



# **Wood Buffalo Environmental Association**

## **Human Exposure Monitoring Program:**

### **Part I – Background and Design Documentation**

**Wood Buffalo Environmental Association  
Fort McMurray, Alberta  
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## Summary

The Wood Buffalo region enjoys good air quality most of the time. A million barrels of oil are being produced as of 2006 by oil sands companies in the region. Oil production will triple in the next ten years. This increased activity along with population growth has raised people's awareness about air quality and quality of life in the region.

In response to this, the Wood Buffalo Environmental Association has established a Human Exposure Monitoring Program in the Wood Buffalo region. Information on the background, design, and methods of the Program is presented in this report.

The purpose of the Program is to monitor levels of people's exposure to selected air pollutants over time and to gather better information on factors that contribute to these exposures.

The Program has the ability to accomplish the following objectives for Wood Buffalo Environmental Association:

- Obtain true information on amounts of air pollutants that people are exposed to, and how much is indoors and outdoors at their homes.
- Provide better information in order to allow people in the region to make informed decisions about the role of indoor and outdoor air pollution.
- Expand the role that Wood Buffalo Environmental Association plays in providing thorough air quality information to people in communities throughout the region.



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## Glossary

absorption	process of absorbing or the condition of being absorbed
cardiovascular	relating to, or involving the heart and the blood vessels
chain of custody	documentation of movement and location of a sample from the time it is collected to the time it is analyzed at a laboratory
chronically ill	illness of long duration
convenience sampling	selecting individuals that are easiest to reach for a study
ethics	defending and recommending concepts of right and wrong behaviour
HEMC	Human Exposure Monitoring Committee
HEMP	Human Exposure Monitoring Program
NHEXAS	National Human Exposure Assessment Survey
NO <sub>2</sub>	nitrogen dioxide
O <sub>3</sub>	ozone
personal air	air in a person's breathing zone (nose/mouth area)
PM <sub>2.5</sub>	particulate matter with a diameter less than 2.5 µm
probability sampling	any method of sampling that utilizes some form of random selection
respirable dust	dust small in size that can get through the lung defence mechanisms of the human body
SO <sub>2</sub>	sulphur dioxide
US	United States
VOCs	volatile organic compounds
WBEA	Wood Buffalo Environmental Association



# 1 Introduction

The Wood Buffalo Environmental Association (WBEA) is a non-profit, community-driven organization that operates modern environmental monitoring programs. WBEA monitors and reports information on air quality and environmental impacts in the Wood Buffalo Region.

The WBEA is committed to providing this information to the public in order to allow them to make informed decisions about their health, and quality of life and traditional land use.



The oil sands industry has achieved successes in reducing air pollutant releases in the region over the years. However, air quality is recognized by people in the region as having a potential to affect health and well-being.

On the other hand, Health Canada<sup>1</sup> states that people have always been exposed to daily health hazards in air, food, water, and the workplace. Scientists often turn to monitoring to help understand what may be happening in the environment and how this may relate to health.

*Many environmental monitoring programs in North America focus on monitoring air, water, land, and other parts of the environment. Yet, the status of people is not monitored, although they are an important part of the environment.*

With this in mind and an understanding of future oil sands development in the region, WBEA supported the establishment of a human exposure monitoring program. This program is similar to efforts taken by the United States (US) Environmental Protection Agency during the past ten years. Their program is called the National Human Exposure Assessment Survey (NHEXAS).<sup>2</sup>



US Environmental Protection Agency uses NHEXAS to gather exposure information on people. This information is used to help organizations decide whether steps are needed to reduce health risks from different types of exposures. These organizations include individuals, communities, local and state governments, and other organizations.

*Why “human exposure” monitoring? Over the past 25 years, scientific studies<sup>3-6</sup> have shown that exposure is a key link in understanding the role between the environment and health status (diseases) in a population. Exposure to air pollutants is only one of a number of factors that may cause diseases such as asthma.<sup>7,8</sup>*

WBEA saw an opportunity of using a human exposure monitoring program to provide people with an understanding of whether or not a role exists between on-going industrial development and people’s exposure to common air pollutants in the region.

The program can also provide people with an understanding of what factors are important with respect to air pollution exposure. This information is valuable for the public. It provides people with a basis to make informed decisions about air quality and how it relates to their health.

