600 | 5 | 300 | 7 | 25,000 | 16,000 | 12,000 | 6,900 | 5,200 |
| **chlorobenzene** | 108-90-7 | Aromatic, almond-like | 220 | 5 | | | | | | | |
| **chlorodibromomethane** | 124-48-1 | Sweet, similar to chloroform | 1300 | 5 | | | | | | | |
| **chloroethane** | 75-00-3 | Ethereal, pungent | 3,800 | 3 | | | | | | | |
| **chloroform** | 67-66-3 | Pleasant, ethereal, nonirritating, sweet | 51,000 | 3 | 31 | 7 | | | | | |
| **chloromethane** | 74-87-3 | Ethereal, nonirritating; faint, sweet | 10,000 | 5 | | | | | | | |
| **chloroprene beta-** | 126-99-8 | Pungent, ether-like odor | 15,000 | 2 | | | | | | | |
| **dibromoethane 1,2-** | 106-93-4 | Mild sweet odor, like chloroform | 10000 | 3 | | | | | | | |
| **dichlorobenzene 1,2-** | 95-50-1 | Pleasant, aromatic odor | 2000 | 3 | | | | | | | |
| **dichlorobenzene 1,3-** | 541-73-1 | | 20 | 6 | | | | | | | |
| **dichlorobenzene 1,4-** | 106-46-7 | Aromatic, mothball-like odor | 180 | 5 | | | | | | | |
| **dichlorodifluoromethane** | 75-71-8 | Ether-like odor | | | | | | | | | |
| **dichloroethane 1,1-** | 75-34-3 | Aromatic ethereal; chloroform-like | 110,000 | 3 | | | | | | | |
| **dichloroethane 1,2-** | 107-06-2 | Pleasant, chloroform-like odor | 3,000 | 3 | | | | | | | |
| **dichloroethylene 1,1-** | 75-35-4 | Mild sweet odor resembling that of chloroform | 500,000 | 5 | | | | | | | |
| **dichloroethylene 1,2- cis-** | 156-59-2 | Ethereal, slightly acrid; Sweet, pleasant; chloroform-like odor | | | | | 140,000 | 140,000 | 140,000 | 140,000 | 140,000 |
| **dichloroethylene 1,2- trans-** | 156-60-5 | Ethereal, slightly acrid; Sweet, pleasant; chloroform-like odor | 84 | 5 | | | 280,000 | 280,000 | 280,000 | 280,000 | 280,000 |
| **dichloropropane 1,2-** | 78-87-5 | Chloroform-like, sweet | 250 | 5 | | | | | | | |
| **dichloropropene 1,3- cis-** | 10061-01-5 | Chloroform-like; sharp; sweet; penetrating, irritating | 1,000 | 5 | | | | | | | |
| **dichloropropene 1,3- trans-** | 10061-02-6 | Chloroform-like; sharp; sweet; penetrating, irritating | 1000 | 5 | | | | | | | |
| **dichlorotetrafluoroethane 1,2-** | 76-14-2 | Very slight ethereal odor | | | | | | | | | |
| **ethyl acrylate** | 140-88-5 | Acrid odor; sour, pungent; hot plastic | 0.2 | 3 | | | | | | | |
| **ethylbenzene** | 100-41-4 | Sweet, gasoline-like; aromatic; pungent | 92 | 3 | | | | | | | |
| **ethyl tert-butyl ether** | 637-92-3 | | | | | | | | | | |
| **hexachlorobutadiene** | 87-68-3 | Mild to pungent; turpentine-like | 1,100 | 3 | | | | | | | |
| **methyl methacrylate** | 80-62-6 | Acrid, fruity odor sulfur-like; sweet; sharp | 50 | 3 | | | | | | | |
| **methyl-2-pentanone 4-** | 108-10-1 | Pleasant odor ketonic camphor odor | 0.68 | 3 | | | | | | | |

Table 1. US EPA Method TO-15 VOCs - Comparison Values

| | AEGL-2 | | | | | AEGL-3 | | | | | TEELs or ERPGs (ppb) | | | | ATSDR Air EMEG | | | EPA RfC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | TEEL-0 | TEEL-1 | TEEL-2 | TEEL-3 | Acute | Intermediate | Chronic | |
| Chemical | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | (NA) | ERPG-1 | ERPG-2 | ERPG-3 | ppb | ppb | ppb | ppb |
| acetone | | | | | | | | | | | 1,000,000 | 1,000,000 | 8,500,000 | 8,500,000 | 26,000 | 13,000 | 13,000 | |
| acetonitrile | | | | | | | | | | | 40,000 | 40,000 | 60,000 | 500,000 | | | | 36 |
| acetylene | | | | | | | | | | | 2,500,000 | 2,500,000 | 2,500,000 | 6,000,000 | | | | |
| acrylonitrile | | | | | | | | | | | 2,000 | 10,000 | 35,000 | 75,000 | 100 | | | 0.92 |
| tert-amyl methyl ether | | | | | | | | | | | | | | | | | | |
| benzene | | | | | | | | | | | 1,000 | 50,000 | 150,000 | 1,000,000 | 50 | 4 | | |
| benzyl chloride | | | | | | | | | | | 1,000 | 1,000 | 10,000 | 25,000 | | | | |
| bromochloromethane | | | | | | | | | | | 200,000 | 600,000 | 1,000,000 | 6,000,000 | | | | |
| bromodichloromethane | | | | | | | | | | | 1,500 | 4,000 | 30,000 | 150,000 | | | | |
| bromoform | | | | | | | | | | | 500 | 500 | 1,500 | 850,000 | | | | |
| bromomethane | | | | | | | | | | | 1,000 | 20,000 | 50,000 | 200,000 | 50 | 50 | 5 | 1.3 |
| 1,3-butadiene | | | | | | | | | | | 2,000 | 10,000 | 200,000 | 5,000,000 | | | | 0.89 |
| 2-butanone | 1,700,000 | 1,700,000 | 1,700,000 | 1,700,000 | 1,700,000 | 10,000,000 | 10,000,000 | 4,000,000 | 2,500,000 | 2,500,000 | 200,000 | 300,000 | 300,000 | 3,000,000 | | | | 340 |
| carbon tetrachloride | 114,000 | 74,000 | 56,000 | 32,000 | 24,000 | 350,000 | 230,000 | 170,000 | 99,000 | 75,000 | 10,000 | 20,000 | 100,000 | 750,000 | 200 | 50 | | |
| chlorobenzene | | | | | | | | | | | 30,000 | 30,000 | 500,000 | 1,000,000 | | | | |
| chlorodibromomethane | | | | | | | | | | | 2,000 | 6,000 | 40,000 | 150,000 | | | | |
| chloroethane | | | | | | | | | | | 1,000,000 | 1,000,000 | 1,000,000 | 3,800,000 | 15,000 | | | 3,800 |
| chloroform | | 120,000 | 88,000 | 44,000 | 31,000 | | 920,000 | 650,000 | 330,000 | 230,000 | 2,000 | 2,000 | 50,000 | 5,000,000 | 100 | 50 | 20 | |
| chloromethane | | | | | | | | | | | 100,000 | 100,000 | 400,000 | 1,000,000 | 500 | 200 | 50 | 44 |
| chloroprene beta- | | | | | | | | | | | 1,000 | 1,000 | 1,000 | 300,000 | | | | |
| dibromoethane 1,2- | | | | | | | | | | | 20,000 | 30,000 | 30,000 | 100,000 | | | | |
| dichlorobenzene 1,2- | | | | | | | | | | | 25,000 | 50,000 | 50,000 | 200,000 | | | | |
| dichlorobenzene 1,3- | | | | | | | | | | | 750 | 2,000 | 15,000 | 75,000 | | | | |
| dichlorobenzene 1,4- | | | | | | | | | | | 75,000 | 110,000 | 110,000 | 150,000 | 800 | 200 | 100 | 130 |
| dichlorodifluoromethane | | | | | | | | | | | 1,000,000 | 3,000,000 | 10,000,000 | 15,000,000 | | | | |
| dichloroethane 1,1- | | | | | | | | | | | 100,000 | 300,000 | 3,000,000 | 3,000,000 | | | | |
| dichloroethane 1,2- | | | | | | | | | | | 50,000 | 50,000 | 200,000 | 300,000 | | | 600 | |
| dichloroethylene 1,1- | | | | | | | | | | | 5,000 | 20,000 | 20,000 | 600,000 | | 20 | | 50 |
| dichloroethylene 1,2- cis- | 500,000 | 500,000 | 500,000 | 340,000 | 230,000 | 850,000 | 850,000 | 850,000 | 620,000 | 310,000 | 200,000 | 200,000 | 400,000 | 2,000,000 | | | | |
| dichloroethylene 1,2- trans- | 1,000,000 | 1,000,000 | 1,000,000 | 690,000 | 450,000 | 1,700,000 | 1,700,000 | 1,700,000 | 1,200,000 | 620,000 | 4,000 | 12,500 | 100,000 | 2,500,000 | 200 | 200 | | |
| dichloropropane 1,2- | | | | | | | | | | | 75,000 | 110,000 | 110,000 | 400,000 | 50 | 7 | | 0.87 |
| dichloropropene 1,3- cis- | | | | | | | | | | | 1,000 | 2,500 | 5,000 | 12,500 | | 3 | 2 | 4.4 |
| dichloropropene 1,3- trans- | | | | | | | | | | | 1,000 | 3,000 | 5,000 | 25,000 | | 3 | 2 | 4.4 |
| dichlorotetrafluoroethane 1,2- | | | | | | | | | | | 1,000,000 | 3,000,000 | 10,000,000 | 15,000,000 | | | | |
| ethyl acrylate | | | | | | | | | | | 15,000 | 15,000 | 30,000 | 300,000 | | | | |
| ethylbenzene | | | | | | | | | | | 100,000 | 125,000 | 125,000 | 800,000 | | 1,000 | | 230 |
| ethyl tert-butyl ether | | | | | | | | | | | | | | | | | | |
| hexachlorobutadiene | | | | | | | | | | | 20 | 3,000 | 10,000 | 30,000 | | | | |
| methyl methacrylate | | | | | | | | | | | 100,000 | 100,000 | 100,000 | 1,000,000 | | | | |
| methyl-2-pentanone 4- | | | | | | | | | | | 75,000 | 75,000 | 250,000 | 500,000 | | | | |

