



**WOOD BUFFALO
ENVIRONMENTAL ASSOCIATION**



ANNUAL REPORT

When one tugs at



a single thing in nature, he finds it attached

to the rest of the world.



1.0 EXECUTIVE SUMMARY	7
1.1 Introduction	7
1.2 Organization	8
1.3 Strategic Framework	9
1.3.1 WBEA Mission	9
1.3.2 WBEA Values	10
1.3.3 WBEA Vision	10
2.0 REPORTS	11
2.1 President's Report	11
2.2 Executive Director's Report	11
3.0 ASSOCIATION ACTIVITIES AND PROGRESS	14
3.1 Ambient Air Monitoring Program	14
3.1.1 Message from the Chair of the Ambient Air Technical Committee	14
3.1.2 Sulphur Dioxide (SO ₂)	16
3.1.3 Oxides of Nitrogen (NO _x)	17
3.1.4 Ozone (O ₃)	18
3.1.5 Total Hydrocarbons (THC)	20
3.1.6 Total Reduced Sulphur Compounds (TRS)	21
3.1.7 Carbon Monoxide (CO)	22
3.1.8 Particulates (PM ₁₀ & PM _{2.5})	23
3.1.9 Meteorology and Air Quality	24
3.1.10 Passive Monitoring	25
3.2 Terrestrial Environmental Effects Monitoring Program	26
3.2.1 Message from the Chair of the Terrestrial Environmental Effects Monitoring Committee	26
3.2.2 Soil Acidification and Forest Health Survey	26
3.2.3 Soil Microbiology	27
3.2.4 Vegetation Stress Survey	27
3.2.5 Lichen Study	27
3.2.6 Nitrogen	27
3.2.7 2003 Reports	28
3.3 Human Exposure Monitoring	29
3.3.1 Message from the Chair of the Human Exposure Monitoring Committee	29
3.4 Communications	29
3.4.1 Message from the Chair of the Communications Committee	29
4.0 LINKS TO THE CLEAN AIR STRATEGIC ALLIANCE	30
4.1 Clean Air Strategic Alliance (CASA)	30
4.2 Alberta's Air Shed Management Zones	30

5.0 FINANCE REPORT	34
Statement of Operations, for the year ended December 31, 2003	34
Schedule 1. Contributions	34
Schedule 2. Ambient Air Monitoring Expenses	34
Schedule 3. Office & Administration Expenses	35
Schedule 4. TEEM Vegetation & Soil Monitoring Expenses	36
Schedule 5. Miscellaneous Expenses	36
6.0 APPENDICES	37
Appendix I. Ambient Air Monitoring Data - 2003	38
Appendix II. Meteorological Observations - 2003	41
Appendix III. WBEA Committee Members	43
Appendix IV. WBEA Members	44
Appendix V. Contractors for the WBEA	44
Appendix VI. 2003 Reports	44
Appendix VII. Glossary of Terms	45

Figures

Figure 1. Regional distribution of air monitoring stations in Wood Buffalo	15
Figure 2. Maximum and average sulphur dioxide concentrations in 2003	17
Figure 3. Maximum and average nitrogen dioxide concentrations in 2003	18
Figure 4. Maximum and average ozone concentrations in 2003	19
Figure 5. WBEA Passive Monitoring Sites	22

Tables

Table 1. SO ₂ concentrations at WBEA monitoring sites in 2003	38
Table 2. TRS compounds and H ₂ S at WBEA monitoring sites in 2003	38
Table 3. THC concentrations at WBEA monitoring sites in 2003	38
Table 4. NO ₂ concentrations at WBEA monitoring sites in 2003	39
Table 5. O ₃ concentrations at WBEA monitoring sites in 2003	39
Table 6. PM _{2.5} concentrations at WBEA monitoring sites in 2003	39
Table 7. CO concentrations at WBEA monitoring sites in 2003	39
Table 8. Average concentrations of SO ₂ , NO ₂ , O ₃ and H ₂ S at forest monitoring sites in 2003	40
Table 9. Temperature measurements at WBEA stations in 2003	41
Table 10. Wind speed measurements at WBEA stations in 2003	41
Table 11. Relative humidity measurements at WBEA stations in 2003	41
Table 12. Solar radiation measurements at WBEA stations in 2003	41
Table 13. Wind direction measurements at WBEA stations in 2003	42

WBEA 2003 Annual Report ↗

1.1 INTRODUCTION

The 2003 Annual Report of the WBEA reflects the spirit of community. We are a diverse group of organizations and individuals united in our concern for the protection of the world in which we live. With you we rejoice in the serenity of the boreal forest, are amazed at the diversity of wildlife and delighted by the variety of vegetation found in the region of Wood Buffalo. Our role is to act as a vanguard against anything that might jeopardize the health of our collective backyard. We do this by vigorous monitoring, 24 hours a day, 365 days a year and making the results of that monitoring available in a clear, understandable manner that is accessible to anyone who wishes to see it.

In consultation with all interested parties, the following items have been recognized as high priority issues for the region.

- > Human Health Effects
- > Odours
- > Soil and Water Acidification
- > Data Validity, Management and Dissemination
- > Ground-Level Ozone
- > Direct Impinging Effects on Vegetation
- > Heavy Metal Deposition and Accumulation
- > Smoke and Dust
- > Global Warming / Greenhouse Gases (i.e., carbon dioxide, methane)

The information gathered concerning these issues is made available to all on our Website. Additional information about the WBEA is presented in quarterly newsletters to the community, an educational video targeted for elementary school age children and at various trade shows, science fairs and presentations.

None of this would be possible without the complete co-operation of all parties and the abiding interest of the communities of the Wood Buffalo region. As our organization gains momentum and enters new areas of environmental monitoring, we welcome the input of new members and look forward to the continued evolution of our comprehensive system of monitoring our region.

1.2 ORGANIZATION

The Wood Buffalo Environmental Association is a not-for-profit organization registered under the Societies Act of Alberta and was the second regional airshed management zone to be developed in the province.

Membership in the Association consists of 22 full status members and one associate member.

The WBEA currently consists of a number of committees and a governing board. The committees

are operational in function, helping to carry out the work of the Association. They are:

- > Ambient Air Technical Committee (AATC)
- > Terrestrial Environmental Effects Monitoring Committee (TEEM)
- > Communications Committee (CC)
- > Human Exposure Monitoring Committee (HEMC)

The Association's Board of Directors meets on a quarterly basis. It is responsible for the stewardship of the WBEA and makes decisions only by consensus to ensure that every member has an equal voice at the table. The Board is supported by a Governance Committee and by a full-time Executive Director who supports and provides expert advice on the strategic direction and activities of the organization.

Governance Committee:

- > Ann Dort-MacLean
Fort McMurray Environmental Association
President & Chairperson
- > Ted Ostrowski
Syncrude Canada Ltd.
Vice-President
- > Eric Davey
Athabasca Tribal Council
Director
- > Darcy Garchinski
Northern Lights Regional Health Authority
Director
- > Samantha James
Albian Sands Energy
Director
- > Dick Ebersohn
Regional Municipality of Wood Buffalo
Director
- > Lisa Schaldemose/Colin Beddoes
Wood Buffalo Environmental Association
Executive Director

Based on a formula relative to environmental impact, industry members provide ongoing operating and capital funding, supporting an annual direct budget of approximately \$2.4 million. With a number of in-kind contributions, actual costs of operating the WBEA are substantially greater than this

figure. The time contributed by community representatives to the WBEA has been immeasurable.

1.3 STRATEGIC FRAMEWORK

Through statements of Mission, Vision Outcomes and Strategic Objectives the Strategic framework focuses on a future linked to the environment, and enables the WBEA to achieve its goals, and adapt to challenges and opportunities that impact its direction.

Strategic objectives in 2003 included:

- > continuing to provide a world class level of air emissions monitoring
- > sustaining state-of-the art research and monitoring projects including the application of traditional knowledge and expertise
- > maintaining collaborative decision making on air related environmental matters amongst a growing number of stakeholder members throughout the region
- > communicating effectively so that stakeholders can understand and use information in responding to environmental issues
- > identifying and implementing opportunities for cooperation with other environmental organizations
- > providing opportunities for all stakeholders and communities to use WBEA as a resource to address air related environmental issues
- > developing new, improved strategies to monitor and respond to air related environmental issues

1.3.1 WBEA MISSION

The mission of the Wood Buffalo Environmental Association is to monitor and provide accurate, credible, transparent and understandable information on air quality and air related environmental impacts in the Wood Buffalo Region that can be used by people to make informed decisions that relate to their health, safety and quality of life and traditional land use. The Association actively facilitates dialogue among its members and others in the region to be sensitive and responsive to the environment in their planning, decision-making and operations.



1.3.2 WBEA VALUES

The work of the WBEA is guided by the following values:

- > *A dedication to maintain a world-class level of monitoring.*
- > *The objectivity of data communicated.*
- > *The communication of timely, accurate and useful information on air emissions.*
- > *A commitment to attract and retain a high level of expertise and competence within the organization.*
- > *A commitment to fostering the involvement of multiple stakeholders.*
- > *A pledge to respect the way of life and knowledge of Aboriginal people.*
- > *A collaborative, consensus based approach to decision making and problem solving.*
- > *A climate of trust, honesty and openness.*
- > *The efficient and prudent use of available resources.*

1.3.3 WBEA VISION

Through its actions in monitoring and communicating information on air quality and facilitating dialogue on air related environmental impacts WBEA seeks to achieve the following results:

- > *People feel comfortable about the environment in relation to their health and have confirmation that industry is fulfilling its commitment to a healthy environment.*
- > *Aboriginal communities have an effective voice in the monitoring of air quality impacts.*
- > *Communities are using WBEA as a resource to become informed about air quality and air-related environmental effects.*
- > *WBEA is perceived by communities as being a credible, trustworthy, committed and responsible association.*
- > *Industry sees WBEA as a forum to fulfill regulatory compliance for air monitoring.*
- > *Information on air related environmental effects is based on timely, accurate and quantitative data that comes from a source in which all stakeholders have confidence.*
- > *The communication of air quality and its effects is available to all stakeholders in ways they can understand, convey and interpret to others in the organizations and communities.*
- > *Monitoring stations are located strategically throughout the region to form a comprehensive system of regional monitoring for air related environmental impacts.*
- > *WBEA has an authentic profile at regional, provincial, national and international levels, with a credible membership and a record of being accountable to the community in which it operates.*
- > *All industries with air emissions in the Wood Buffalo Region are members of WBEA.*
- > *WBEA maintains a collaborative, consensual decision making process on air quality issues amongst a growing number of stakeholder members across all sectors throughout the region.*
- > *WBEA's mandate includes monitoring air emissions effects on water, soil, vegetation, fish and wildlife and interpreting information and measuring cumulative effects.*

2.1 PRESIDENT'S REPORT

The Wood Buffalo Environmental Association has been in operation for a number of years. I have been fortunate to have been involved in various capacities – first as a representative for the municipality and then as a representative of the Fort McMurray Environmental Association.

The WBEA has evolved over the years, expanding both the mandate and the membership. The one constant being the multi-stakeholder consensus based decision-making focus.

WBEA started out as RAQCC (Regional Air Quality Coordinating Committee), which was an offshoot of the Fort McKay Interface Committee in which the community of Fort McKay, industry and government established a way to effectively respond to community questions and concerns. This group then expanded to form RAQCC to look at regional air quality. From this, WBEA was developed.