### *1.1 Objective of Report*

The objective of this report is to provide general scientific information on the background, design, and methods of the WBEA Human Exposure Monitoring Program (HEMP).

A companion report – Human Exposure Monitoring Program: Part II – Methods and Procedures – provides more technical information on methods and procedures used in HEMP.



## 2 Background on Exposure to Air Pollutants

Air pollution exposure is any contact between a pollutant and an individual who has breathed air containing the pollutant.<sup>9</sup> A pollutant must follow pathways from the point of release into the environment to the point of contact with humans for exposure to take place.

An exposure pathway describes how a pollutant travels through the environment from its source to humans. An exposure pathway consists of five elements:<sup>6,9</sup>

- Source of contamination.
- Environmental media.
- Point of exposure.
- A person or population.
- Route of exposure.



### 2.1 Indoor Air

*Most people believe that exposure to outdoor air pollution can damage our health. Fewer people realize that indoor air pollution exposure can be, as or even more, harmful.<sup>10</sup>*

Studies by Alberta Health & Wellness,<sup>11</sup> Health Canada researchers,<sup>12</sup> and the US Environmental Protection Agency<sup>3</sup> indicate that levels of many indoor air pollutants can be much higher than outdoor levels.

As Canadians typically spend close to 90 percent of their time indoors,<sup>13</sup> there is considerable concern about the health effects from indoor air quality. Unfortunately, people who spend the most time indoors and are exposed to indoor air pollutants for long periods of time, are often the same people who are most susceptible to their effects if exposures are high enough.<sup>10</sup> They include the young, elderly, and chronically ill, especially those suffering from respiratory or cardiovascular diseases.



## 2.2 Outdoor Air

Outdoor air pollution comes from many different sources, including motor vehicles, industries, commercial businesses, and even windblown dust. Canadians spend a small amount of time outdoors (less than 12 percent of time on average).<sup>13</sup> As this represents a small amount of total time, outdoor exposure would only contribute to a small amount of total air pollution exposure to the general population.<sup>14</sup>



Nevertheless, studies on urban populations have reported positive links between outdoor air pollutants and people's health.<sup>15</sup> This provides a starting point for gathering better information to understand the role that outdoor air pollution has in contributing to exposure in Wood Buffalo region. Those same people – the young, elderly, and chronically ill – would be most susceptible to health effects of outdoor air pollution if exposures are high enough.

## 3 Purpose of HEMP

The Wood Buffalo region enjoys air quality that is considered good most of the time. This can be readily confirmed in WBEA annual reports on air quality in the region.<sup>16-19</sup> At times, a combination of factors and natural events (e.g., forest fires) can create conditions that lead to poor air quality. However, occurrence of these conditions is infrequent compared to times in which air quality is good.

A million barrels of oil are being produced as of 2006 by oil sands companies in the Regional Municipality of Wood Buffalo. Oil production will triple in the next ten years. This increased activity along with population growth has raised people's awareness about air quality and quality of life in the region.



In response to this, WBEA developed a Human Exposure Monitoring Program. Background information on the

Human Exposure Monitoring Program (HEMP) is provided in Appendices A and B of the Part II report and at [www.wbea.org/](http://www.wbea.org/).

The ability to show that air pollutants are a cause of diseases in a population remains a challenge, particularly when exposures are small. Air pollution exposure is only one of a number of factors that may contribute to development of diseases. Because of this, HEMP emphasizes measurement of air pollution exposure. If exposures are high enough, these exposures may represent a link between air pollutants in the environment and diseases that occur in a population.

*The purpose of the Human Exposure Monitoring Program is to monitor levels of people's exposure to selected air pollutants over time and to gather better information on factors that contribute to these exposures.*

Measurement methods for air pollution – although well established in practice – are limited in being able to detect changes over short time periods. To overcome this, HEMP will periodically take measurements in a community over time – e.g. every couple of years. HEMP will also report findings of these measurements to the public.



This approach has the ability to accomplish the following objectives for WBEA:

- Obtain true information on amounts of air pollutants that people are exposed to, and how much is indoors and outdoors at their homes.
- Provide better information in order to allow people to make informed decisions about the role of indoor and outdoor air pollution.
- Expand the role that WBEA plays in providing thorough air quality information to people in communities throughout the Wood Buffalo region.