Prepared by Michigan Department of Community Health for Exposure Investigation at Continental Aluminum

Table 1. US EPA Method TO-15 VOCs - Comparison Values

| Chemical | CASRN | Odor description | Odor Threshold | | California REL | | AEGL-1 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 10 min | 30 min | 60 min | 4 hrs | 8 hrs |
| | | | ppb | Ref. | ppb | Avg. time (hr) | ppb | ppb | ppb | ppb | ppb |
| **methylene chloride** | 75-09-2 | Sweet, pleasant; chloroform-like | 155,000 | 3 | 4,000 | 1 | | | | | |
| **methyl-tert-butyl ether** | 1634-04-4 | Terpene-like | | | | | | | | | |
| **octane n-** | 111-65-9 | Gasoline-like odor | 4000 | 3 | | | | | | | |
| **propylene** | 115-07-1 | Practically odorless | 5800 | 3 | | | | | | | |
| **styrene** | 100-42-5 | Sweet, sharp; floral | 4.7 | 1 | 4,900 | 1 | | | | | |
| **tetrachloroethane 1,1,2,2-** | 79-34-5 | Sweetish, suffocating, chloroform-like, pungent | 1,500 | 5 | | | | | | | |
| **tetrachloroethylene** | 127-18-4 | Ethereal; mild, chloroform-like; sweet; chlorinated solvent odor | 1,000 | 5 | 2,900 | 1 | 35,000 | 35,000 | 35,000 | 35,000 | 35,000 |
| **toluene** | 108-88-3 | Sweet, pungent, Benzene-like | 0.27 | 3 | 9,800 | 1 | 260,000 | 120,000 | 82,000 | 41,000 | 29,000 |
| **trichloro-1,2,2-trifluoroethane 1,1,2-** | 76-13-1 | Faint but like carbon tetrachloride at high concentrations | 45000 | 3 | | | | | | | |
| **trichlorobenzene 1,2,4-** | 120-82-1 | Aromatic odor | 3200 | 3 | | | | | | | |
| **trichloroethane 1,1,1-** | 71-55-6 | Ethereal, chloroform-like | 44,000 | 3 | 12,000 | 1 | 230,000 | 230,000 | 230,000 | 230,000 | 230,000 |
| **trichloroethane 1,1,2-** | 79-00-5 | Sweet. chloroform | | | | | | | | | |
| **trichloroethylene** | 79-01-6 | Ethereal, chloroform-like, sweet | 21,000 | 3 | | | 260,000 | 180,000 | 130,000 | 84,000 | 77,000 |
| **trichlorofluoromethane** | 75-69-4 | Nearly odorless; sweet | 5000 | 3 | | | | | | | |
| **trimethylbenzene 1,2,4-** | 95-63-6 | Distinctive, aromatic odor | | | | | | | | | |
| **trimethylbenzene 1,3,5-** | 108-67-8 | Distinctive, peculiar aromatic odor | | | | | | | | | |
| **vinyl chloride** | 75-01-4 | Sweet; pleasant | 260,000 | 4 | 70,000 | 1 | | | | | |
| **total xylenes** | 1330-20-7 | Sweet | - | 7 | 1,700 | 1 | 130,000 | 130,000 | 130,000 | 130,000 | 130,000 |
| | | | | | | | | | | | |
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| | | | | | | | | | | | |
| | 1 = American Industrial Hygiene Association. Taken from http://response.restoration.noaa.gov/cameo/dr_aloha/odor/odor.html | | | | | | | | | | |
| | 2 = US EPA TTN Air Toxics website - http://www.epa.gov/ttn/atw/index.html | | | | | | | | | | |
| | 3 = Hazardous Substances Data Bank website - http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB | | | | | | | | | | |
| | 4 = American Association of Railroads. Taken from http://response.restoration.noaa.gov/cameo/dr_aloha/odor/odor.html | | | | | | | | | | |
| | 5 = ATSDR Toxicological Profiles website - http://www.atsdr.cdc.gov/toxpro2.html | | | | | | | | | | |
| | 6 = National Toxicology Program Chemical Respository website - http://ntp-db.niehs.nih.gov/NTP_Reports/NTP_Chem_H&S/NTP_Chem5/Radian541-73-1.txt | | | | | | | | | | |
| | 7 = o-xylene odor threshold = 50 ppb (ref. 3); m-xylene = 3,700 ppb (ref. 5); p-xylene = 470 ppb (ref. 5) | | | | | | | | | | |