As the organization evolved, so did the membership, to include outlying communities from as far away as Fort Chipewyan to the communities to the south of Fort McMurray. We now have representation from NGO's and Health Authorities. The diverse membership share the same concerns for monitoring and protecting the air quality in the region. A lot of time and attention is spent on collecting credible scientific data, but even more important, a lot of time is spent making this data useful and meaningful to the membership. While the science is important, it is useless unless we can communicate the information to all of the members in a manner that they can understand and that has meaning for them. Unless the information is communicated in significant manner then we will have done only half of our job. The cooperation and active participation of all of our members is what has resulted in our winning an Emerald Award and a Financial Post Award. The multi stakeholder, equal partnership of the Association makes us unique and vibrant. As our membership continues to grow and as we evolve to continue to meet the needs of the membership, we

will continue to be an exciting organization. Together we set the agenda and mandate and together we add to the quality of life in the region. 2003 was a busy year and 2004 promises more growth and productivity.

Ann Dort-MacLean
President



2.2 EXECUTIVE DIRECTOR'S REPORT

The Wood Buffalo region is currently undergoing a period of unprecedented industrial growth. The Wood Buffalo Environmental Association continues to keep pace with monitoring the effects of development and provides a circle within which multi-stakeholder dialogue can take place.

The 2003 operating year has been one of transition for the WBEA. The Wood Buffalo Environmental Association's subcommittees continue to take on new projects. During 2003, new contracts have been awarded for ambient air monitoring, the analysis of volatile organic compounds, and for investigation of the terrestrial effects of airborne emissions.

Our members continue to build upon the Association's strengths and ongoing initiatives in diverse areas. A well attended strategic planning session at year end has allowed us to re-visit our vision and mission, core values, and affirm organizational outcomes. As a direct result, we have begun to implement a results-based management process where outcomes are shaped and monitored directly by members. As new members and representatives join WBEA and its subcommittees our level of effectiveness increases.

The Association's activities have been consolidated within four core operational areas:

- 1) Monitoring environmental quality
- 2) Investigation, data and information gathering
- 3) Communicating information on environmental quality

4) Collaborative environmental decision-making and action.

MONITORING ENVIRONMENTAL QUALITY

Considerable effort was applied by WBEA members and staff in the areas of planning and operations to ensure a smooth transition of the operation and maintenance contract for the WBEA air monitoring network. Parallel data collection was set up during December at a number of WBEA stations to ensure that data quality would not be compromised with the switch to a new data collection system. Members of the Ambient Air Technical Committee (AATC) also worked diligently during the last quarter of 2003 on an initiative to enhance the existing VOC monitoring program in the region.

TRENDS IN ANNUAL AVERAGE EMISSIONS CONCENTRATIONS IN AMBIENT AIR:

Sulphur dioxide (SO₂) > annual average concentrations were consistent with levels recorded from 2000-2002. Annual average concentrations at plant sites ranged from 2 to 3 ppb and annual average concentrations at community stations ranged from 0 ppb in Fort Chipewyan to 1 ppb in Fort McKay and Fort McMurray.

Nitrogen dioxide (NO₂) > annual average concentration levels in Fort McMurray and Fort Chipewyan were 10 and 1 ppb respectively, and were consistent with those recorded from 2000-2002. Concentrations in Fort McKay were slightly lower at 6 ppb. Annual average plant site concentrations increased to between 5 and 10 ppb in 2003.

Ozone (O₃) > concentrations of ozone were slightly higher than those recorded in previous years with annual average levels of 23 ppb in both Fort McMurray and Fort McKay, and 30 ppb in Fort Chipewyan.

Particulate matter (PM_{2.5}) > at 2.4 µg/m³, annual average measurements of particulate matter at the Fort Chipewyan monitoring station remained the same as those recorded in 2002. Levels at the Fort McKay and Albion mine stations were

consistent with 2002 readings at 5 and 4.5 µg/m³ respectively.

Total reduced sulphur and hydrogen sulphide (TRS) > H₂S annual average concentrations ranged from 2 to 9 ppb at plant sites. TRS annual average concentrations ranged from plant site levels of 1 to 9 ppb and from town site levels of 8 ppb in Fort McMurray to 7ppb in Fort McKay.

Carbon monoxide (CO) > carbon monoxide, measured only in downtown Fort McMurray is largely attributable to vehicle emissions. An annual average concentration of 0.2 ppm was identical to levels recorded in 2001 and 2002.

FOCUSED INVESTIGATION, DATA AND INFORMATION GATHERING

The Terrestrial Environmental Effects Monitoring Committee and Science Subcommittee continue to pursue their goals of providing reliable data on the terrestrial effects of air emissions. Ongoing lichen, soil microbiology and forest heath assessments are aimed at understanding the range and effects of air emissions in the region.

COMMUNICATING INFORMATION ON ENVIRONMENTAL QUALITY

During 2003, WBEA and its Communications Committee attended community events, distributed a quarterly newsletter, and communicated with stakeholders and the public through the media. Our aim is to ensure that the public receives timely and understandable data and information.

The Association's Human Exposure Monitoring Committee has focused on establishing a formal community consultation and communications process and advance planning for its community oriented monitoring program. Groundwork was begun to establish a mechanism for providing information on common sources of indoor air contamination to the public. The development of innovative and locally appropriate communication materials continues.

COLLABORATIVE ENVIRONMENTAL DECISION-MAKING AND ACTION

The WBEA continues to promote its mandate relative to other environmental organizations in the region. We seek to expand our membership to include all stakeholders in the region whose actions and policies impact the environment. Dynamic circles and processes that support dialogue and collaborative decision-making have been established and we continue to strive to facilitate their growth and development. All who are interested in the Association and its activities are invited to contact us. We will be glad to provide you with further information regarding our activities.

Colin Beddoes
Executive Director



3.1 AMBIENT AIR MONITORING PROGRAM

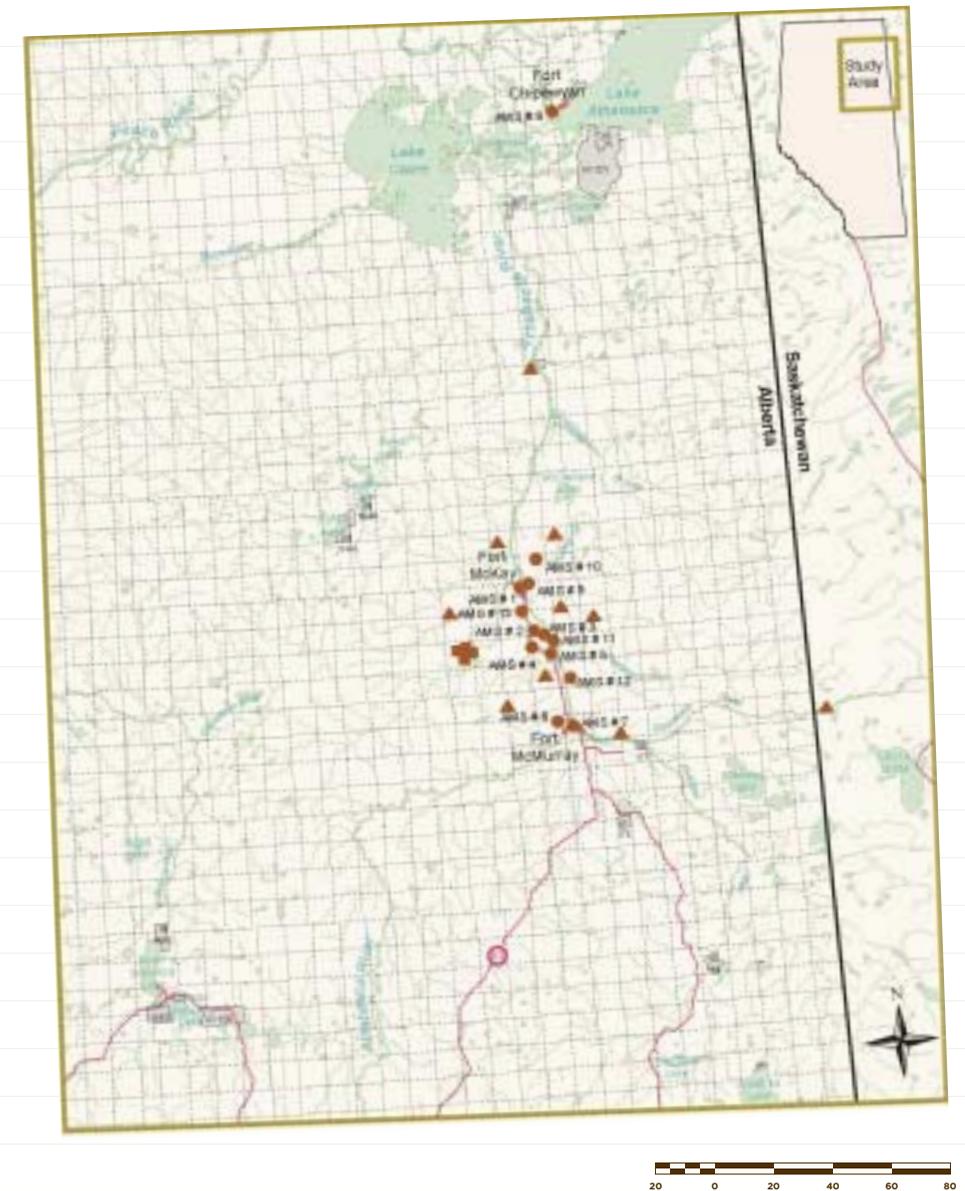
3.1.1 MESSAGE FROM THE CHAIR OF THE AMBIENT AIR TECHNICAL COMMITTEE

The ongoing initiatives of the AATC include three main areas. We meet monthly with the Operation and Maintenance Contractor to address issues that could impact data quality or data availability. Additionally, we ensure that the Immediate Reporting Protocol is strictly adhered to so that Alberta Environment and the Oil sands plants in the region are informed immediately of ambient air exceedances, thus allowing industry to take immediate action to improve ambient air quality should an exceedance occur. Thirdly, the 2003 Capital Replacement Plan, which replaces older analyzers with new analyzers, was reviewed and accepted by the AATC. This initiative supports WBEA's commitment to provide "state of the art" monitoring.

New initiatives include spending considerable time and effort in enhancing the existing VOC Monitoring Program in the region. A VOC workshop was held in February, with a contract being awarded to the Alberta Research Council (ARC) in October. Meetings were held in the last quarter to determine the path forward with respect to an enhanced VOC target list for the region. The enhanced VOC target list is a VOC list specific to the WBEA that focuses on compounds emitted in the region and includes; the ozone precursor list of compounds, polar compounds and reduced sulphur compounds. In order to ensure a smooth transition with the new Operations and Maintenance Contractor (Jacques Whitford) for 2004 a number of meetings were held in the last quarter to ensure that roles and responsibilities were clearly understood. Parallel data collection was also set up during December at a number of WBEA Stations to ensure that data quality would not be compromised with the switching over to a new data collection system.

Diane Phillips
Chair, Ambient Air Technical Committee

Figure 1. Regional Distribution of WBEA Air Monitoring Stations in the Wood Buffalo Region.