Scientists also benefit from having this type of information. Specifically, scientists can use this information to:

- Better understand relationships between amounts of air pollutants that people are exposed to and amounts indoors and outdoors.
- Better understand important factors affecting people's exposure.
- Make recommendations on ways to reduce people's exposure that will have a real benefit in improving quality of life in Wood Buffalo Region.

Further information on the roles and responsibilities of organizations participating in HEMP is provided in Appendix A of the Part II report.

## 4 Design of HEMP

An initial community exposure study was undertaken in Fort McMurray in the late 1990s.<sup>11</sup> This study is referred to as the Alberta Oil Sands Community Exposure and Health Effects Assessment Program. Scientific methods used in the Fort McMurray study were initially developed elsewhere<sup>3</sup> and have since been improved upon by Alberta Health & Wellness and other researchers.<sup>20,21</sup>

The Fort McMurray study<sup>11</sup> provides valuable "baseline" scientific information on amounts of air pollutants that people in Fort McMurray were exposed to and amounts indoors and outdoors of their homes during 1997 and 1998. Fort McMurray makes up approximately 95% of the population within the Wood Buffalo Region.

The Regional Municipality of Wood Buffalo has a number of smaller communities that are near (e.g. less than 25 km) to current and proposed oil sand development projects. Also, First Nation people in the region follow traditional patterns of hunting, fishing, and trapping.



People in these communities and First Nation people are uncertain about change that industrial and commercial developments and population growth may have on air quality and their quality of life. A number of common air pollutants are associated with oil sand development project emissions. HEMP is designed to gather information on people's exposure and air quality in a number of communities.

#### 4.1 *Scientific Direction*



HEMP will use a **Science Advisory Committee** to provide technical direction. This committee will have the responsibility of ensuring that proper scientific methods are used so that reliable data are collected in an on-going manner.

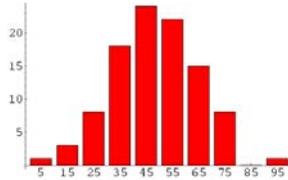
This approach was used to provide technical direction for the Fort McMurray study.<sup>11</sup> Their scientific team was led by: Dr. Petros Koutrakis (Harvard School of Public Health, Boston, MA), the late Rein Otson (Health Canada, Ottawa, ON), Dr. Pierre Band (Health Canada, Longueuil, QB), Dr. Tee Guidotti (George Washington University, Baltimore, MD), and Dr. Antero Aitio (World Health Organization, Geneva, Switzerland).

In addition to the Science Advisory Committee, a team of scientists based in Alberta will direct day-to-day scientific aspects of HEMP. A scientist at Alberta Health & Wellness (Edmonton) will lead this team. Again, this is consistent with how day-to-day scientific aspects of the Fort McMurray<sup>11</sup> and other studies<sup>20,21</sup> were conducted in Alberta.

The primary role of the science team is to ensure that reliable data are collected on a day-to-day basis and to provide scientific advice about program methods. This team will also be responsible for analysis and interpretation of results, and write-up of the findings.



## 4.2 Program Design



**Sample size** – A minimum of 30 people in a community was identified as a target sample size for HEMP studies. A statistical theory – the Central Limit Theorem – states that as sample size increases, the distribution of the sampling average will approach a normal distribution. It is on this foundation that much of the scientific basis for statistical testing rests. It is important to ensure that a sample is large enough to have results approximate the normal distribution. A sample size of 30 is usually considered adequate for this purpose.<sup>22</sup>

In order to ensure that results are obtained from a least 30 people in a community, a slightly larger sample is required. This allows for some people to drop out during the program while still maintaining a large enough sample. In this case, the plan is to recruit 35 people from a community.

**Sampling seasons** – Outdoor temperatures, indoor concentrations, and human time activities (e.g., time spent indoors versus time spent outdoors) vary between seasons. Two sampling periods – winter and summer months – will be used by HEMP to measure exposure representing the greatest variation among these factors.

**Sampling duration** – Sampling duration is the length of time in which air samples will be collected by HEMP. A seven-day duration will be used.<sup>20,21</sup> This represents a one-week period – and it is intended to capture people’s weekday and weekend exposure characteristics.

A seven-day period is also sufficiently long enough to ensure that air pollutants whose concentrations are low can be reliably detected using current field sampling methods.