Table 1. US EPA Method TO-15 VOCs - Comparison Values

| | AEGL-2 | | | | | AEGL-3 | | | | | TEELs or ERPGs (ppb) | | | | ATSDR Air EMEG | | | EPA RfC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | TEEL-0 | TEEL-1 | TEEL-2 | TEEL-3 | Acute | Intermediate | Chronic | |
| **Chemical** | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | (NA) | ERPG-1 | ERPG-2 | ERPG-3 | ppb | ppb | ppb | ppb |
| **methylene chloride** | | | | | | | | | | | 25,000 | 250,000 | 750,000 | 4,000,000 | 600 | 300 | 300 | |
| **methyl-tert-butyl ether** | | | | | | | | | | | 50,000 | 150,000 | 250,000 | 10,000,000 | 2000 | 700 | 700 | 830 |
| **octane n-** | | | | | | | | | | | 300,000 | 300,000 | 400,000 | 1,000,000 | | | | |
| **propylene** | | | | | | | | | | | 24,000,000 | 24,000,000 | 24,000,000 | 24,000,000 | | | | |
| **styrene** | | | | | | | | | | | 50,000 | 50,000 | 250,000 | 1,000,000 | | | 60 | 230 |
| **tetrachloroethane 1,1,2,2-** | | | | | | | | | | | 3,000 | 3,000 | 5,000 | 100,000 | | 400 | | |
| **tetrachloroethylene** | 230,000 | 230,000 | 230,000 | 120,000 | 81,000 | 1,600,000 | 1,600,000 | 1,200,000 | 580,000 | 410,000 | 25,000 | 100,000 | 200,000 | 1,000,000 | 200 | | 40 | |
| **toluene** | 600,000 | 270,000 | 190,000 | 94,000 | 67,000 | 1,600,000 | 900,000 | 630,000 | 320,000 | 220,000 | 50,000 | 50,000 | 300,000 | 1,000,000 | 1,000 | | 80 | 110 |
| **trichloro-1,2,2-trifluoroethane 1,1,2-** | | | | | | | | | | | 1,000,000 | 1,250,000 | 1,500,000 | 2,000,000 | | | | |
| **trichlorobenzene 1,2,4-** | | | | | | | | | | | 5,000 | 5,000 | 5,000 | 40,000 | | | | |
| **trichloroethane 1,1,1-** | 930,000 | 670,000 | 600,000 | 380,000 | 310,000 | 4,800,000 | 4,800,000 | 3,800,000 | 2,400,000 | 1,900,000 | 350,000 | 350,000 | 700,000 | 3,500,000 | 2,000 | 700 | | |
| **trichloroethane 1,1,2-** | | | | | | | | | | | 10,000 | 10,000 | 20,000 | 100,000 | | | | |
| **trichloroethylene** | 960,000 | 620,000 | 450,000 | 270,000 | 240,000 | 10,000,000 | 6,100,000 | 3,800,000 | 1,500,000 | 970,000 | 100,000 | 100,000 | 500,000 | 5,000,000 | 2,000 | 100 | | 7.4 |
| **trichlorofluoromethane** | | | | | | | | | | | 500,000 | 500,000 | 1,500,000 | 2,000,000 | | | | |
| **trimethylbenzene 1,2,4-** | | | | | | | | | | | 25,000 | 36,600 | 36,600 | 1,500,000 | | | | |
| **trimethylbenzene 1,3,5-** | | | | | | | | | | | 25,000 | 25,000 | 25,000 | 500,000 | | | | |
| **vinyl chloride** | | | | | | | | | | | 1,000 | 5,000 | 5,000 | 75,000 | 500 | 30 | | 39 |
| **total xylenes** | 990,000 | 480,000 | 430,000 | 430,000 | 430,000 | 2,100,000 | 1,000,000 | 930,000 | 930,000 | 930,000 | 100,000 | 150,000 | 200,000 | 900,000 | 1,000 | 700 | 100 | |
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Table 2. Single Point Monitor Mineral Acids - Comparison Values

| Chemical | CASRN | Odor description | Odor Threshold | | California REL | |
|---|---|---|---|---|---|---|
| | | | ppb | Ref. | ppb | Avg. time (hr) |
| Hydrogen bromide | 10035-10-6 | Sharp, irritating; stinging | 2,000 | 2 | | |
| Hydrogen chloride | 7647-01-0 | Pungent, irritating; sharp | 260 | 1 | 1,400 | 1 |
| Hydrogen fluoride | 7664-39-3 | Strong, irritating | 40 | 1 | 290 | 1 |
| Hydrogen iodide | 10034-85-2 | Pungent | | | | |
| Nitric acid | 7697-37-2 | Sweet to acrid, suffocating, choking | 270 | 3 | 33 | 1 |
| Sulfuric acid | 7664-93-9 | Odorless as liquid; fumes are irritating | 245 | 3 | 29 | 1 |
| | | | | | | |
| | 1 = Hazardous Substances Data Bank website - http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB | | | | | |
| | 2 = Occupational Safety and Health Administration | | | | | |
| | 3 = California Office of Environmental Health Hazard Assessment - http://www.oehha.org/air/acute_rels/pdf/7697372A.pdf | | | | | |

Table 2. Single Point Monitor Mineral Acids - Comparison Values

| | AEGL-1 | | | | | AEGL-2 | | | | | AEGL-3 | | | | | TEELs or ERPGs (ppb) | | | | ATSDR Air EMEG | | | EPA RfC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | TEEL-0 | TEEL-1 | TEEL-2 | TEEL-3 | **Acute** | **Intermediate** | **Chronic** | |
| **Chemical** | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | ppb | (NA) | ERPG-1 | ERPG-2 | ERPG-3 | ppb | ppb | ppb | ppb |
| Hydrogen bromide | | | | | | | | | | | | | | | | 3,000 | 3,000 | 3,000 | 30,000 | | | | |
| Hydrogen chloride | 1,800 | 1,800 | 1,800 | 1,800 | 1,800 | 100,000 | 43,000 | 22,000 | 11,000 | 11,000 | 620,000 | 210,000 | 100,000 | 26,000 | 26,000 | 500 | 3,000 | 20,000 | 150,000 | | | | 13 |
| Hydrogen fluoride | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 | 95,000 | 34,000 | 24,000 | 12,000 | 12,000 | 170,000 | 62,000 | 44,000 | 22,000 | 22,000 | 2,000 | 2,000 | 20,000 | 50,000 | 30 | 20 | | |
| Hydrogen iodide | | | | | | | | | | | | | | | | | | | | | | | |
| Nitric acid | | 500 | 500 | 500 | 500 | | 4.9 | 4 | 2.7 | 2.2 | | 27 | 22 | 15 | 12 | 1,000 | 1,000 | 6,000 | 78,000 | | | | |
| Sulfuric acid | | | | | | | | | | | | | | | | 0.2 | 0.5 | 2 | 7 | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | |
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Table 3. NIOSH 7300 Selected Metals - Comparison Values

| Chemical | CASRN | Odor description | Odor Threshold | | California REL | |
|---|---|---|---|---|---|---|
| | | | mg/m$^3$ * | Ref. | mg/m$^3$ | Avg. time (hr) |
| **aluminum** | 7429-90-5 | Metallic | | | | |
| **barium** | 7440-39-3 | | | | | |
| **beryllium** | 7440-41-7 | | | | | |
| **cadmium** | 7440-43-9 | | | | | |
| **chromium (VI), particulates** | 18540-29-9 | | | | | |
| **copper** | 7440-50-8 | | | | 100 | 1 |
| **lead** | 7439-92-1 | | | | | |
| **manganese** | 7439-96-5 | | | | | |
| **selenium** | 7782-79-2 | Upon combustion, like rotten horseradish | | | | |
| **zinc** | 7440-66-6 | | | | | |
| | | | | | | |
| | * These exist in the particulate state in the atmosphere and therefore are expressed as mg/m$^3$. | | | | | |