● AIR MONITORING STATIONS	■ MACKAY RIVER PASSIVES (PETRO-CANADA)	▲ PASSIVE MONITORING STATIONS	ANALYST KP
CLIENT WOOD BUFFALO ENVIRONMENTAL ASSOCIATION		JOB NO. CE02631	DATE 02/03
PROJECT TEEM MONITORING PROGRAMS		GIS FILE wood_buff_teem.apr	

3.1.2 SULPHUR DIOXIDE (SO₂)

Characteristics > Sulphur dioxide is a colourless gas with a pungent odour that can be detected by taste and odour at concentrations as low as 300 parts per billion (ppb). SO₂ is formed during the processing and combustion of fossil fuels containing sulphur. Sulphur dioxide reacts in the atmosphere to form sulphuric acid and acidic aerosols, which contribute to acid rain. Sulphur dioxide combines with other atmospheric gases to produce fine particles, which may reduce visibility.

Exposure > Brief exposure to high concentrations of sulphur dioxide and its products can irritate the upper respiratory tract and aggravate existing cardiac and respiratory disease. Long-term exposure may increase the risk of chronic respiratory disease.

Sensitive vegetation may be injured by exposure to high sulphur dioxide concentrations. Symptoms include a bleached appearance of the leaf with silvering or bronzing of the underside.

Sources > It is estimated that sulphur dioxide emissions from WBEA Industry Members within the Wood Buffalo Zone averaged 263 tonnes per day (tpd) in 2003.

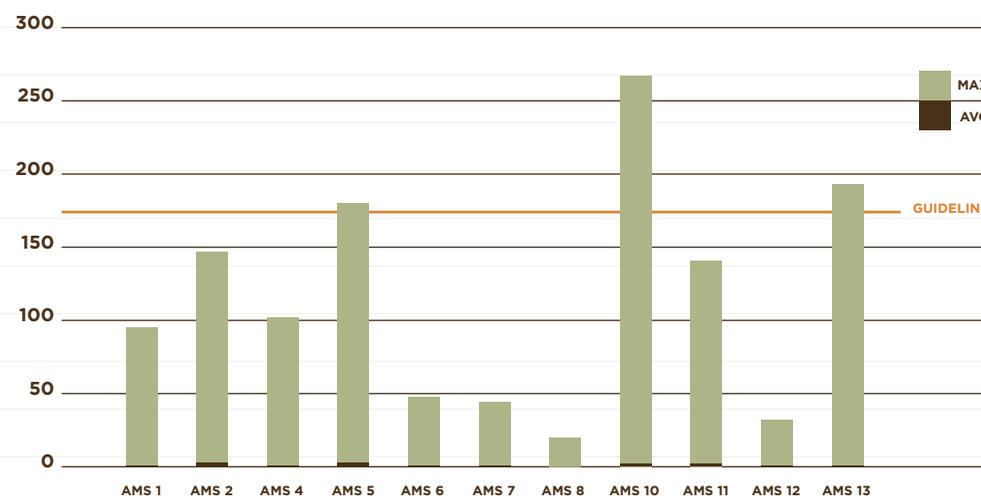
Alberta Guidelines > Alberta Environment has adopted Environment Canada's most desirable objectives for sulphur dioxide as Alberta guidelines. The Alberta guidelines for ambient air are:

- > 1-hour average of 172 ppb
- > 24-hour average of 57 ppb
- > Annual average of 11 ppb

Monitoring Results > In 2003, the average sulphur dioxide concentration in the ambient environment was highest at the Mildred Lake and Mannix sites (AMS 2 & AMS 5), 3 ppb, followed by the Albian Mine and Lower Camp sites (AMS 10 & AMS 11), with 2 ppb. The lowest average concentration was recorded at Fort Chipewyan (AMS 8), 0 ppb. This range of concentrations is consistent with the location of the monitoring stations. The Mildred Lake site are located within the boundary of the Syncrude Lease, the Albian Mine site within the Albian lease, the Mannix site within the Suncor lease, while Fort Chipewyan is remote from oil sands sources of pollutants. Concentrations at Fort Chipewyan averaged 0 ppb in 2002, 0 ppb in 2001 and 0.2 ppb in 2000. This site is also remote from other major industrial sources of pollution. The 2003 yearly average concentration at the other sites were 1 ppb.

The Alberta guideline for 1-hour average SO₂ concentration of 172 ppb was not exceeded in the population centers of Fort McMurray, Fort McKay, or Fort Chipewyan. The 1-hour guideline was exceeded on three occasions at sites located close to the plants. The maximum 1-hour values reached in the town sites were 95 ppb at Fort McKay, 44 ppb at the Athabasca Valley site in Fort McMurray, and 20 ppb at Fort Chipewyan (Figure 1). Closer to the plants a maximum of 147 ppb was reached at the Mildred Lake site. This is lower than the maximum 1-hour concentration of 382 ppb recorded in 2002, 289 ppb recorded in 2001 and 284 ppb recorded in 2000 at the plant sites.

Figure 2. Average and 1-hour Maximum Sulphur Dioxide Concentrations (ppb) for each Station in 2003



3.1.3 OXIDES OF NITROGEN (NO_x)

Characteristics > Nitrogen dioxide (NO₂) is a reddish-brown gas with a pungent, irritating odour. Oxides of nitrogen, mostly in the form of nitrogen oxide (NO) and nitrogen dioxide (NO₂) are produced by the high temperature combustion of fossil fuels. Nitrogen oxide is the predominant species emitted by combustion sources and is rapidly changed to nitrogen dioxide in the atmosphere. NO₂ plays a major role in atmospheric photochemical reactions and ground level ozone formation and destruction.

Exposure > Nitrogen dioxide has been linked to respiratory disease and acid rain.

Exposure of vegetation to high concentrations of nitrogen oxides results in silvering of the lower leaf surface. A waxy appearance emerges shortly after exposure followed within a few days by bronzing.

Sources > Major sources of nitrogen oxides within the Wood Buffalo are the oil sands extraction and processing plants followed by local vehicle use and light industry. It is estimated that nitrogen oxides emissions from WBEA Industry Members within the Wood Buffalo Zone averaged 96.6 tonnes per day (tpd) in 2003.

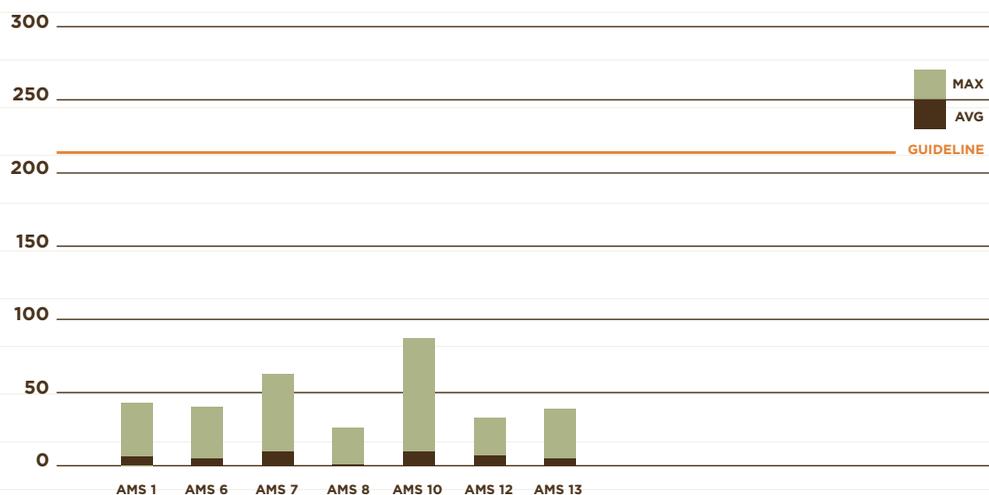
Alberta Guidelines > Alberta Environment guidelines are based on the prevention of human health effects. They are equal to Environment Canada's most rigorous ambient air quality objectives. The Alberta guidelines for nitrogen dioxide, the major component of nitrogen oxides in the ambient atmosphere are:

- > 1-hour average of 212 ppb
- > 24-hour average of 106 ppb
- > Annual average of 32 ppb

Monitoring Results > Ambient atmospheric concentrations of nitrogen dioxide (NO₂) are monitored at seven locations in the Wood Buffalo zone. The average annual concentration of nitrogen dioxide in 2003 ranged from a low of 1 ppb at Fort Chipewyan to a high of 10 ppb at the downtown station (Athabasca Valley) and the Albian Mine site (AMS 7 & AMS 10). The 2003 average at the downtown site was similar to that measured in 2002, 9 ppb, in 2001, 10 ppb, and to the 9 ppb in 2000. Nitrogen dioxide concentrations at this location reflect emissions from nearby motor vehicle traffic. At the residentially located Patricia McInnes monitoring station and at Fort McKay, the average concentrations were 5 and 6 ppb respectively. These values are well below the Alberta guideline of 30 ppb for an annual average NO₂ concentration in ambient air.

There were no exceedances of the Alberta Clean Air Guidelines for NO₂. The highest maximum 1-hour concentration was recorded at 87 ppb at the Albian Mine site (AMS 10). The maximum 1-hour value of 63 ppb at the Athabasca Valley site was in the same range as the maximums of 56 reported in 2002, 62 ppb reported in 2001, and 52 ppb in 2000. This value is about 30% of the Alberta guideline of 212 ppb for NO₂ as a 1-hour average. At Fort McKay, the maximum of 43 ppb was similar to the 35 ppb measured in 2002 and the 42 ppb measured in 2001.

Figure 3. Average and 1-hour Maximum Nitrogen Dioxide Concentrations (ppb) for each Station in 2003



3.1.4 OZONE (O₃)

Characteristics > At normal atmospheric concentrations, ozone is an odourless, colourless gas but at high concentrations, such as found near photocopier machines, laser printers and near electrical discharges, it has a sharp, distinctive odour. Ozone is both a natural component of the atmosphere and a major constituent of photochemical smog.

Exposure > Ozone is a strong oxidizer and can irritate eyes, nose and throat and decrease athletic performance. High concentrations can increase susceptibility to respiratory disease and reduce crop yields.

Sources > Unlike other pollutants, ozone is not emitted directly into the atmosphere but is produced in the atmosphere through a series of complex chemical reactions. Concentrations are controlled largely by emissions of nitrogen oxides and reactive hydrocarbons. These reactions may lead to an increase in ozone concentrations or a decrease, the latter of which is the case in Alberta cities. Ozone is also a natural component of the upper atmosphere and may be transported to ground level by meteorological processes.

Alberta Guidelines > Alberta Environment guidelines for ozone are:

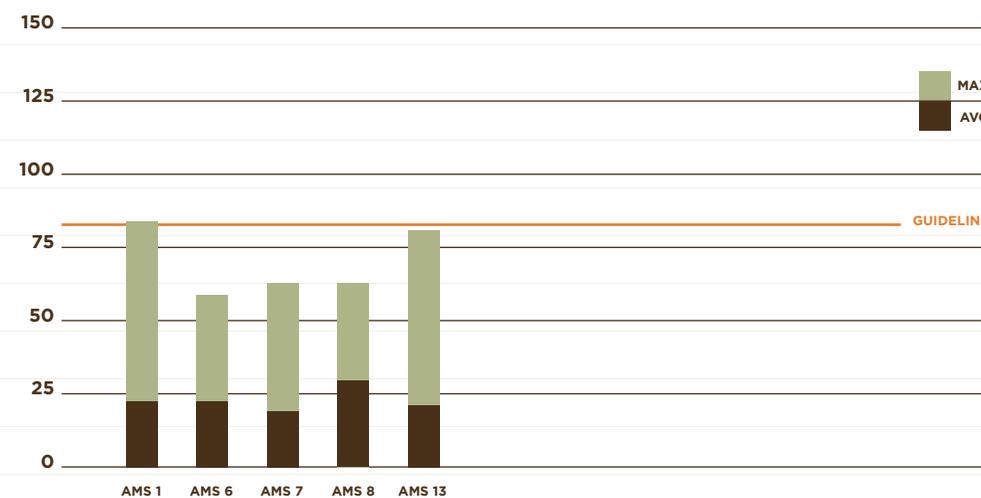
- > 1-hour average of 82 ppb
- > 24-hour average of 25 ppb

Provincial and Federal guidelines for ozone are presently under review.

