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

Conducted by ATSDR and MDCH

TABLE OF CONTENTS

OBJECTIVE/PURPOSE 3
RATIONALE 4
BACKGROUND 5
AGENCY ROLES 6
ESTABLISHING CRITERIA 7
"Odor Events" 7
Comparison Values 7
METHODS 12
Instantaneous ("Grab") Air Sampling 12
Continuous Air Monitoring 15
Metals (Airborne Particulates) Analysis 19
Meteorological Data 22
Odor Complaint Information 23
REPORTING OF RESULTS 24
CONFIDENTIALITY 25
FOLLOW-UP ACTIVITIES 26
REFERENCES 27
TABLES 29
APPENDICES 38

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
	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	

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				

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				

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 Traffic jam Lawncare equipment in use
Diesel-engine exhaust	Idling semi-truck Heavy-duty or agricultural equipment School bus
Fuel smell	Tanker refilling fuel tanks (gas station, airport)
Natural gas	Oil or gas pump/flare
General smokiness	Burning leaves, brush Outdoor cooking (barbeque, smoker) Wood-burner
Tar	Road-surface work Roofing work
“Chemical” smell	Pesticide application (yard, golf course, crop field) Exterior painting/staining work
“Waste” smell	Septic or sewer gas 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 4^0C (4) HNO_3 TO pH < 2, 4^0C
(2) HCL to pH < 2, 40C (5) NaOH to pH > 12, 4^0C
(3) H_2SO_4 to pH < 2, 4^0C (6) ZaOAc to pH > 9, 4^0C

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

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.