Table 3. NIOSH 7300 Selected Metals - Comparison Values

| AEGL-1 | | | | | AEGL-2 | | | | | AEGL-3 | | | | | TEELs or ERPGs ($mg/m^3$) | | | | ATSDR Air EMEG | | | EPA RfC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 10 min | 30 min | 60 min | 4 hrs | 8 hrs | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | 10 min | 30 min | 60 min | 4 hrs | 8 hrs | TEEL-0 | TEEL-1 | TEEL-2 | TEEL-3 | **Acute** | **Intermediate** | **Chronic** | |
| $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | (NA) | ERPG-1 | ERPG-2 | ERPG-3 | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ | $mg/m^3$ |
| | | | | | | | | | | | | | | | 15 | 30 | 50 | 250 | | | | |
| | | | | | | | | | | | | | | | 0.5 | 1.5 | 25 | 125 | | | | |
| | | | | | | | | | | | | | | | 0.002 | 0.005 | 0.025 | 0.1 | | | | 0.00002 |
| | | | | | | | | | | | | | | | 0.005 | 0.03 | 0.5 | 7.5 | | | | |
| | | | | | | | | | | | | | | | | | | | 0.001 | | | 0.000006 |
| | | | | | | | | | | | | | | | 1 | 3 | 5 | 100 | | | | |
| | | | | | | | | | | | | | | | 0.05 | 0.15 | 0.25 | 100 | | | | |
| | | | | | | | | | | | | | | | 0.2 | 3 | 5 | 500 | | | 0.00004 | 0.00005 |
| | | | | | | | | | | | | | | | 0.2 | 0.6 | 1 | 1 | | | | |
| | | | | | | | | | | | | | | | 10 | 30 | 50 | 250 | | | | |
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## APPENDICES

A. Air Sampling Forms
   1. Sampling Event Documentation (for Summa canister sampling)
   2. Chain of Custody (for Summa canister sampling)
   3. SPM Quality Assurance/Quality Control Checklist
   4. Chemcassette® Use Record
   5. MDEQ Equipment Maintenance Checklist
   6. Field Data Collection/Chain of Custody Record form (for metals sampling)
   7. High-Volume Data Record

B. Maintenance Schedule for SPM Machine

1. Sampling Event Documentation (for Summa canister sampling)

# Sampling Event Documentation (for Summa canister sampling)

Date of Event:_____

Address of Event:_____ (Semi-Quadrant ____ )

ODOR EVENT SAMPLING

Time Odor Event first noticed (per caller):
Time Odor Event reported (per dispatch or sampler):
Time sampler arrived on-scene (per sampler):

1. Can you verify odor at the sampling location? Yes / No
**If No, please wait a minimum of 5 minutes (unless emergency personnel are required elsewhere.) If no odor is detected, do not take a sample. Call is concluded.**
**If Yes, continue.**

2. Are confounders present? Yes / No
**If No, proceed to pre-sample vacuum reading.**
**If Yes, continue.**

3. What are the confounders? (See sampler folder for list for activities that can cause odors that could confound analytical results.)

4. Could odor be attributable to confounders? Yes / No
**If Yes, do not take sample. Call is concluded.**
**If No, continue.**

Gauge reading of canister before taking sample:_____

**Take sample. Record time:_____ Record canister ID:_____**

Gauge reading of canister after taking sample:_____

FOLLOW-UP NOTES

Caller's description of odor:

Sampler's description of odor:

Was a representative from Continental Aluminum present during the sampling? Yes / No
If yes, did the representative take an air sample? Yes / No

**If you took a sample at the odor event site, proceed to the designated control site for this semi-quadrant and take a control sample. (OVER)**

CONTROL AIR SAMPLING

**Note: Take a control sample only if an odor-event sample was taken.**

Control sample semi-quadrant:_____

**Proceed with taking control sample, then answer follow-up questions.**

Gauge reading of canister before taking sample:_____

**Take sample. Record time:_____ Record canister ID:_____**

Gauge reading of canister after taking sample:_____

FOLLOW-UP QUESTIONS

1. Can you detect any odor at the control location? Yes / No
   **If Yes, please describe odor.**

2. Are confounders present? Yes / No
   **If No, skip to Question 5.**
   **If Yes, continue.**

3. What are the confounders? (See attached list for activities that can cause odors that might confound analytical results.)

4. Can odor be attributable to confounders? Yes / No
   **Regardless of answer, a control sample must be taken if a sample was taken at the odor event site.**

5. Was a representative from Continental Aluminum present during the sampling? Yes / No
   If yes, did the representative take an air sample? Yes / No

**Please complete forms and handle them and canisters as instructed.**

NAME OF RESPONDER(S):_____

AGENCY:_____

SIGNATURE(S):_____

**Thank you for your time and effort in this Exposure Investigation.**

# Odor-Causing Activities that can Potentially Confound Analytical Results of Odor Event Sample:

| Odor | Activity |
|---|---|
| Gasoline-engine exhaust | Idling car<br>Traffic jam<br>Lawncare equipment in use |
| Diesel-engine exhaust | Idling semi-truck<br>Heavy-duty or agricultural equipment<br>School bus |
| Fuel smell | Tanker refilling fuel tanks (gas station, airport) |
| Natural gas | Oil or gas pump/flare |
| General smokiness | Burning leaves, brush<br>Outdoor cooking (barbeque, smoker)<br>Wood-burner |
| Tar | Road-surface work<br>Roofing work |
| “Chemical” smell | Pesticide application (yard, golf course, crop field)<br>Exterior painting/staining work |
| “Waste” smell | Septic or sewer gas<br>Livestock manure |

2. Chain of Custody (for Summa canister sampling)

EASTERN RESEARCH GROUP, INC.

**ERG Lab ID #:** _____

# Toxics/SNMOC Sample Data Sheet

**LAB PRE SAMPLING**

Site Code: _____ Canister Number: _____
City / State: _____ Lab Initial Can. Press. (“Hg): _____
AIRS Code: _____ Duplicate Event (Y/N): _____
Collection Date: _____ Duplicate Can #: _____

**Options**

SNMOC (Y/N): _____ Date Can. Cleaned: _____
TOXICS (Y/N): _____ Cleaning Batch #: _____

**FIELD SETUP**

Operator: _____ Sys. #: _____ MFC Setting: _____
Setup Date: _____ Elapsed Timer Reset (Y/N): _____
Field Initial Can. Press. (“Hg): _____ Canister Valve Opened (Y/N): _____

**FIELD RECOVERY**

Recovery Date: _____ Sample Duration (3 or 24 hr): _____
Field Final Can. Press. (“Hg): _____ Elapsed Time: _____
Canister Valve Closed (Y/N): _____

**LAB RECOVERY**

Received by: _____ Date: _____ Lab Final Can. Press. (“Hg): _____
Sample Login Date: _____ Status (valid/void): _____
If void, why: _____

**SNMOC**

Analyst: Date: _
Data File Name: _____ Dup. File Name: _____ Rep. File Name: _____

**TOXICS**

Analyst: Date: _
Data File Name: _____ Dup. File Name: _____ Rep. File Name: _____

Comments:

White: Sample File Copy Yellow: Receiving Copy Pink: Field Copy

3. SPM Quality Assurance/Quality Control Checklist (for continuous air monitoring)

# SPM Quality Assurance/Quality Control Checklist

Date:_____

Time:_____

Name:_____

Agency:_____

Is a Chemcassette® in place? Yes / No
If No, contact MDCH to report and receive instructions.
If Yes, continue.

Is the tape load lever closed? Yes / No
If No, close tape load lever.
If Yes, continue.

Is the power switch on? Yes / No
If No, contact MDCH to report and receive instructions.
If Yes, continue.

Is green system status LED lighted? Yes / No
If No, check cable connections. Also, contact MDCH to report and receive any further instructions.
If Yes, continue.

Are you switching out a Chemcassette® today? Yes / No

4. Chemcassette® Use Record

# Chemcassette® Use Record (for continuous air monitoring)

Date and time cassette inserted in SPM Monitor:_____

Name of person changing tape:_____

Agency:_____

Signature:_____

Date and time cassette removed from SPM Monitor:_____

Name of person changing tape:_____

Agency:_____

Signature:_____

**Place used cassette in ziplocking baggie and seal. Place that baggie and this completed form into a second baggie and seal. Store in trailer for MDCH pick-up.**

5. MDEQ Equipment Maintenance Checklist

# MDEQ Equipment Maintenance Checklist

Date:_____

Time:_____

Name:_____

Agency:_____

DATALOGGER:

Is datalogger light on? Yes / No

(Log on to computer to check real-time measurements.)