Monitoring Results > Ozone is monitored at five sites in the Wood Buffalo zone: Fort McKay, Patricia McInnes, Athabasca Valley, Fort Chipewyan and UE-1. The average annual concentrations for ozone ranged from 19 ppb at the Athabasca Valley site (downtown Fort McMurray), to 21 ppb at the UE-1 site, to 23 ppb at the Patricia McInnes and Fort McKay sites and 30 ppb in Fort Chipewyan. These values support the understanding that ozone concentrations are controlled largely by emissions of nitrogen oxides and reactive hydrocarbons. The Fort Chipewyan site reflects naturally occurring levels of ozone with vehicle emissions depressing these levels where more traffic is present.

There was one exceedance of the Alberta Clean Air Guidelines for Ozone in 2003. The highest hourly concentration measured in 2003 was 84 ppb at the Fort McKay site and 81 ppb at the UE-1 site followed 63 ppb at both the Fort Chipewyan and Athabasca Valley sites followed by 65 ppb at the Patricia McInnes site.

Figure 4. Average and 1-hour Maximum Ozone Concentrations (ppb) for each Station in 2003



3.1.5 HYDROCARBONS (THC)

Characteristics > Hydrocarbons are divided into two broad categories, “non-reactive” and “reactive”. The major non-reactive hydrocarbon in the atmosphere is the colourless, odourless gas, methane, which is a major contributor to the greenhouse effect. The reactive hydrocarbons consist of many volatile organic compounds (VOCs). Some VOCs react with the oxides of nitrogen in the atmosphere to form ozone. These include ethylene, propane, butane, benzene, α -pinene and a host of other hydrocarbons.

Exposure > Among the reactive VOCs are the aromatic compounds benzene, toluene, ethylbenzenes, and xylenes (BTEX). When these are present in sufficient quantities, these compounds affect human health.

Polycyclic aromatic hydrocarbons (PAH's) are of higher molecular weight and less volatile and some are known to be carcinogenic.

Sources > Large amounts of methane are produced naturally through the decay of vegetation. Trees and plants are major natural emitters of reactive hydrocarbons with major sources from human activity being motor vehicle exhaust, gasoline handling and the petroleum and chemical industries.

Combustion processes, both natural such as forest fires, and human influenced such as industrial activities and the use of motor vehicles, result in the formation of PAH's.

Fugitive emissions, tailings ponds, and extraction plant vents from oil sands activities are the most significant anthropogenic sources of reactive hydrocarbons and methane in the region.

Alberta Guidelines > There are currently no Alberta guidelines for ambient hydrocarbon concentrations; however, Alberta Environment is working on a VOC guideline

Monitoring results > Total hydrocarbons are monitored at all Wood Buffalo sites except Fort Chipewyan (AMS 8). Average annual concentrations ranged from 1.9 to 2.3 ppm. The Fort McKay site (AMS 1) had the highest annual average ambient environment concentration at 2.3 ppm. This was followed by the Albion Mine and UE-1 sites (AMS 10 & AMS 13) at 2.2 ppm, Lower Camp and Barge landing sites (AMS 11 & AMS 9) at 2.1 ppm, Athabasca Valley site and Mannix sites (AMS 7 & AMS 5) at 2.0 ppm, and Buffalo Viewpoint, Patricia McInnes and Fort McKay sites (AMS 4, AMS 6 & AMS 5) at 1.9 ppm. These values are similar to those measured in previous years.

The highest 1-hour maximum concentration of 49.9 ppm was recorded at the Albion Mine site (AMS 10). This maximum 1-hour value was higher than that of other sites located near industrial sources that ranged from 6.3 ppm to 30.8 ppm.

Samples were collected at six stations for detailed analysis of volatile organic compound (VOCs) and polynuclear aromatic compounds (PAH's) were sampled at three stations.

Sampling at UE-1 experienced technical difficulties that caused results to be removed from the WBEA database.

The most frequent VOCs detected in the region were isobutane and butane followed by isopentane. Ambient atmospheric concentrations of benzene averaged 0.17 ppb at the Fort McKay site, 0.18 ppb at the Patricia McInnes site, 0.25 ppb at the Athabasca Valley site and 0.19 ppb at the Barge Landing site.

Average BTEX concentrations were 1.15 ppb at Fort McKay, 0.95 ppb at the Patricia McInnes site, 1.26 ppb at the Athabasca Valley site and 7.7 ppb at the Barge Landing site.

Phenanthrene and pyrene were the PAH's most commonly detected in ambient air samples in 2003. Concentrations of phenanthrene averaged 0.004 $\mu\text{g}/\text{m}^3$ at Fort McKay, 0.009 $\mu\text{g}/\text{m}^3$ at Patricia McInnes and 0.004 $\mu\text{g}/\text{m}^3$ at Athabasca Valley. Pyrene concentrations averaged 0.002 $\mu\text{g}/\text{m}^3$ at Fort McKay, 0.005 $\mu\text{g}/\text{m}^3$ at Patricia McInnes and 0.001 $\mu\text{g}/\text{m}^3$ at Athabasca Valley. Other PAHs were generally below detection limits.

3.1.6 TOTAL REDUCED SULPHUR COMPOUNDS (TRS)

Characteristics > Hydrogen sulphide is a colourless gas with a characteristic rotten egg odour.

The term total reduced sulphur compounds (TRS) is used to collectively describe hydrogen sulphide and mercaptans. Hydrogen sulphide (H_2S) is the major constituent of TRS.

It should be noted that continuous analyzers may read many sulphur compounds as H_2S when they are in fact mercaptans.

Exposure > Hydrogen sulphide is toxic at high concentrations.

Sources > Hydrogen sulphide is produced both naturally and through industrial processes. It is found naturally in coal, natural gas, oil, sulphur hot springs, sloughs, swamps, and lakes. In the absence of oxygen the decomposition of organic matter by bacteria results in the release of H_2S . This produces the characteristic odour commonly associated with sewers, sewage lagoons, and swamps. Industrial sources are primarily petroleum refining, petrochemical complexes, and pulp and paper mills.

Sulphur is removed from bitumen by oil sand industries, first as H_2S and then converted into elemental sulphur or burned to produce SO_2 . However, some H_2S does escape from fugitive sources within the plant areas and H_2S is released from the tailings ponds on an intermittent basis. The majority of the TRS is H_2S with light mercaptans making up most of the remaining.

Alberta Guidelines > The guidelines for maximum permissible concentrations of H_2S are based on the odour threshold, although many individuals can smell H_2S at levels below the ambient guidelines. Alberta has adopted Environment Canada's most rigorous ambient objectives for maximum permissible H_2S concentrations. TRS in the WBEA air monitoring network is treated as H_2S for guideline levels. The Alberta guidelines are:

- > 1-hour average of 10 ppb
- > 24-hour average of 3 ppb

Monitoring results > Hydrogen sulphide is monitored at four WBEA stations and TRS at six additional sites. In the Wood Buffalo Air Monitoring Network TRS levels are treated the same as those of H_2S .

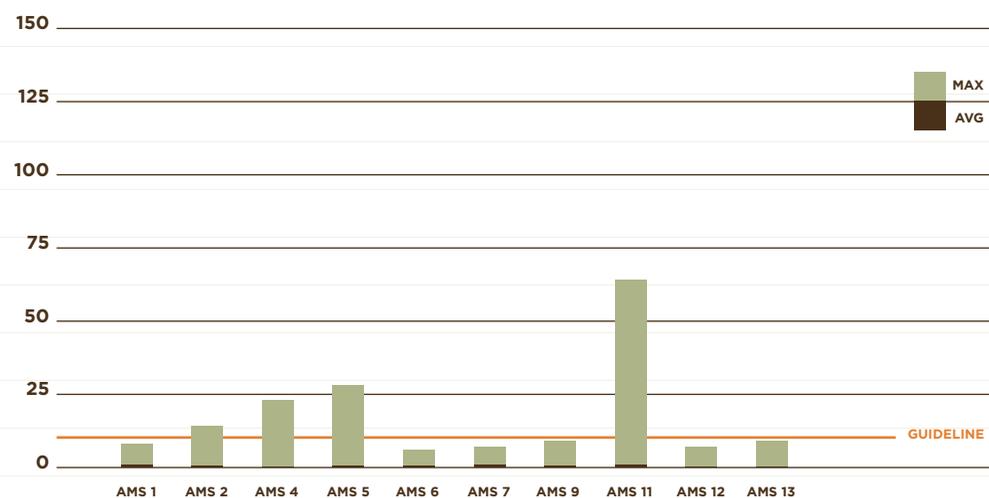
The highest average H_2S /TRS concentration was recorded at the Lower Camp site (AMS 11) at 0.9 ppb. Mildred Lake (AMS 2), Mannix (AMS 5) and Buffalo Viewpoint (AMS 4) had average annual H_2S /TRS concentrations of 0.6 ppb, 0.6 ppb and 0.2 ppb, respectively. H_2S /TRS annual averages at Barge

Landing (AMS 9) and UE-1 (AMS 13) were 0.6 ppb and 0.3 ppb, respectively. TRS/H₂S annual averages at the Athabasca Valley, Patricia McInnes, and Fort McKay sites were 0.8 ppb, 0.5 ppb and 0.7 ppb, respectively.

The 1-hour Alberta Environment guideline for H₂S of 10 ppb was exceeded 26 times in 2003. The maximum 1-hour concentration measurement was 64 ppb at the Lower Camp site (AMS 11). The number of exceedances and maximum concentrations have decreased from those recorded in 2002. There were 42 1-hour exceedances with a maximum concentration of 39 ppb recorded in 2002 as compared to 22 1-hour exceedances with a maximum concentration of 28 ppb in 2001. The 2002 numbers however remained lower than those in 2000 which saw 61 1-hour exceedances with a maximum of 99 ppb.

There were also 4 exceedances of the Alberta Environment guideline for a 24-hour average H₂S concentration with a maximum 24-hour average concentration of 5 ppb at the Lower Camp site. This is an increase from the three 24-hour exceedances in 2002 with a maximum concentration of 4 ppb.

Figure 5. Average & 1-Hour Maximum H₂S/TRS Concentrations (ppb) for each Station in 2003.



3.1.7 CARBON MONOXIDE (CO)

Characteristics > Carbon monoxide (CO) is a colourless, odourless, and tasteless gas. It produced by the incomplete combustion of carbon containing fuels.