**Pollutants** – A number of common air pollutants will be monitored by HEMP. Specifically, these include: nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>), ozone (O<sub>3</sub>), selected volatile organic compounds (VOCs), and airborne respirable particulate matter (also referred to as PM<sub>2.5</sub>).



These air pollutants are selected based upon public health concerns related to exposure indoors and outdoors.<sup>3-6,23</sup> Although these pollutants tend to be present at low levels indoors and outdoors, previous studies<sup>11,20,21</sup> have demonstrated that they can be reliably measured. Brief descriptions of these air pollutants are provided below:

- **Nitrogen dioxide (NO<sub>2</sub>)** – NO<sub>2</sub> is a gas that results from burning of fuels. Sources include vehicular exhaust, industrial emissions, gas stoves, tobacco smoke, kerosene heaters, wood-burning stoves, fireplaces, and gas pilot lights.
- **Sulphur dioxide (SO<sub>2</sub>)** – SO<sub>2</sub> is another gas that is produced by combustion of sulphur-containing fuels. Sources include motor vehicles, industrial emissions, unvented kerosene heaters, and wood-burning heaters and stoves.
- **Ozone (O<sub>3</sub>)** – O<sub>3</sub> is a gas created through the interaction of hydrocarbons, nitrogen oxides, and sunlight. Ozone is primarily found in outdoor air. Indoor sources may also include residential electronic air cleaners, negative ion generators, photocopy machines, deodorizers, germicides, and some aerosol sprays.
- **Volatile organic compounds (VOCs)** – VOCs represent a number of pollutants that contain carbon and are gases at room temperature. Sources include household cleaning agents, paints, solvents, tobacco smoke, furniture, carpeting, motor vehicle exhaust, and industrial emissions.
- **Respirable particulates** – These are small (microscopic) particles that remain floating in air and can enter the respiratory system. They are produced by combustion, grinding, and/or resuspension activities. Sources include tobacco smoke, kerosene heaters, home renovations, wood stoves, fireplaces, humidifier deposits, dander, motor vehicle exhaust, and commercial and industrial development activities.



## 5 HEMP Program Methods

### 5.1 Monitoring Equipment

Each air pollutant will be monitored for a seven-day period at three locations at a person's home:



- Personal air– in a person's breathing zone (e.g. close to a person's nose/mouth area).
- Indoor air– at a suitable location inside the person's home.
- Outdoor air– at a suitable location outside a person's home.

To ensure that reliable monitoring results are obtained, additional samples will be collected. These samples are collected for quality assurance and quality control (QA/QC) purposes.

Specifically, "blank", or unexposed air monitors will be used for QA/QC purposes. Blanks are handled and analyzed in an identical manner as other air monitors. Unlike the other monitors however, blanks are not exposed to air.

Air monitoring equipment used by HEMP consists of passive and active monitors.<sup>20,21</sup> Passive monitors work on the basis of pollutants in air diffusing into the sampler. Active monitors use a portable sampling pump to draw air containing the pollutant into the sampler.

Meteorological data will also be needed. These data will be obtained from the nearest WBEA meteorological station during the program. These data assist in understanding factors in the outdoor environment that can influence measurements from passive and active monitors. This includes wind speed, wind direction, temperature, and relative humidity.



## Passive Air Monitoring

Passive air monitors are inexpensive, portable air sampling equipment. They are ideal for measuring personal and environmental exposures over time frames generally ranging from one day to two weeks. These monitors work by selectively absorbing specific air pollutants.



HEMP will use passive air monitors for measuring  $\text{NO}_2$ ,  $\text{SO}_2$ ,  $\text{O}_3$ , and selected VOCs (e.g. benzene and toluene) in personal air, and indoor and outdoor air. Each monitor contains a chemical adsorbent that collects compounds from the air by diffusion. Once a monitor has been exposed for a known length of time, it is returned to the laboratory where the amount of absorbed pollutant is determined. Information on methods for passive monitoring are presented in Appendix C of the Part II report.<sup>20,21,24-26</sup>

## Active Air Monitoring

Active air monitors will be used for measurement of respirable particulates in personal air and indoors and outdoors at a person's home. These monitors consist of battery-operated pumps and air sampling heads containing a filter.