Are there are Flags showing in the computer program? Yes / No

**If No, continue.**

**If Yes, list which Flags are showing and corrective action taken:**

(See SPM Quality Assurance/Quality Control Checklist for acid monitor)

METEOROLOGICAL EQUIPMENT:

Is antenna tower on the front of the trailer upright? Yes / No

**If No, call MDCH to report and MDEQ to request assistance.**

**If Yes, continue.**

(Log on to computer to check real-time measurements.)

Are real-time measurements showing in the computer program? Yes / No

**If No, call MDCH to report and MDEQ to request assistance.**

**If Yes, continue.**

DOWNLOADING DATA:

Are you downloading data today? Yes / No

(over)

HIGH-VOLUME PUMPS:

Are you installing or removing a filter from the high-volume pumps today?
Yes / No

**If No, you are done with this sheet.**
**If Yes, continue.**

Please circle whether you are **installing** or **removing** the filter.

Reading of magnehelic gauge:_____

Time pump is set to start/stop:_____

Check any of the activities listed below that are occurring and provide explanation (location relative to trailer, timing or duration if known, etc.):

___Roof and building repairs
___Road and drive repairs
___Agricultural activity
___Nearby construction
___Open burning
Explanation:

6. Field Data Collection/Chain of Custody Record form (for metals sampling)

# FIELD DATA COLLECTION/CHAIN-OF-CUSTODY RECORD

**FEDERAL OCCUPATIONAL HEALTH SERVICE**
**2165 WEST PARK COURT, SUITE C**
**STONE MOUNTAIN, GEORGIA 30087**
**PH (770) 498-3449 FAX (770) 469-8623**

**PROJECT REFERENCE NUMBER:**
D8HO3HE34100/98FED16234-11/MI730:
Continental EI: Michigan

**SAMPLING SITE/DESCRIPTION:**
MI730: Continental Exposure Investigation: Michigan

**ANALYSIS REQUESTED**
*(INVESTIGATOR: YOU MUST SPECIFY EITHER METHOD OR ANALYTE(S) FOR EACH SAMPLE)*

**MATRIX CODES**
A = air B = bulk S = soil T = tape
DW = drinking water WW = wastewater
SD = sediment V = vacuum L = liquid

**PRESERVATION CODES**
(1) COOL TO $4^0$C (4) $HNO_3$ TO pH < 2, $4^0$C
(2) HCL to pH < 2, 40C (5) NaOH to pH > 12, $4^0$C
(3) $H_2SO_4$ to pH < 2, $4^0$C (6) ZaOAc to pH > 9, $4^0$C

*ATTENTION LABORATORY: SEND RESULTS TO:*

**VIA:** (Please check)
[ X ] Mail to:
[ X ] E-MAIL to:
[ X ] Fax to:

**NAME: Christina Bush** **PHONE: 517-335-9717**
**ADDRESS: MI Dept of Community Health, 3423 N. MLK Blvd, Lansing, MI 48906**
same as above at: bushcr@michigan.gov
Clifford L. Moseley at (770) 469-8623

| SAMPLE ID NUMBER | SAMPLING LOCATION | TYPE OF SAMPLE (MATRIX CODE) | FLOW RATE | START TIME | STOP TIME | Preservation Code | PM 10 weight gain | Metals Analysis (Pb, AL, Mn, Cd) | | | ADDITIONAL INFORMATION |
|---|---|---|---|---|---|---|---|---|---|---|---|
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| RELINQUISHED BY: | TIME/DATE: | RELINQUISHED BY: | TIME/DATE: |
|---|---|---|---|
| Christina Bush | | | |
| *(PRINCIPAL INVESTIGATOR)* | | *(LABORATORY REVIEWER)* | |
| **RELINQUISHED BY:** | **TIME/DATE:** | **RELINQUISHED BY:** | **TIME/DATE:** |
| | | | |
| *(LABORATORY SAMPLE RECEIVING)* | | *(LABORATORY SUPERVISOR)* | |
| **RELINQUISHED BY:** | **TIME/DATE:** | | |
| | | | |
| *(ANALYST)* | | | |

**SAMPLES SHIPPED TO:**

COMPANY: **DataChem Laboratories, Inc.**
ADDRESS: **960 West LeVoy Drive**
**Salt Lake City, UT 84123**

ATTN: SAMPLE RECEIVING ( Paul Pope )
PHONE: **800-356-9135**
FAX: **801-268-9992**

CARRIER: **Federal Express**
DATE:
TIME:
AIRBILL #:

7. High-Volume Data Record

# Hi-Volume Data Record

Project:_____P.N.:_____

Station:_____

Sampling Site:_____

Sampler Model:_____Sampler Serial No.:_____

Sample Date:_____Filter No.:_____

FLOW READING: Initial_____Final_____Average_____

RUNNING TIME METER: Initial_____Final_____

TOTAL SAMPLE TIME:_____minutes

TOTAL AIR VOLUME:_____std $m^3$

TSP/PM10 CONCENTRATION:_____µg/std $m^3$

OPTIONAL:

Temperature: Initial_____Final_____Average_____

Barometric Pressure: Initial_____Final_____Average_____

Comments: _____

_____

_____

_____

_____

Operator:_____

Appendix B. Routine Maintenance Schedule for SPM Monitor

The maintenance schedule described herein is based on the guidelines given in the Operating Instructions manual for the SPM Single Point Monitor, P/N 907889 Rev. 4.6 (6/97).

Three items of routine maintenance apply: replacing Chemcassettes®, verifying system response, and replacing the two internal filters annually.

1. **Replacing Chemcassettes® - Extended Play (EP) Chemcassettes® (the cassettes to be used in this Investigation) require replacement every 30 days.** Refer to the diagram in the manual for proper positioning.
    A. Open the tape load lever. The green system status LED will flash slowly. The digital display will show "AC LINE."
    B. Remove the center retaining screw securing the Chemcassette®. Remove the old cassette.
    C. Remove the take-up reel, slip off the used Chemcassette® tape, and replace the take-up reel.
    D. Install the fresh Chemcassette® with raised lettering facing up. Pull 12 inches of tape out of the fresh cassette. Place the end of the tape in the slot on the take-up reel cover.
    E. Thread the Chemcassette® tape through the detector head, capstan assembly, and over the guide posts (refer to diagram in manual). The EP cassette will lock in position when tape outlet is at approximately the one o'clock position.
    F. Install the take-up reel cover.
    G. Rotate the assembled take-up reel clockwise to take up any slack.
    H. Install the Chemcassette® center retaining screw.
    I. Close the tape load lever. The SPM will automatically begin monitoring.

2. **Verifying System Response – Perform the verification routine every two to four weeks.** This routine checks the operating condition of the SPM optical system through use of the optical test card supplied with the instrument. The instrument must be in Monitor Mode to start this test, and if the unit has the ChemKey option, the ChemKey must be installed and turned on. Refer to the diagram in the manual for proper positioning.
    A. Open the tape load level. Remove the Chemcassette® from the detector head.
    B. Press the alarm test button. The green system status LED will flash rapidly and display will show "VERIFY."
    C. Insert the test card with position #1 centered in the detector head. Be sure that the colored chip on the test card faces up and that the card is inserted fully into the detector head.
    D. Close the tape load lever and press the alarm test button. The audible alarm will emit one short signal.