Exposure > Carbon monoxide has a strong affinity for haemoglobin and thus reduces the ability of blood to transport oxygen. Exposure to concentrations of 400 to 500 ppm for periods of one hour may not produce an appreciable effect, but concentrations in excess of 4,000 ppm may cause asphyxiation.

Long-term exposure to low concentrations may cause adverse effects in people suffering from cardiovascular disease.

Sources > Transportation is the major source of carbon monoxide with elevated concentrations during the morning and evening rush hours. Other sources include building heating systems, boilers, and industrial operations.

Alberta Guidelines > The Alberta Environment guidelines for the maximum permissible concentrations of carbon monoxide are based on the prevention of adverse human health effects. Alberta Ambient Air Quality Guidelines:

- > 1-hour average of 13 ppm
- > 8-hour average of 5 ppm

Monitoring Results > Carbon monoxide is monitored at the WBEA's Athabasca Valley station in Fort McMurray (AMS 7). There were no exceedances of the Alberta Clean Air Guidelines for CO in 2003. The maximum 1-hour average concentration measured in 2003 was 2.9 ppm and the yearly average was 0.2 ppm. Concentrations are well below the Alberta Environment guideline values for carbon monoxide. The 1-hour maximum of 2.9 is similar to the 2002 1-hour maximum of 2.7 ppm and lower than the 1-hour averages of 5.8 ppm in 2001 and 4.4 ppm measured in 2000.

3.1.8 PARTICULATES (PM₁₀ & PM_{2.5})

Characteristics > Ambient particulate matter consists of a mixture of particles of varying size and chemical composition. Measurements of the PM₁₀ size particles include the PM_{2.5} size fraction.

Exposure > Particles less than 10 micrometers in diameter (PM₁₀) can be inhaled. The fraction of particles that are less than 2.5 micrometers in diameter (PM_{2.5}), commonly referred to as fine particulate matter, can be trapped in the airways and lungs and are believed to cause adverse health effects.

Fine particles (PM_{2.5}) also reduce visibility and can contribute to acidification of soils.

Sources > Sources of PM₁₀ size particles include windblown soil, road dust, and industrial activities. PM_{2.5} size particles are formed from gases released to the atmosphere by combustion processes, from motor vehicles, power plants, gas processing plants, compressor stations, household heating, and forest fires.

Alberta Guidelines > Guidelines for ambient atmospheric concentrations of PM₁₀ and PM_{2.5} size particles are under consideration by the Alberta and the Federal governments.

A provisional Canada-wide Standard has been adopted for PM_{2.5} of 30 µg/m³, 24-hour averaging time, by the year 2010.

Monitoring Results > Concentrations of particulate matter are measured both by collection on a filter followed by weighing and by continuous monitoring. Particles collected on filters can then be analyzed for chemical composition. In the Wood Buffalo zone PM₁₀ and PM_{2.5} size particles are collected at the Athabasca Valley, Patricia McInnes, Fort McKay, Fort Chipewyan, Albian Mine, Millennium and UE-1 monitoring stations. Concentrations of PM_{2.5} size particles are also continuously monitored at these sites.

Continuous monitoring of PM_{2.5} showed annual average concentrations ranging from 2.4 µg/m³ at Fort Chipewyan to 5 µg/m³ at the Fort McKay site.

Maximum 1-hour average concentrations were higher, ranging from 48.0 µg/m³ at the Athabasca Valley site to 445 µg/m³ at the UE-1 site.

3.1.9 METEOROLOGY AND AIR QUALITY

Influence of Meteorology > Air quality is dependent on the rate that pollutants are emitted to the atmosphere and the rate at which these pollutants are dispersed away from the sources. Air pollution transport and dispersion are influenced by wind speed and direction, the temperature structure of the atmosphere, the solar cycle, turbulence, precipitation and changes in these elements induced by local topography.

Precipitation may remove pollutants from the atmosphere, depositing them on soils and vegetation. Rates of deposition of pollutant gases are highest when vegetation and soils are wet. Vegetation is more susceptible to damage during periods of highest growth.

Meteorological Monitoring > Meteorological parameters measured in support of the Wood Buffalo Environmental Association air quality monitoring programs are:

- > wind speed and direction
- > temperature
- > difference in temperature at two heights
- > solar radiation
- > amount of precipitation
- > relative humidity
- > surface wetness

Precipitation samples are also collected and chemically analyzed for acidity and major constituents.

Monitoring Results > Hourly average temperature extremes in Fort McMurray ranged from -38.6°C to 32.3°C at Patricia McInnes (AMS 6) and -38.7°C to 33.8°C at Athabasca Valley (AMS 7) in 2003. At Fort McKay (AMS 1) the range was -50.0°C to 33.7°C and at Fort Chipewyan (AMS 8), -36.9°C to 32.1°C.

Winds at the Athabasca site in Fort McMurray were predominantly from the Southeast (27.9% of total operational time); again reflective of the geography of the site (orientation of the river valley). Second total predominant wind direction was from the North. Wind speed also at this site averaged 9.9 km/hr. Patricia McInnes site, less influenced by the geography of the valley, had predominantly South West winds (18.0% of total operational time) and averaged speeds of 10.0 km/hr. The second total predominant wind direction was from the South East (16.8% of total operational time).

Fort McKay winds averaged 8.1 km/hr and predominantly from the South at 25.8% of the total operational time. Secondary wind direction averages were predominantly from the North at 20.2% of the total operational time. Fort Chipewyan (AMS 8) the predominant wind pattern was off of the lake from the East (noted at 25.0% of total operational time). Wind speed annual average at this site was 14.3 km/hr. The second predominant wind pattern was from the North West (19.3% of total operational time).

3.1.10 PASSIVE MONITORING

Characteristics > Passive monitoring systems are useful adjuncts to continuous air monitoring networks. They require no expensive shelters or power, and can be deployed in remote locations. They provide average concentrations of pollutants over a previously selected monitoring period, usually one to three months.

Monitoring Program > The WBEA uses a network of passive monitors to measure concentrations of sulphur dioxide, ozone, and nitrogen dioxide at remote forestry locations. The network consists of 10 sites, as shown on the map in Figure 3. Passive samplers are affected by both meteorological conditions and their location in relation to the forest canopy. During 2000, the proximity of several samplers to the forest canopy was adjusted to provide results that are more representative of air quality at that location. (see Figure 1)

The results from the passive monitoring systems were compared to continuous air monitoring stations by co-locating the two types of monitoring at Fort McKay (AMS 1) and Patricia McInnes (AMS 6).

In 2002 the WBEA set up four new passive towers around the Petro-Canada MacKay River project. Sampling began in August 2002 and the compounds monitored are nitrogen dioxide (NO₂), sulphur dioxide (SO₂), ozone (O₃) and hydrogen sulphide (H₂S).

Monitoring Results > In comparing the passive and the continuous monitoring conducted at Fort McKay and Patricia McInnes it was found that the results were similar. The results from the passive sampling at the two stations, as well as the forest sites, will be used by the TEEM program for dry acid deposition calculations.

The average concentrations of sulphur dioxide, nitrogen dioxide, and ozone were measured monthly at each remote site over the year. Concentrations are shown in Table 8 of Appendix 1.

The forest or remote passive sampling results for sulphur dioxide (SO₂), nitrogen dioxide (NO₂) and ozone (O₃) were compared according to their location in the region. Highest SO₂ values were measured at sites closer to the oil sands plants to the east and south. The highest average concentration of SO₂ was 2.5 ppb at site JPH4, east of the plants, followed by 1.85 ppb at site AH8 that is located to the east of the plants. Sites located at greater distances from the sources had the lowest concentrations. The average sulphur dioxide concentrations at JPL8, a site east of Fort McMurray across the Saskatchewan border, were 0.23 ppb. Nitrogen dioxide showed the same general trends with the highest average concentration of 3.3 ppb being found at JPH4 and the lowest concentration of NO₂ of 0.48 ppb found at JPL8. Ozone results from the passive samplers varied little among the sites. The highest average ozone concentration was 229.6 ppb, measured at AH3 that is located southeast of the oil sands plants and the lowest concentration of O₃ of 23.4 ppb found at JPL8.

The average concentrations from the MacKay River passives were; 1.64 ppb NO₂, 0.57 ppb SO₂, 23.1 ppb O₃ and 0.09 ppb H₂S. These values are higher than the concentrations recorded from August to December 2002 of 1.10 ppb NO₂, 0.46 ppb SO₂, 21.4 ppb O₃ and 0.10 ppb H₂S.

3.2 TERRESTRIAL ENVIRONMENTAL EFFECTS MONITORING

Terrestrial Environmental Effects Monitoring (TEEM) Program primary objective is to collect and report terrestrial environmental effects data within the Wood Buffalo region that is credible, accurate and timely in a program that is state-of-the-art. Maintaining this high standard, in 2003 TEEM and the Science Subcommittee (SSC) focused on strategic planning, enlisted the help of technical experts to develop reports to assist in future monitoring programs and finalizing reports. Moreover, in 2003 TEEM recognized the importance of contracting technical reviewers to review reports and provide input on future monitoring.

TEEM's strategic planning efforts focused on refining methods for the Jack Pine Acidification Program, slated to begin in 2004, review of satellite imaging technology to monitor for vegetation stress in the region and a literature review of the effects of nitrogen on plants and plant communities typical of the region.

3.2.1 MESSAGE FROM THE CHAIR OF THE TERRESTRIAL ENVIRONMENTAL EFFECTS MONITORING COMMITTEE

2003 was a good year for the Terrestrial Environmental Effects Monitoring (TEEM) program. Field work was limited to collecting additional information to finish reports and test methodologies for the upcoming field season. Several outstanding reports were finished and a couple of studies initiated. Our friends and neighbours who enjoy picking berries were pleased to receive the final report on the Traditional Foods study which indicated that traditional foods are not impacted by regional air quality.

We are really looking forward to 2004. This is the year that we conduct a complete monitoring program on each of our Jackpine sites. We will be adding a soil microbiology component to this work which will add a new dimension to our work. We will also be reviewing better ways to monitor the region using modern remote sensing techniques. If the appropriate technology can be

found, it will enable us to provide our stakeholders and neighbours with timely information on the health of our forests. We will also be researching methodologies on how to monitor for the impact of nitrogen oxides in the environment.

Darrell Martindale
Chair, Terrestrial Environmental Effects Monitoring Committee

3.2.2 SOIL ACIDIFICATION AND FOREST HEALTH

Acidification is the process of making substances acidic by lowering its pH. In the Oil Sands Region, there is concern over acid deposition, which is caused by sulphur dioxide and nitrogen dioxide combining with water vapour in the atmosphere to form sulfuric and nitric acids. When these air pollutants are deposited, either directly from the air (referred to as dry deposition) and/or through rainfall or snow (referred to as wet deposition), on ecosystems there can be affects to the soil and vegetation. Sometimes the dry and wet deposition is more acidic than the ecosystem, which can result in lowering the pH of soils. Soils that are most affected by changes in pH (lowering the pH to become more acidic) are sandy soils that often support Jack Pine Stands. If there is a change in pH in the soil then the plants may be affected and result in such changes as reduced growth, mortality and/or make the plants more prone to such natural affects as diseases. A Jack Pine Monitoring Program was established in 1996 to determine if Jack Pine Stands and their associated soils being affected by dry and wet deposition. Every 6 years the monitoring program involves intense field sampling that includes measuring tree growth, collecting tree needles and lichens as well as sampling the soil. In 2003, TEEM evaluated the field and laboratory methods used and developed a Request for Proposal to undertake this monitoring program in 2004. TEEM recognized the value in expanding the program to include a soil microbiology and lichen components as well as more detailed information on vascular plants that occur within the Jack Pine Monitoring Sites. In 2004, TEEM will also be expanding the acidification program to include four new jack pine monitoring sites.