Once the monitors have been exposed for a known period of time, the filters are removed and returned to the laboratory. The laboratory determines the amount of respirable particulates by weighing the filter. Methods for respirable particulate monitoring are presented in Appendix D of the Part II report.<sup>20,21,27</sup>

## Placement of Air Monitors

**Personal Air Monitoring** – A separate clip-on passive monitor is used for each pollutant for personal air monitoring. All four passive monitors ( $\text{NO}_2$ ,  $\text{SO}_2$ ,  $\text{O}_3$ , and VOCs) are clipped to a “necklace” to be able to measure personal exposure.



For respirable particulates, a sampling head containing a filter is attached to the front of a person. Air is drawn through the sampling head connected by a tube to a battery-operating pump attached at the waist.

All of the personal monitors are worn for a seven-day period. During this time, people are encouraged to continue normal activities while wearing the monitors. During activities such as sleeping or showering, the monitors have to be kept as near to the person as possible while protecting the monitor from damage and high humidity environments.



**Indoor and Outdoor Monitoring** – Each type of passive and active monitor is placed inside and outside a person’s home. A stationary stand is used to house the monitors during the seven-day monitoring period.

All air monitors are attached to identical indoor and outdoor stationary stands approximately one meter above the floor or ground. The outdoor stand has a rain shield approximately 30 cm in diameter to shelter the monitors.

Respirable particulate sampling heads are placed in a facedown position approximately one meter above the floor or ground. This position avoids interference from particles settling due to gravity.

The exact location of all air monitor locations is determined during an initial visit to each person’s home. Locations are selected after carefully considering:

- Type of home (house, apartment, etc.).
- Layout of the home.
- Layout of the outside yard or grounds.
- Daily habits of the person.



Inside, air monitors are placed in the main living area of a person’s home. This is the room in which a person spends the most time while awake. For example, this could be in the kitchen or living room. In addition, care is taken to

ensure that the air monitors are placed no closer than two meters away from exterior doors, windows, and heat vents.

Outdoors, a person's backyard is the preferred location to put the monitors. Care is taken to ensure that the monitors are placed at least one meter away from trees and bushes or at least five meters away from any type of air vent. For second floor apartments, a "yardarm" system is used to extend the air monitors from a window or balcony.

If a yardarm is not possible, the air monitors are placed at ground level. Field sampling personnel draw a rough sketch of where the indoor and outdoor air monitors are placed at each person's home.

## 5.2 *Recruiting Volunteers*

HEMP will recruit unpaid volunteers over the age of 18 years from several Regional Municipality of Wood Buffalo communities. These communities include:



- Fort McMurray
- Mikesew Cree First Nation and the Athabasca Chipewyan First Nation (in Fort Chipewyan)
- Chipewyan Prairie First Nation (in Janvier)
- Fort McKay First Nation
- Fort McMurray #468 First Nation/Anzac

HEMP has a schedule for sampling in these communities (Appendix E of the Part II report).

Several approaches to recruit volunteers may be used. One approach involves a form of convenience sampling and the second approach involves probability sampling.

**Convenience Sampling** – This approach involves active recruitment through advertising in local media and at other venues. These venues include making presentations at industries, educational institutions, recreational facilities, and other public meetings.



Recruitment materials (e.g., brochures, community presentations, information bulletins) have been developed by the WBEA Human Exposure Monitoring Committee to assist with this. A webpage has also been developed to accomplish a number of objectives for HEMP:

- Communicate information about HEMP.
- Recruit people from communities.
- Collect general contact and demographic information from people that wish to volunteer.

The webpage can be accessed at [www.wbea.org/html/human\\_exposure/human\\_exposure.html](http://www.wbea.org/html/human_exposure/human_exposure.html). An example of the registration form that volunteers are required to complete is provided in Appendix F of the Part II report.

The convenience sampling approach can be efficiently used to select volunteers in a large community like Fort McMurray. This can be accomplished by ensuring that enough volunteers are recruited and then only selecting volunteers that are a good representation of homes located across Fort McMurray. Other factors can also be screened during the selection process, such as the number of males and females, ages, and occupation.

**Probability Sampling** – This approach involves randomly identifying and recruiting people to participate in the program.<sup>28</sup> Studies in the community of Fort McKay<sup>29-31</sup> have shown that the probability sampling approach can be efficiently used to select volunteers in small communities.