E. Open the tape load lever and reverse the test card, centering position #2 in the detector head.
F. Close the tape load lever and press alarm test key.
G. If all electronics and optical systems are operating properly, the instrument will simulate an alarm condition and activate both the audible and visual alarms.
H. Open the tape load lever and press alarm reset. Replace the Chemcassette® and re-thread the tape. After pressing the alarm reset button, the alarm lamp does not extinguish. Wait until monitoring is resumed, then press the alarm reset button again.
I. Close the tape load lever. The SPM will automatically begin monitoring.
J. Press the alarm reset button to turn off the alarm lamp.
K. Plug the end of the sample line. A fault #17 will be generated, indicating that there are no leaks between the sampling point and the SPM.
L. If the system is not operating properly, the audible alarm will signal two times and the red system status LED will light. If this occurs, open the tape load lever, press alarm reset and repeat the verification procedure. If the system still indicates a malfunction, contact the manufacturer for assistance.

3. Replacing Internal Filters – **Internal filters should be replaced annually.** Refer to the diagram in the manual for proper access to the internal unit.
   A. Separate cover/collar from body.
   B. Open unit. Filters are located inside center area of cover/collar, below and partially behind printed circuit board.
   C. Remove the three screws and six fiber washers securing the printed circuit board.
   D. Leave all cables connected except J-11 and J-3 (refer to manual).
   E. Carefully lift outward on the printed circuit board to locate J-11.
   F. Support the printed circuit board temporarily in a raised position.
   G. Remove acid scrubber filter, mounted vertically. Replace with new filter (P/N 710235).
   H. Remove particulate filter. Replace with new filter (P.N 780248). Arrow on body of filter must point in correct airflow direction.
   I. Verify there are no kinks in tubing.
   J. Lower the printed circuit board to its original position.
   K. Reconnect cables, double-checking all connections.
   L. Secure the Printed circuit board with the screws and fiber washers.
   M. Before securing the cover to the body, verify that the SPM will go into Monitor Mode by powering up the unit. If the SPM does not go into Monitor Mode, power it down and check all connections and try again. If the problem persists, contact the manufacturer.
   N. Power down the SPM.
   O. Secure the cover to the body.
   P. Power up the unit and verify system response, as outlined previously.

**Appendix B. Contents of Sampler's Resource Folder for MDCH Exposure Investigation at Continental Aluminum, Lyon Township, Oakland County, Michigan**

MDCH Exposure Investigation
Lyon Twp, Oakland Co, Michigan
March 1 – May 29, 2004

Sampler's Resource Folder
(for Summa canister sampling)

CONTENTS:

1. Protocol to follow when responding to an odor-event call ("Responding to an Odor-Event Call") – light green sheet

2. Laminated map of area around Continental Aluminum (about 1.5-mile radius) showing semi-quadrants and control air sampling sites; reverse side shows description of sites and how to sample at them

3. List of potential confounders ("Odor-Causing Activities that can Potentially Confound Analytical Results of Odor Event Sample")

4. Lyon Township Odor Surveillance Forms

5. Exposure Investigation Protocol information sheet ("MDCH/ATSDR Exposure Investigation at Continental Aluminum") to distribute to those who ask

6. "Sampling Event Documentation (for Summa canister sampling)" forms

7. Sample ERG Chain of Custody form, showing areas to be filled out upon sampling

8. Business card for Christina Bush, lead investigator (keep in folder; contact information is also on the Protocol factsheet)

(Some contents have been modified for this report to protect privacy of individuals.)

# Responding to an Odor-Event Call

**Call Comes In**

1. If a sample has already been taken during the current six-hour period (6 to 12 or 12 to 6), let the caller know. You do not have to go. **(Samplers only go to an odor event if sampling is a possibility.)** Ask the caller to be sure to submit an odor surveillance form to the township offices; MDCH will receive a copy.
2. If you are **not** able to leave your current situation, tell the caller, apologize, and ask them to call one of the other samplers.
3. If you **are** able to go to the event, get name, event address, and contact phone number information from caller.
4. Let caller know about how soon you will arrive. Let the caller know they need to remain at the site until you arrive, since you will be taking information from them.
5. **If the caller is dissatisfied, have them call Christina Bush at 1-800-648-6942 or 517-335-9717 to discuss the situation with her.**

**Going to the Odor Event**

1. BRING THE SUMMA CANS, SAMPLER'S RESOURCE FOLDER, AND YOUR ASSIGNED CELL PHONE.
2. If you are detained along the route to the odor event, call the person who reported the event and let them know you will be a little late. If you think you will be very late, suggest that they call another sampler.
3. When you are en route, **contact Continental Aluminum.**

**At the Odor Event**

1. The caller should be at the odor event site when you arrive. If they are not there, call them on your cell phone and ask them to return to the site, regardless of whether an odor is present. (If you do detect an odor, tell them so but that **you cannot take a sample without them present**, per your instructions. Also, you will be taking some information from them and providing them with a Lyon Township Odor Surveillance Form, if they need one, which they should fill out and submit to the township offices.) If the caller does not return to the site, make a note of it and do not continue with the visit. Christina Bush from MDCH will follow-up with the caller.
2. Follow the Sampling Event Documentation sheet, as instructed during training. If you cannot detect an odor right away, stay at the site at least 5 minutes. If you are unable to detect an odor at all, tell the caller that you cannot take a sample. **If the caller is dissatisfied, have them call Christina Bush at 1-800-648-6942 or 517-335-9717 to discuss the situation with her.**
3. **If you are taking a sample, take a vacuum reading on the canister before and after sampling.** Make sure the green valve on the canister is closed (turned all the way in, clockwise). Using crescent wrench, remove brass cap on top of canister and connect gauge. Open valve and take reading. Close valve. Remove gauge. Take sample by opening valve, allowing the can to

come to pressure. Repeat gauge reading to verify that vacuum condition has changed. Close valve and replace cap. Fill out the Chain of Custody form as instructed during training, retaining the pink copy (bottom page) to leave with the Sampling Event Documentation at the township offices.

4. If the caller or others who may be witnessing the event/sampling have any questions regarding the Exposure Investigation, give them the "MDCH/ATSDR Exposure Investigation at Continental Aluminum" information sheet and ask that they get in touch with Christina Bush at MDCH (contact information is on the sheet).

**Control Air Sampling**

1. If you took a sample at the odor-event site, determine which semi-quadrant you are to go to for the control sample and go to the pre-assigned location for that semi-quadrant. Proceed with sampling, following the Sampling Event Documentation sheet, as instructed during training, including checking the vacuum on the can.

**Afterward**

1. If you took samples, package the canisters and fill out the Chain of Custody forms as instructed in training. Bring the packages to the township offices as soon as possible for shipping. **Leave the Sampling Event Documentation and the pink copy of the Chain of Custody form with the township offices** to be copied and faxed to Christina Bush at MDCH. These sheets do <u>not</u> get sent in with the canisters.

   **IF YOU TOOK SAMPLES, NOTIFY THE OTHER SAMPLERS**
   (since we are limiting number of samples taken to 1 per 6-hour period).

2. If you did <u>not</u> take a sample, it is <u>not necessary to notify</u> the other samplers.
3. If you have concerns or questions regarding the sampling procedure, call Christina Bush at MDCH at 517-335-9717.

# Control Air Sampling Sites

**Take a control air sample only if you have taken an odor-event air sample. Determine which semi-quadrant you took the odor-event air sample and go to the opposite semi-quadrant for the control sample. Do this immediately after completing the steps for the odor-event sampling.**

**1. Airport.** First thing before heading to the airport, make a **courtesy call to** the airport manager (leave voicemail if necessary) and let her know who you are, type of vehicle you are driving, and that you are sampling at the airport. (This is in case she receives word that "someone" is at the airport.) When you arrive, either pull in off Pontiac Trail at the gated pull-in east of the airport office building and park there, or enter the driveway west of the office building, drive around behind the building and park at the east end of the building (again, near the gated pull-in, just inside of it now). Walk over to the field east of the eastern hangars and take the sample there.