3.2.3 SOIL MICROBIOLOGY

Soil Microbiology includes such small organisms such as fungus that live in the soil. These small organisms in the soil serve a valuable function by providing increased moisture and nutrients to plants, which in turn contribute to the overall growth and success of the habitats. It is possible that a change in soil pH, as a result of acid deposition, could change the abundance of these small organisms.

The Soil Microbiology Monitoring Program was initiated in 2002 and included field and laboratory analysis of samples collected from four of the Jack Pine Monitoring Sites. In 2003, the program was expanded to allow for better refinement of methods and provide a preliminary estimate of any changes in soil organisms that could potentially be linked to acidification. This component, undertaken by Dr. Suzanne Visser (University of Calgary) will be integrated as part of the 2004 Acidification Program. Moreover the results from the 2002 -2003 soil microbiology programs will be summarized in a report, which is expected in the spring of 2004.

3.2.4 VEGETATION STRESS

Vegetation stress can occur when vegetation is affected by natural or human causes. Signs of vegetation stress include such symptoms as discoloration of leaves or needles, reduced plant growth and plant mortality. To date the vegetation stress monitoring program used False-colour Infra-red aerial photographs to determine the how much of the vegetation surrounding the mine sites were affected by emissions associated with oil sands mining. TEEM's efforts to utilize state-of-art technology required a review of more current remote sensing technologies, which are better at detecting changes in vegetation health as well a providing a digital database of any changes in forest health. It is expected that the information gleamed from this report as well as future planning initiatives will allow TEEM to develop a more improved, cost-effective, program to assess vegetation stress in the region.



3.2.5 LICHENS

A Lichen Monitoring Program was initiated in 2002 to examine the effects of air quality on lichens and lichen habitat. Lichens are a group of organisms that consists of fungus living in association with green algae or bacteria. Lichens can grow on trees, rocks and soil surfaces. Those lichens get most of their nutrients from the air and as a result are good indicators of the potential effects of air emissions.

In the field, lichens were identified, described and collected for further analysis in the laboratory. A total of 48 monitoring sites were located along north, south, east and west transects that extended from a central point between the Mildred Lake Mine and Suncor's Lease 86/17 Mine. The monitoring program was designed to describe potential effects on lichens in terms of abundance and diversity as well as the chemistry of lichens collected based on laboratory analysis. A draft report was submitted in 2003 and TEEM in cooperation with the SSC enlisted the help of three technical reviewers (two lichenologists and one statistician) to critique the report. The researchers are in the process of finalizing the report and making recommendations for future monitoring. It is expected that this component will be integrated as part of the 2004 Acidification Program and some additional lichen monitoring may occur in 2004. Moreover, if time, researchers and funds are available a second phase of the Lichen Pilot Program may be initiated in 2004.

3.2.6 NITROGEN

In 2003, TEEM's strategic planning efforts also focused on Nitrogen. TEEM, in cooperation with the SSC contracted researchers from the University of Alberta to undertake a literature



review of the effects of nitrogen on plants and plant communities specific to the Wood Buffalo region. The literature review summarized and documented the results of research initiatives undertaken throughout the world in an effort to identify nitrogen thresholds that resulted in effects on plants. This information coupled with knowledge of the region allowed the researchers from the University of Alberta to make a series of recommendations that will form the basis for developing a Nitrogen Monitoring Program. TEEM also sent representatives from the SSC to attend a conference in the UK that focused on monitoring the effects of nitrogen on terrestrial receptors. The SSC representatives presented information from this conference to the SSC and TEEM. Information gathered from this conference will be applied to any future nitrogen monitoring initiatives. Currently, TEEM is working closely with CEMA's NSMWG on a nitrogen project, which is designed to assess the nitrogen deposition in the region. Information gained through this effort, will allow TEEM to develop an effective Nitrogen Monitoring program for the region.

3.2.7 OTHER 2003 PROGRAMS AND REPORTS

In 2003, TEEM finalized a number of reports from previous years and communicated the results to stakeholders. The following provides a brief description of reports that were finalized in 2003 that will be finalized in 2004.

Spring Acid Pulse Report entitled Analysis of the Water Quality of the Steepbank, Firebag and Muskeg Rivers during the Spring Melt (1989-2001) (Western Resource Solutions 2003). This report presented the results of a technical review of water quality data collected in throughout the 1990's from the Steepbank, Firebag and Muskeg rivers. The primary objective of this report was to determine if there was a pronounced change in pH, specifically a spring acid pulse, in these three rivers. The data did not support a pronounced change in pH. TEEM will pass along this report and accompanying briefing note to Alberta

Environment and RAMP with the expectation that this may be monitored in the future.

The Trace Metals in Country Foods Report was finalized and approved by TEEM. This pilot project was initiated based on concerns from the community of Ft. McKay that industrial air emissions might increase metal levels in traditionally used country foods and medicines. The pilot project was designed to determine trace metal concentrations in traditional food resources utilized by the Fort McKay community. In late August 1999, TEEM approved an expansion of the study to include Fort Chipewyan as a "distance from source" location for comparison with results obtained from Fort McKay. One of the key components of this study was the involvement of the people of Fort McKay and Fort Chipewyan in sample collection and study design (i.e., selection of species and geographical areas to sample). The sampling design of this program did not allow for a meaningful statistical assessment and, therefore, further sampling will be required to allow for better verification. TEEM intends on communicating the results of the Tradition Country Foods pilot program to both Fort McKay and Fort Chipewyan in 2004. This request for an open house has been passed along to the WBEA Communications Committee.

TEEM is currently awaiting the final TEEM database and associated manual. This database, which is designed to house all TEEM data as well as allow for easy access and search requests should be finalized in March 2004.

3.3 HUMAN EXPOSURE MONITORING

3.3.1 MESSAGE FROM THE CHAIR OF THE HUMAN EXPOSURE MONITORING COMMITTEE

Strategic Planning (March 2002) identified that a top concern to the members of the Wood Buffalo Environmental Association was human health. It was this concern that prompted the formation of the WBEA Human Exposure Working Group. The committee has representation from health, community and industry. Our purpose is to ensure human exposure monitoring and potential human health effects of air emissions is part of a long-term air quality monitoring strategy within the Regional Municipality of Wood Buffalo.

In 2003, Alberta Health and Wellness was invited to speak to stakeholders and representatives about the air monitoring model being proposed for the program. HEMC initiated consultation with the IRC directors to determine best/most suitable communications practices within their respective communities to insure program endorsement and support.

A communications strategy and budget were developed in order to promote program awareness and to help initiate the volunteer drive throughout the Regional Municipality of Wood Buffalo. HEMC spent time developing a proposal for the program in order to solicit additional funds through other sources if needed and available.

Our hope is to make presentations in each of the communities outlining what the monitoring process consists of and having the communities endorse the program. We will develop a monitoring schedule for the program, develop and put forth a sound 2005 budget for implementing the monitoring program for WBEA stakeholder approval and begin the volunteer drive process for those communities chosen. The plan is to begin the monitoring program in 2005.

Darcy Garchinski
Chair, Human Exposure Monitoring Committee

3.4 COMMUNICATIONS

3.4.1 MESSAGE FROM THE CHAIR OF THE COMMUNICATIONS COMMITTEE

In 2003, WBEA's Communication Committee continued with its mandate to provide the public with both technical and non-technical information on the association and its activities. This was achieved on a multitude of levels, as the WBEA had a presence at several events throughout the year. These included the Visitor's Bureau spring and fall trade shows, Environment Week's household hazardous waste round-up, the Fort Chipewyan Winter Festival, the Fort McKay Science Fair and the Fort McMurray Science Fair.

In addition, the Communication Committee delivered timely information through its quarterly newsletter, which is distributed to all homes in Fort McMurray and the surrounding communities. The newsletter is designed to provide readers information on WBEA and other local environmental initiatives; to introduce new WBEA members; and feature interesting articles relating to environmental themes. Meanwhile, throughout the year the WBEA was regularly featured in advertisements and news stories in both the Fort McMurray Today and on CJOK/KYX-98 radio.

Finally, the Communications Committee continued to work with community stakeholders to successfully introduce the WBEA Crystal Clean Environment Award to both public and separate schools in the region. Although the award wasn't launched in 2003, we are optimistic it will be introduced to students in grades 6-8 in 2004.

Randy Provencal
Chair, Communications Committee

4.1 CLEAN AIR STRATEGIC ALLIANCE

In 1996, the WBEA was endorsed as a regional airshed management zone by the Clean Air Strategic Alliance (CASA). The WBEA has adopted the CASA principles of consensus-based multi-party organizations as well as its Air Quality Management Guidelines.

Representing the Regional Municipality of Wood Buffalo, the WBEA actively participates in CASA activities and provides on-going progress updates of its own activities. The Association also shares its research information with other regional airshed management zones as they establish their management plans and continue to develop their programs (West Central Zone, Parkland Airshed Management Zone and Fort Air Partnership).

For more information about CASA and its programs, visit their website at casa@casahome.org.

4.2 ALBERTA'S AIRSHED MANAGEMENT ZONES

In 2003 there were six airshed zones operating in Alberta. Interest in forming new zones has been expressed in the Cold Lake area, the Edmonton-Wabamun area, the Bow Valley corridor, and the Lethbridge region. The Palliser Airshed Society started operations in Medicine Hat and Redcliffe in 2003 and is seeking official endorsement by the CASA board of directors. For more information about the Palliser Airshed Society visit <http://www.palliserairshed.ca>.

FORT AIRSHED

The Fort Air Partnership (FAP) is a voluntary partnership - a group of stakeholders that sees the benefit of sitting down at the same table and working through issues together to produce relevant, credible information that can be used to manage and improve air quality, protect environmental health, and influence public policy.

FAP is a registered, non-profit society whose committee members use a consensus decision-making model.

As one of Alberta's six airsheds, FAP serves a specific area of approximately 4,500 square kilometres in size. The organization's vision is that people living and working in the Fort Saskatchewan area have air quality that compares favourably with other areas in Alberta.

In 2003, FAP went on-line with real time air quality monitoring data from seven of eight of its ambient air monitoring stations, with the final station expected to go on line in the first half of 2004. The goal is to ensure the network is functioning over 98 per cent of the time. A technical working group sub-committee is responsible for deciding on which equipment needs replacing, to ensure high uptime and lower maintenance costs. An on-going project of this group is to prepare a feasibility study of implementing a passive monitoring network.

As part of its 2003 business plan to be accountable to all stakeholders, FAP published reports to the community in several local newspapers. In March 2003, we also conducted a telephone survey of 400 adults who live within the boundaries of the airshed to help identify air quality concerns in the area. FAP participated in the annual Fort Saskatchewan trade fair in April, to raise awareness about the organization and air quality in the community. An article exploring relationship of air quality and human health in the Fort Saskatchewan area was published on the FAP Web site in December 2003. As part of its objective to continuously improve the FAP Web site, health fact sheets will be developed on subjects determined by the health subcommittee. Two of these fact sheets were posted in 2003. Part of FAP's business plan for 2003, which will continue into 2004, is to identify further financial and in-kind resources that can be committed to implementing, maintaining and sustaining the Fort Air Partnership's air monitoring and information programs.