This method works by dividing all the houses in a small community into equal sections and randomly selecting a similar amount of houses in each section. Prior to recruitment, an information letter is delivered to each house indicating that a study is being undertaken and that they may be asked to participate. A door-to-door campaign is then used to recruit volunteers.



Smokers are not excluded from participating in a program. Smoking and exposure to environmental tobacco smoke is identified during initial recruitment of all volunteers and in surveys.

People's exposure to environmental tobacco smoke is then taken into account during analysis of results. An ideal design has some smokers participate in the program, but no more than is represented by the percent of population that smokes.

### 5.3 Surveys and Forms

**Time activity diary** – A diary technique will be used by HEMP to collect people's time activity data.<sup>3,4</sup> Specifically, people will be asked to complete a diary about their activities and where they spend their time during the seven-day monitoring period.



These diaries inform investigators about what people do and where they spent their time while wearing the air monitors. Previous work has indicated that the amount of time spent in various locations (e.g. indoors vs. outdoors) is an important factor influencing personal exposure.<sup>32,33</sup> More information on the time activity diary used by HEMP is presented in Appendix G of the Part II report.

**Demographic and health survey** – Another survey will be used to collect information about general characteristics of people participating in the program (e.g., gender, age).<sup>4</sup> This is referred to as a demographic, exposure, and general health survey.<sup>20,21</sup>

This survey also collects data on sources that may affect the levels of air pollutants being measured (e.g. occupation, household characteristics, presence of tobacco smoke, etc.).<sup>4</sup> This information is essential for understanding potential sources of an air pollutant.



These types of surveys are a relatively inexpensive method to gather information from people and – if well designed – can be easily carried out.<sup>4</sup> More information on the demographic and health survey used by HEMP is presented in Appendix H of the Part II report.

#### 5.4 *Field Activities*

**Project Coordinator** – A Project Coordinator will be used to direct field activities during sampling collection in a community. This includes being responsible for a number of activities, including:

- Selecting and screening participants.
- Booking appointments for field monitoring teams.
- Looking after the air monitoring equipment inventory.
- Coordinating shipment of air monitors to the laboratory for analysis.
- Ensuring capture of sampling time information and respondent data.
- Ensuring data collected is electronically entered.



More information about responsibilities of the Project Coordinator is located in Appendix I of the Part II report. To ensure proper collection of field data, the Project Coordinator will use a data control form for each program participant (Appendix J of the Part II report).

**Field Monitoring Teams** – Monitoring teams will be used in the field. These teams will consist of a minimum of two trained members. The teams will be responsible for placing air monitors in each person's home and picking up the air monitors. They will also collect the diary and survey forms and record other pieces of information in the field.



HEMP with the assistance of personnel from Alberta Health & Wellness (Edmonton) will conduct multi-day training sessions. These sessions will be used to train field monitoring teams prior to data collection in each

community. Specifically, this will consist of classroom training to review and learn monitoring program objectives, field sampling procedures, and field documentation, or data collection (paper work) requirements.

At the end of training sessions, each team member will be required to practice and demonstrate their ability to correctly handle and locate air monitors in a participant's home. They must also be able to answer questions or concerns people may have about the air monitoring equipment.



The field teams will operate in pairs in the field to ensure safety and improve accuracy. Each team will receive a list of participants and appointment times. Each team is responsible for contacting a participant at a pre-arranged appointment time to place the air monitors in a home, outside the home, and on the individual.

Upon arrival at a home, the field teams will provide details about equipment being placed in the home and explain what to do if there are problems with the equipment. They will also provide details about the time activity diary and demographic and health survey that a person is required to complete.

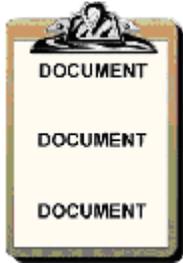
Each person is asked to record his or her activities throughout the seven-day sampling period. At the conclusion of the sampling period, field teams will review and collect the time activity diaries and the demographic and health survey.