**2. Open field between New Hudson Dr/Lyon Center Dr (same street, map says one, street sign says another, next to new apartment complexes) and Rondeau (1st street east).** Walk at least 10 yards in from either road.

**3. North side of Grand River Ave at bike-trail crossing.** Park in the parking area right outside the gate for the Detroit Edison New Hudson Service Center. Take the sample on the trail, at least 10 yards from your vehicle and from Grand River.

**4. South Hill Rd, 0.2 mile south of Grand River Ave, at fire hydrant.** Park at least 10 yards away from the hydrant and take the sample at the hydrant.

**5. End of Lee Drive.** Lee Drive proceeds west from South Hill Road. At the top of the hill (a horse farm is on the left), the road turns to the north (right). Go to the end of this road (it might be called Coyote but there was no street sign when I drove the route); there is a line of trees and you can see Grand River Avenue in the distance. At the end of the cul-de-sac, park and sample from the road, at least 10 yards from your vehicle.

**6. Coyote Golf Course on Milford Rd.** If gates are open, park in parking lot and sample near the northern boundary of the property. (Do not sample in the cornfield.) If after hours and gates are closed, pull into driveway entrance, park, and sample along northern fence-line, at least 10 yards from your vehicle and from the road.

**7. End of Ponds Drive.** Take Ponds Drive all the way to the end. Park and sample from the road, at least 10 yards from your vehicle.

**8. Travis Rd at Tindale.** Park on Tindale and sample at least 10 yards south of your vehicle on Tindale.

## Odor-Causing Activities that can Potentially Confound Analytical Results of Odor Event Sample:

| Odor | Activity |
|---|---|
| Gasoline-engine exhaust | Idling car<br>Traffic jam<br>Lawncare equipment in use |
| Diesel-engine exhaust | Idling semi-truck<br>Heavy-duty or agricultural equipment<br>School bus |
| Fuel smell | Tanker refilling fuel tanks (gas station, airport) |
| Natural gas | Oil or gas pump/flare |
| General smokiness | Burning leaves, brush<br>Outdoor cooking (barbeque, smoker)<br>Wood-burner |
| Tar | Road-surface work<br>Roofing work |
| "Chemical" smell | Pesticide application (yard, golf course, crop field)<br>Exterior painting/staining work |
| "Waste" smell | Septic or sewer gas<br>Livestock manure |

# LYON TOWNSHIP ODOR SURVEILLANCE FORM

**Complainant Name:**_____

**Complainant Phone Number (for any follow-up):**_____

**Address where odor is occurring/occurred:**_____

**ODOR INFORMATION:**

**Date of odor:**_____ **Time detected:**_____ **Duration:**_____

**Odor descriptor (circle all that apply):**

| | |
|---|---|
| **A** | **ammonia** |
| **B** | **burning leaves or brush** |
| **C** | **citrus** |
| **D** | **cut grass** |
| **E** | **diesel exhaust** |
| **F** | **fishy** |
| **G** | **garlic** |
| **H** | **gasoline** |
| **I** | **house (interior) paint** |
| **J** | **lawn/garden treatment chemicals** |
| **K** | **livestock manure** |
| **L** | **metallic** |
| **M** | **mint** |
| **N** | **mothballs** |
| **O** | **natural gas (propane, etc.)** |
| **P** | **paint thinner** |
| **Q** | **plastic** |
| **R** | **sewer or septic gas** |
| **S** | **spray paint (fumes)** |
| **T** | **sulfur (rotten eggs)** |
| **U** | **swimming pool** |
| **V** | **tar/asphalt** |
| **W** | **urine** |
| **X** | **vinegar** |
| **Z** | **other (please describe in Comments)** |

**Odor Intensity (no fractions):**

| | |
|---|---|
| **0** | **Just detectable** |
| **1** | **Easily noticed but can detect other smells/odors** |
| **2** | **Can't smell anything else** |

**Comments (description other than what is listed, weather conditions, other information):**

**Please return forms to Lyon Township or call in your complaint information. Additional copies of this form are available at the Township offices. The township may share these forms with state or local agencies for purposes of complaint investigations. Agencies will protect personal identifying information to the extent permitted by law.**

# MDCH/ATSDR Exposure Investigation at Continental Aluminum

This factsheet presents the very basics of the Exposure Investigation to be conducted in Lyon Township. For more detail, please read the Protocol, available at the Lyon Township offices, Lyon Township Public Library, Salem-South Lyon District Library, or at the MDCH website http://www.michigan.gov/mdch-toxics under Features.

**Who**: The person leading the investigation is Christina Bush, a toxicologist at MDCH. MDCH is the Michigan Department of Community Health. ATSDR is the federal Agency for Toxic Substances and Disease Registry.

**What**: MDCH and ATSDR are conducting an Exposure Investigation, which means we are going to take air samples to determine what chemicals are present in the air, especially during odor events.

**Where**: The Investigation is taking place in Lyon Township. "Grab" (instantaneous) air samples will be taken where odors are detected. Continuous monitoring and particulate monitoring will take place at a stationary trailer placed at Dolsen Elementary School.

**When**: The Investigation will start March 1, 2004, and is expected to last no more than 90 days.

**Why**: ATSDR received a petition from the township requesting a public health assessment. The township was concerned that the emissions from Continental Aluminum, a recycling aluminum smelter on Milford Road, may not be safe. Residents have complained since the recycler started operations about odors believed to be from the plant. The data available to ATSDR and MDCH were inadequate to determine whether a public health hazard existed.

This Investigation proposes to determine what chemicals are in the air, especially during odor events. We may or may not be able to determine whether a public health hazard exists. However, we will attempt to answer the following questions:

1. What VOCs (volatile organic compounds, a class of chemicals), at what concentrations, are detected in the air during odor events? Are the concentrations above background, or control, levels?
2. Is hydrogen chloride or hydrogen fluoride (chemicals tested for in the stack tests at Continental Aluminum) detectable in the air during odor events? Is there a temporal (time) trend to the detection of these acids?
3. What metals (as airborne particulates), at what concentrations, are in the air?
4. Is it plausible that the earlier reported health effects are associated with detected chemicals and concentrations?
5. When an odor event occurs, do meteorological data indicate that the Continental Aluminum plant is upwind of the odor detection (i.e., is it plausible that Continental Aluminum is the source of the odor)?

**How**:

1. To determine if any VOCs (chemicals that easily enter a vapor or gas state and may have an odor) are present during odor events, we will analyze "grab," or instantaneous, air samples. Samplers will be trained how to take the samples. Certain criteria must be met in order for the sample to be taken. VOC sources include paint and solvents (which might be on aluminum scrap).

2. To determine if hydrogen chloride and hydrogen fluoride might be in the air, the air will be monitored continuously by a machine called an acid monitor. The monitor detects mineral acids on a chemically-treated paper tape, which is then "read" by the machine's optics to calculate the concentration of the acid. The data are logged onto a computer, which will be downloaded weekly by MDCH. Hydrogen chloride and hydrogen fluoride are acidic emissions routinely tested for in Continental Aluminum's stack tests.
3. To determine the amount of airborne particulate metals, 24-hour air samples will be collected every 6 days with a machine called a PM10 high-volume sampling pump. The air is drawn through a filter, onto which particles smaller than 10 microns (one thousandth of a millimeter) collect. The filter is then processed to determine the amount of each metal of interest. The metals we will be monitoring for are aluminum, barium, beryllium, cadmium, chromium, copper, lead, manganese, selenium, and zinc. These metals can be emitted by aluminum recycling smelters.
4. Meteorological data will be collected during the Investigation to help determine if detected odors are coming from the direction of Continental Aluminum or if there are certain conditions under which odors seem to be more prevalent. Temperature, wind speed, wind direction, relative humidity, and barometric pressure will be recorded.