PALLISER AIRSHED

The Palliser Airshed Society (PAS) was established in the spring of 2003 to take responsibility for assessing air quality issues within an approximate 150 square kilometre area of south eastern Alberta,

with a population of approximately 53,000 people. The Palliser airshed is the first to be developed in southern Alberta and as such shows the commitment to air quality issues from all the stakeholders in the Medicine Hat area and will seek official endorsement by the CASA board of directors in the spring of 2004. The PAS air quality monitoring network consists of one continuous station and six passive monitoring sites. The continuous site will provide real time data for nitrogen dioxide (NO₂), ozone (O₃), total hydrocarbons (THC), fine particulate matter (PM_{2.5}) and meteorological data. Monthly data from the passive sites will include nitrogen oxides (NO_x), sulphur dioxide (SO₂) and ozone.

PARKLAND AIRSHED

2003 marked the fifth year of operation of the Parkland Airshed Management Zone Association's (PAMZ) regional air quality monitoring (AQM) program. Throughout the year the association continued to organize and hold public meetings and workshops with a common theme of exploring air quality-related issues and seeking input into strategies and plans to address them.

In February, a Pollution Prevention Workshop was held in Red Deer. Guest speakers included representatives from Alberta Environment, the CASA pollution prevention and continuous improvement project team and a pollution prevention expert from the United States. Recommendations and actions from the workshop were incorporated into a PAMZ pollution prevention action plan approved by the association's board of directors in March. The plan is currently being implemented by PAMZ and workshop attendees.

In May a public meeting was held in Dovercourt, a hamlet southeast of Rocky Mountain House, to identify possible locations for the PAMZ portable air quality monitoring station for 2004. The four monitoring locations chosen based on input received at this meeting were Dovercourt, Rimbey, Red Deer City Centre and a location associated with a large-scale "best practices" hog farming operation.

In June, PAMZ hosted a two-day Environment Canada "Let's Drive Green" Vehicle Emissions Inspection Clinic in Red Deer at the Bower Mall Shopping Center. The event was a total success with 243 vehicles tested and a pass rate of 86 per cent.

In July, the Ozone Research Monitoring Program was expanded to include high volume sampling for Beryllium-7 at the Harlech Station, located in the foothills northeast of Nordegg. Environment Canada is providing the equipment and materials for this sampling and the analysis is being conducted by the Saskatchewan Research Council. Additionally, Environment Canada is also providing funding for the operation of the Harlech Station that includes equipment loaned to PAMZ by Alberta Environment.

In late November, utilizing surplus equipment from other PAMZ stations and equipment donations from several member-companies, a second portable monitoring station was added to the PAMZ AQM program. This station will be used primarily to fill data gaps that may exist for technical issues, e.g. ozone and fine particulate matter and for monitoring at locations specifically to build a historical and geographical zonal air quality database.

PAMZ launched its revamped Web site, www.pamz.org at the beginning of December. The Web site is now operated by PAMZ and contains zone air quality data, an events calendar, a survey page and several other innovative features.

Throughout the year PAMZ continued to work with Alberta Health and Wellness and the David Thompson Health Region on the design and development of a community exposure and health effects assessment program scheduled to start up in 2004.

During 2003, PAMZ continued its series of public presentations to raise public awareness and knowledge of air quality issues including ozone in Alberta - a federal perspective, ground-level ozone in Alberta, transportation emissions in Alberta, health effects associated with short-term exposure to low levels of hydrogen sulphide, and indoor air quality and its effect on occupant health.

PEACE AIRSHED

2003 was a monumental year for the Peace Airshed Zone Association (PASZA) with the association receiving the endorsement in March of the CASA board of directors. Another milestone was the establishment of an office operation in Grande Prairie where the administration, accounting, field support and data quality assurance/quality control operations are now centralized.

In June, the passive monitoring network was rationalized from 49 to 43 stations based on a review of the first eight months of data collected by the program. At the close of the year amendments to Alberta Environment operating approvals for 17 PASZA member facilities were nearing the final stages of completion. These amendments will replace the facilities' previous compliance static air quality monitoring (AQM) programs with their participation and support of the more comprehensive PASZA regional passive AQM program.

Start-up of the Henry Pirker Air Monitoring Station, originally scheduled for the fall, was deferred due to a relocation of the original site. The station will be dedicated to the memory of the late Henry Pirker, a lifelong environmentalist, apiarist and resident of the Debolt area. Henry was also a CASA board member who made important contributions to PASZA in its formative years and also to several CASA project teams and other organizations all with the common goal of improving air quality.

The Henry Pirker Station will continuously monitor Grande Prairie's air quality by measuring concentrations of five pollutants: carbon monoxide, fine particulate matter, nitrogen dioxide, ozone and sulphur dioxide. From these measurements, an hourly air quality index (AQI) will be calculated to provide city residents with an indicator of air quality that is simple and easy to understand. At the end of the year the station itself had been completed using purchased, leased and loaned equipment. Final approval from the City of Grande Prairie for a site in Muskosepepi Park along with installation is expected in early January 2004. Throughout 2003, work continued on the design

and implementation of the remainder of the PASZA continuous AQM program utilizing as much as possible, instrumentation and equipment from existing government and industry-operated stations in the region. A minimum of two more continuous stations are scheduled for start-up in 2004.

WEST CENTRAL AIRSHED ZONE

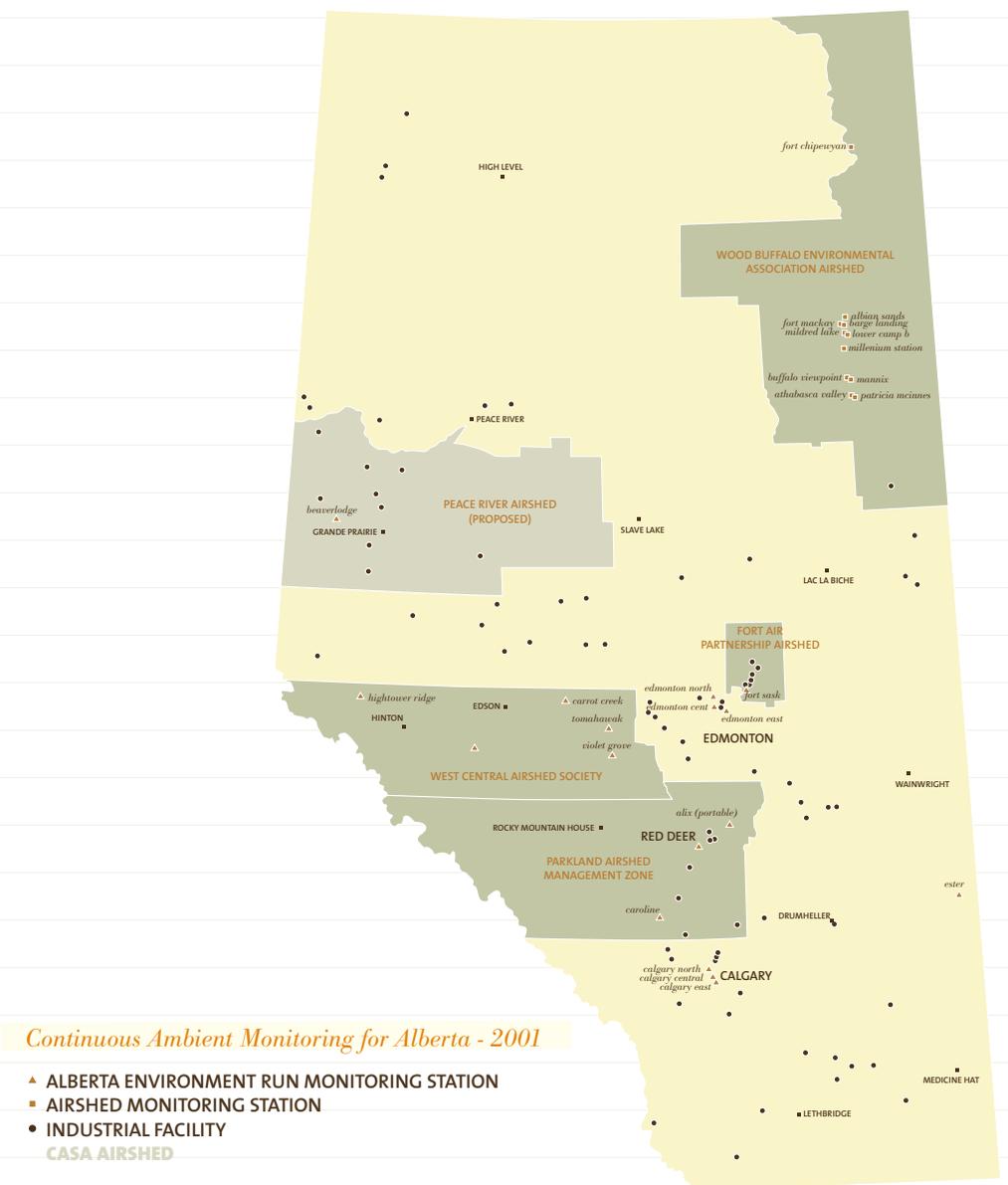
West Central Airshed Society (WCAS) has completed its eighth successful year. The society has continued to provide an in depth understanding of air quality in the region. Expansion of the boundaries and the monitoring program has proven to be a large challenge. A scientific review of the monitoring program and a review and optimization of the monitoring in the Wabumun and Genesee areas was undertaken. A joint expansion submission from WCAS, TranAlta and EPCOR was submitted to Alberta Environment and was subsequently approved in August of 2003.

The new program includes the construction of four new continuous air-monitoring stations. The new stations will provide a good understanding of air quality in the Wabumun and Genesee areas and will add to the regional base of air quality information. Twelve passive monitoring sites were also established in the eastern boundary region to provide an indication of air quality travelling to and from the City of Edmonton.

Year eight brings to a close the agriculture bio-monitoring study on the effects of air quality on Alfalfa (*Medicago sativa* L.) and Saskatoons (*Amelanchier alnifolia* Nutt.). Dr. Sagar Krupa, Dr. Allan Legge and Dr. Milo Nosal will complete a paper on the results of this study early in 2004. The major goal of this program was to gather enough data to test a computer model that could predict plant injury in response to sulphur dioxide. Agriculture bio-monitoring will continue to be a part of the WCAS program. The agriculture program will determine its future direction once the final report is available. An agreement with Weldwood of Canada was negotiated in November and WCAS installed a new air monitoring station in Hinton. WCAS will operate and maintain the station and will be responsible for

data collection and reporting. The Hinton station data is available on the WCAS Web site at <http://www.wcas.ca> and is reported on a real time basis. This station is the first urban station WCAS operates, two more urban stations are planned for Drayton Valley and Edson. Both of these stations will be operated in 2004 for Weyerhaeuser Canada. Adding urban stations to the network provides a new dimension and balance to the air monitoring program for the region.

WCAS recognizes the need to communicate with the public. We do this by providing numerous public presentations, the Web site, and the publication of two newsletters. The newsletters were mailed out to thousands of homes in the region and will continue in 2004. The above information was kindly provided by CASA.