**Field Procedures** – Procedures have been developed for the field monitoring teams to follow when setting up and taking down air monitors (Appendix K of the Part II report). These procedures were developed by others.<sup>20,21</sup>



Once a person has been recruited and/or volunteered for the program, a standard protocol is used to handle all aspects of their participation:

1. Each person initially receives a formal letter from the Project Coordinator. The letter explains what they can expect during their week of participation in the program. The letter also provides details on who to contact if they have any questions. An example of this letter is provided in Appendix L of the Part II report.
2. Field monitoring teams then explain the program in detail and answer any questions or concerns people may have. Samples of the monitoring equipment are shown and typical placements in the homes are explained. The purpose of the time activity diary and demographic and health survey are also explained.



3. Each person is then required to sign a consent form (Appendix M of Part II report). In signing the form, they must volunteer to make themselves available to allow field monitoring teams to place and remove monitoring equipment at the beginning and end of a consecutive seven-day period. They must also volunteer to complete the time activity diary and demographic and health survey.
4. Appointment times for placing and removing the air monitoring equipment in a person's home are set.
5. At an agreed upon time, field teams place air monitoring equipment at each person's home. These monitors remain for a seven-day sampling period. The time activity diary and demographic and health survey is given to each person to complete.
6. Field monitoring teams remove the monitoring equipment at the end of the seven-day period. The completed time activity diary and demographic and health surveys are picked up.



At the end of fieldwork, field teams separate the consent forms from other documents, sorted by identification number. The consent forms are filed in secured storage. Since these forms contain names and links to other data

collected in the field, they are kept separate from other information to assure confidentiality of information.

**Chain of Custody** – Chain of custody is defined as the documentation of movement and location of samples from the time it is collected to the time it is analyzed at a laboratory. HEMP will use chain of custody forms (log sheets) to track and ensure proper movement of field samples to the laboratories for analysis.

Chain of custody forms will be used for passive air monitors (Appendix N of Part II report) and filters from the active air monitors (see Appendix O of Part II report).

## 6 Data Analysis and Reporting

### 6.1 Analysis

#### Data Entry

HEMP will use standard data entry procedures to ensure proper transfer of analytical data to electronic files. These procedures were developed during the course of other similar studies in Alberta.<sup>20,21</sup> A brief description of these procedures is presented in Appendix P of the Part II report.



#### Laboratory Analysis

HEMP will use accredited laboratories in Alberta for analysis of the passive air monitors and filters from the active air monitors. Results of analysis conducted at these laboratories will be sent directly to Alberta Health & Wellness (Edmonton) for interpretation.

**Passive Air Monitoring** – Details of laboratory methods of passive air monitoring of NO<sub>2</sub>, SO<sub>2</sub>, O<sub>3</sub>, and selected VOCs (e.g. benzene and toluene) are presented in Appendix Q of the Part II report.



**Active Air Monitoring (Particulate Matter)** – Details of laboratory methods of active air monitoring of particulate matter are presented in Appendix R of the Part II report.

## *6.2 Reporting*

Alberta Health & Wellness (Edmonton) will be responsible for preparing periodic reports for HEMP. Along with this important responsibility will be interpretation and communication of the findings to HEMP. HEMP will be responsible for communicating findings of the studies to the public in the Wood Buffalo region.

## **7 Ethical Considerations**

Ethics are an important consideration in planning, conducting, and communicating results of community-health and exposure assessment studies.<sup>34</sup> Here it is important to protect the interests and identity of people who volunteer in these studies both during and after completion.

Ethical issues that will be addressed by HEMP include:

- Obtaining fully informed consent of people volunteering in the program.
- Providing timely feedback of interim and final program results.
- Supporting each person's freedom of choice to participate, not participate, or withdraw from the program
- Protecting the identities of volunteers after completion of the program.



Procedures successfully used in previous community health and exposure assessment studies in Alberta<sup>11,20,21</sup> will be

followed to ensure ethical treatment of people who volunteer in HEMP studies. Specifically, the following precautions will be maintained to ensure confidentiality of data collected:

- All information collected by field teams will be stored in a secure location.
- Consent forms will remain separate from other documents and filed in secured storage to ensure confidentiality of information.
- Data collection forms will have a unique, arbitrarily assigned identification number, which will make it possible to link all information collected, but will protect any identifiable information.
- Only the Project Coordinator and health data analysts at Alberta Health & Wellness (Edmonton) will have the ability to link personal information to exposure data. This may be necessary to follow up with participants who have incomplete data.
- Results will be presented in a format that does not contain any identifiable information.



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