Analytical results will be compared to Comparison Levels chosen by MDCH/ATSDR, the findings interpreted, and the information shared with the community. We will provide informal updates throughout the Investigation and prepare a formal document within three months of the completion of the Investigation.

## What MDCH/ATSDR needs from the community:

We know that the results of this Investigation will be important to all of you in different ways. Your conscientious participation in this Investigation is also important.

First, there is a limited number of canisters to be used in the VOC (grab sample) testing. If you detect an odor and are thinking about calling the emergency responders, **the odor must last until the responder gets to your address AND the responder must be able to detect the odor.** This involves a judgment call, but we feel that it makes for the most prudent and efficient use of the resources. Also, no more than 1 sample per 6-hour period (midnight-6AM, 6AM-noon, noon-6PM, 6PM-midnight) will be taken (the sampler will tell you if a sample has been taken for that period when you call).

Contacting air samplers during odor events – **DO NOT CALL 9-1-1**

**7 AM – 5 PM: call 486-3775 (fire department)**

If event occurs **5PM – 7AM or the fire department is not available**, call one of the numbers below (these numbers are not available until March 1):

**XXX-XXX-XXXX (5PM – 7AM, daily)**
**XXX-XXX-XXXX (24/7 daily after March 3)**
**XXX-XXX-XXXX (10AM – 5PM, Monday-Friday)**
**XXX-XXX-XXXX (8AM – 9PM daily after April 6)**

Second, **continue logging odor complaints with the township**. We need the forms to be a consistent format, so Lyon Township has designed a new form and has them available at their offices.

Contact Information:

MDCH Christina Bush bushcr@michigan.gov 1-800-648-6942 or 517-335-9717

# Sampling Event Documentation (for Summa canister sampling)

Date of Event:_____

Address of Event:_____ (Semi-Quadrant ____ )

ODOR EVENT SAMPLING

Time Odor Event first noticed (per caller):
Time Odor Event reported (per dispatch or sampler):
Time sampler arrived on-scene (per sampler):

1. Can you verify odor at the sampling location? Yes / No
**If No, please wait a minimum of 5 minutes (unless emergency personnel are required elsewhere.) If no odor is detected, do not take a sample. Call is concluded.**
**If Yes, continue.**

2. Are confounders present? Yes / No
**If No, proceed to pre-sample vacuum reading.**
**If Yes, continue.**

3. What are the confounders? (See sampler folder for list for activities that can cause odors that could confound analytical results.)

4. Could odor be attributable to confounders? Yes / No
**If Yes, do not take sample. Call is concluded.**
**If No, continue.**

Gauge reading of canister before taking sample:_____

**Take sample. Record time:_____ Record canister ID:_____**

Gauge reading of canister after taking sample:_____

FOLLOW-UP NOTES

Caller's description of odor:

Sampler's description of odor:

Was a representative from Continental Aluminum present during the sampling? Yes / No
If yes, did the representative take an air sample? Yes / No

**If you took a sample at the odor event site, proceed to the designated control site for this semi-quadrant and take a control sample. (OVER)**

CONTROL AIR SAMPLING

**Note: Take a control sample only if an odor-event sample was taken.**

Control sample semi-quadrant:_____

**Proceed with taking control sample, then answer follow-up questions.**

Gauge reading of canister before taking sample:_____

**Take sample. Record time:_____ Record canister ID:_____**

Gauge reading of canister after taking sample:_____

FOLLOW-UP QUESTIONS

1. Can you detect any odor at the control location? Yes / No
   **If Yes, please describe odor.**

2. Are confounders present? Yes / No
   **If No, skip to Question 5.**
   **If Yes, continue.**

3. What are the confounders? (See attached list for activities that can cause odors that might confound analytical results.)

4. Can odor be attributable to confounders? Yes / No
   **Regardless of answer, a control sample must be taken if a sample was taken at the odor event site.**

5. Was a representative from Continental Aluminum present during the sampling? Yes / No
   If yes, did the representative take an air sample? Yes / No

**Please complete forms and handle them and canisters as instructed.**

NAME OF RESPONDER(S):_____

AGENCY:_____

SIGNATURE(S):_____

**Thank you for your time and effort in this Exposure Investigation.**

**Appendix C. Historic Continental Aluminum Odor Complaint Statistics**

Total number of complaints per year (1 complaint/day/address):

| Year | Total complaints |
|---|---|
| 1998 | 55 |
| 1999 | 252 |
| 2000 | 271 |
| 2001 | 102 |
| 2002 | 55 |
| Total | 735 |

Number of complaints per month:

| Month | 1998 | 1999 | 2000 | 2001 | 2002 | Total |
|---|---|---|---|---|---|---|
| January | 0 | 0 | 16 | 3 | 15 | 34 |
| February | 0 | 1 | 26 | 4 | 5 | 36 |
| March | 1 | 3 | 21 | 6 | 8 | 39 |
| April | 6 | 1 | 26 | 17 | 6 | 56 |
| May | 6 | 20 | 29 | 6 | 6 | 67 |
| June | 13 | 24 | 40 | 7 | 1 | 85 |
| July | 9 | 25 | 13 | 1 | 3 | 51 |
| August | 10 | 28 | 22 | 8 | 5 | 73 |
| September | 8 | 46 | 30 | 14 | 0* | 98 |
| October | 2 | 34 | 24 | 25 | 0* | 85 |
| November | 0 | 34 | 15 | 6 | 4 | 59 |
| December | 0 | 36 | 9 | 5 | 2 | 52 |

*Fire in August 2002; plant not operating again until November.

Number of complaints per season (Winter = December-February, etc.):

| Season | 1998 | 1999 | 2000 | 2001 | 2002 | Total |
|---|---|---|---|---|---|---|
| Winter | 0 | 1 | 78 | 16 | 25 | 120 |
| Spring | 13 | 24 | 76 | 29 | 20 | 162 |
| Summer | 32 | 77 | 75 | 16 | 9 | 209 |
| Autumn | 10 | 114 | 69 | 45 | 4 | 242 |

Time of day with most complaints:

| Time | 1998 | 1999 | 2000 | 2001 | 2002 | Total |
|---|---|---|---|---|---|---|
| Not specified | 12 | 10 | 33 | 6 | 9 | 58 |
| 00:00 - 03:00 | 0 | 2 | 8 | 1 | 0 | 11 |
| 03:00 - 06:00 | 0 | 9 | 12 | 1 | 1 | 23 |
| 06:00 - 09:00 | 3 | 57 | 37 | 17 | 9 | 123 |
| 09:00 - 12:00 | 5 | 43 | 38 | 19 | 14 | 119 |
| 12:00 - 15:00 | 6 | 46 | 53 | 22 | 7 | 134 |
| 15:00 - 18:00 | 4 | 48 | 53 | 20 | 4 | 129 |
| 18:00 - 21:00 | 1 | 12 | 16 | 4 | 4 | 37 |
| 21:00 - 23:59 | 0 | 7 | 10 | 3 | 4 | 24 |
| All day | 24 | 18 | 11 | 9 | 3 | 65 |

Top 10 odor characteristics cited:

1. burning or burnt plastic
2. burnt
3. strong
4. burnt paint
5. acid
6. bad
7. burning or burnt wire
8. chlorine
9. musty
10. chemical

Top 10 health effects mentioned:

1. burned or burning eyes
2. breathing problems
3. headache
4. nausea, nauseous, retching, sick to stomach, or vomiting
5. burned or burning throat
6. burned or burning nose
7. coughing
8. dry, irritated, sore, or raw throat
9. choking
10. gagging

# Certification

This **Continental Aluminum Exposure Investigation: Air Monitoring Results** 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 begun.

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