**WOOD BUFFALO ENVIRONMENTAL ASSOCIATION
STATEMENT OF OPERATIONS FOR THE YEAR ENDED DECEMBER 31, 2003**

REVENUES		2003	2002
<i>Contributions</i>	(Schedule 1)	\$ 2,273,159	2,404,898
<i>Interest</i>		22,211	17,947
		2,295,370	2,422,845
EXPENSES			
<i>Ambient air monitoring expenses</i>	(Schedule 2)	\$ 1,325,757	1,202,481
<i>Office and administration expenses</i>	(Schedule 3)	430,296	436,272
<i>TEEM vegetation and soil monitoring</i>	(Schedule 4)	358,753	437,260
<i>Miscellaneous projects</i>	(Schedule 5)	3,594	10,082
<i>Amortization</i>		178,232	168,626
		2,296,632	2,254,721
(DEFICIENCY) EXCESS OF REVENUES OVER EXPENSES		(1,262)	168,124

SCHEDULE 1 - CONTRIBUTIONS*

<i>Contributions</i>		2003	2002
Synchrude Canada Ltd.		\$ 1,054,218	1,001,305
Suncor Energy Inc.		670,360	850,867
Albian Sands Energy Inc.		398,285	412,051
Petro Canada Oil Sands		170,749	165,035
Canadian Natural Resources Ltd.		78,667	61,662
OPTI Nexen		53,500	-
Williams Energy		5,000	5,352
True North Energy		-	75,487
Less GST included in contributions		(157,620)	(166,861)
TOTAL CONTRIBUTIONS		2,273,159	2,404,898

SCHEDULE 2 - AMBIENT AIR MONITORING EXPENSES*

<i>Ambient air monitoring expenses</i>		2003	2002
Contracts: Operations & maintenance - regular		\$ 835,324	796,346
Lab analysis		288,734	253,414
Passive monitoring analysis		58,441	29,455
Passive monitoring transportation		45,531	35,996
Phase 2 strategic plan		37,572	1,697
Station utilities		20,261	11,593
Contracts: Operations & maintenance - extras		20,225	32,398
MacKay River project		6,804	9,282
Station equipment rental costs		6,550	1,200
Station insurance		2,523	10,805
Fort McKay Environment		2,497	4,366
Technical consulting		1,295	-
QA/QC audit		-	12,679
Acid deposition		-	3,250
TOTAL AAM EXPENSES		1,325,757	1,202,481

SCHEDULE 3 - OFFICE AND ADMINISTRATION EXPENSES*

	2003	2002
<i>Communications</i>		
Annual report	\$ 38,498	25,291
Radio advertising	21,952	24,155
Newsletter	13,223	12,158
Communication tools	7,605	9,321
Newspaper advertising	5,247	5,386
Trade fair	4,890	2,719
Travel	2,881	12,884
Website	1,108	3,611
Meals and entertainment	87	-
Field day	-	11,689
Brochures	-	2,742
Communications audit/survey	-	1,776
Presentation and promotions	-	501
	95,491	112,233
<i>Administration personnel</i>		
Project management	\$ 62,145	84,755
Environmental assistant	68,627	61,551
Administrative/secretarial services	47,784	17,961
Bookkeeping	25,997	17,603
Casual labour	-	1,896
Total wages/contracts	204,553	183,766
CPP expense	7,649	4,482
EI expense	4,916	3,355
WCB	143	112
	217,261	191,715
<i>Office expenses</i>		
Office, postage & stationery	\$ 12,920	11,583
Occupancy costs	11,151	6,116
Office equipment lease	11,102	5,771
Telephone, fax & internet	9,346	11,972
Conferences & meetings	8,001	12,753
Professional fees	7,500	8,213
Computer & other expenses	6,923	5,588
Strategic workshops	5,536	22,614
Miscellaneous	3,686	500
Repairs and maintenance	1,647	3,167
Staff development	1,550	-
Bank charges and interest	1,381	1,002
Insurance	1,311	1,943
Meals & entertainment	177	2,269
	82,231	93,491
<i>Stakeholder involvement</i>	22,602	25,191
<i>Travel</i>	12,711	13,642
TOTAL OFFICE AND ADMINISTRATION EXPENSES	430,296	436,272

SCHEDULE 4 - TEEM VEGETATION & SOIL MONITORING EXPENSES**TEEM vegetation & soil monitoring*

	2003	2002
Lichen pilot study	\$ 102,684	-
Administration	71,708	66,194
Science advice	46,862	19,864
Soil microbiology	29,400	25,654
Remote sensing	26,456	-
Miscellaneous	24,503	-
Eutrophication literature	24,311	-
TEEM database	14,109	29,921
Acid Plot - Tree Health	6,220	57,686
TEEM conferences and meetings	5,366	3,693
SSC / ISC meetings	3,895	500
Stakeholder participation	2,184	5,192
Statistical review	650	-
Workshops	405	10,332
Direct effects project	-	105,898
New acid plot site establishment	-	34,963
Traditional resources	-	32,170
Infra-red photography (FCIR)	-	18,589
Compositing review	-	12,595
Science subcommittee coordinator	-	5,673
Estimation of dry acid deposition	-	4,110
Project management recruitment	-	2,365
Spring acid pulse	-	1,424
Science advisory consultants	-	437
TOTAL TEEM VEGETATION & SOIL MONITORING EXPENSES	358,753	437,260

SCHEDULE 5 - MISCELLANEOUS EXPENSES**Human exposure monitoring committee*

	2003	2002
Human exposure working group	\$ 3,293	1,021
Human exposure working group meeting expenses	301	-
Odour sampling	-	9,061
TOTAL MISCELLANEOUS EXPENSES	3,594	10,082

Appendices ⇨

* FOR THE YEAR ENDED DECEMBER 31, 2003

Table 1. Average Concentration of SO₂ in 2003 (ppm)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	0.001	0.095
Mildred Lake (AMS 2)	0.003	0.147
Buffalo Viewpoint (AMS 4)	0.001	0.102
Mannix (AMS 5)	0.003	0.180
Patricia McInnes (AMS 6)	0.001	0.048
Athabasca Valley (AMS 7)	0.001	0.044
Fort Chipewyan (AMS 8)	0.000	0.020
Albian Mine Site (AMS 10)	0.002	0.267
Lower Camp (AMS 11)	0.002	0.141
Millennium (AMS 12)	0.001	0.032
Syncrude UE-1 (AMS 13)	0.001	0.193

Table 2. Average Concentration of TRS/H₂S in 2003 (ppb)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	0.7	8
Mildred Lake (AMS 2)	0.6	14
Buffalo Viewpoint (AMS 4)	0.2	23
Mannix (AMS 5)	0.6	28
Patricia McInnes (AMS 6)	0.5	6
Athabasca Valley (AMS 7)	0.8	7
Barge Landing (AMS 9)	0.6	9
Lower Camp (AMS 11)	0.9	64
Millennium (AMS 12)	0.1	7
Syncrude UE-1 (AMS 13)	0.3	9

Table 3. Average Concentration of THC in 2003 (ppm)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	1.85	11.1
Mildred Lake (AMS 2)	2.25	9.6
Buffalo Viewpoint (AMS 4)	1.92	6.3
Mannix (AMS 5)	1.98	7.0
Patricia McInnes (AMS 6)	1.88	3.0
Athabasca Valley (AMS 7)	2.03	3.7
Barge Landing (AMS 9)	2.08	30.8
Albian Mine Site (AMS 10)	2.22	49.9
Lower Camp (AMS 11)	2.10	13.0
Millennium (AMS 12)	2.04	3.4
Syncrude UE-1 (AMS 13)	2.18	15.4

Table 4. Average Concentration of NO₂ in 2003 (ppm)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	0.006	0.043
Patricia McInnes (AMS 6)	0.005	0.040
Athabasca Valley (AMS 7)	0.010	0.063
Fort Chipewyan (AMS 8)	0.001	0.026
Albian Mine Site (AMS 10)	0.010	0.087
Millennium (AMS 12)	0.007	0.033
Syncrude UE-1 (AMS 13)	0.005	0.039

Table 5. Average Concentration of O₃ in 2003 (ppb)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	22.6	84
Patricia McInnes (AMS 6)	22.6	59
Athabasca Valley (AMS 7)	19.3	63
Fort Chipewyan (AMS 8)	29.5	63
Syncrude UE-1 (AMS 13)	21.1	81

Table 6. Average Concentration of PM_{2.5} in 2003 (µg/m³)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	5.0	80.9
Patricia McInnes (AMS 6)	3.4	62.9
Athabasca Valley (AMS 7)	3.8	48.0
Fort Chipewyan (AMS 8)	2.4	48.6
Albian Mine Site (AMS 10)	4.5	52.7
Millennium (AMS 12)	2.8	19.1
Syncrude UE-1 (AMS 13)	3.6	445.0

Table 7. Average Concentration of CO in 2003 (ppm)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Athabasca Valley (AMS 7)	0.2	2.9

Table 8. Average Concentration Passive Monitoring of NO₂, SO₂, O₃ and H₂S in 2003 (ppb)

SITE	NITROGEN DIOXIDE	SULPHUR DIOXIDE	OZONE	HYDROGEN SULPHIDE
PL7	1.25	0.80	27.20	-
PH6	1.89	1.07	26.09	-
AL8	0.98	0.56	24.58	-
PH4	3.31	2.53	28.77	-
AH8	1.79	1.85	29.30	-
PH2	2.34	1.54	25.98	-
PL1	0.87	0.77	28.94	-
PL8	0.48	0.30	23.42	-
AH3	1.10	0.79	29.63	-
AH7	1.65	1.85	29.35	-
AMS1	4.59	1.42	20.65	-
AMS6	4.94	1.55	23.40	-
MK1	1.59	0.53	23.42	0.08
MK2	1.65	0.56	22.18	0.09
MK3	1.71	0.55	23.91	0.09
MK4	1.59	0.63	22.93	0.09

Forest Sites - PL, PH, AL, AH - for TEEM Program

AMS - Air Monitoring Stations - Fort McKay (AMS1), Patricia McInnes (AMS6)

MK - MacKay River Passives

Table 9. Temperature measurements at WBEA monitoring sites in 2003 (degrees celsius)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	0.96	33.72
Mildred Lake (AMS 2)	2.25	33.31
Buffalo Viewpoint (AMS 4)	1.76	33.07
Mannix (AMS 5) 2m	1.38	32.61
Patricia McInnes (AMS 6)	1.67	32.30
Athabasca Valley (AMS 7)	1.72	33.80
Fort Chipewyan (AMS 8)	-0.14	32.10
Barge Landing (AMS 9)	0.80	33.20
Albian mine Site (AMS 10)	0.74	32.80
Lower Camp (AMS 11)	1.92	33.38
Millennium (AMS 12)	-18.04	13.26
Syncrude UE-1 (AMS 13)	0.25	34.65

Table 10. Wind speed measurements at WBEA monitoring sites in 2003 (kilometers per hour)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	8.1	36.5
Mildred Lake (AMS 2)	10.7	40.5
Lower Camp B (AMS 3)	8.6	32.8
Buffalo Viewpoint (AMS 4)	10.8	47.2
Mannix (AMS 5) 20m	11.0	50.0
Patricia McInnes (AMS 6)	9.9	43.6
Athabasca Valley (AMS 7)	9.9	76.4
Fort Chipewyan (AMS 8)	14.2	50.8
Barge Landing (AMS 9)	5.2	21.7
Albian Mine Site (AMS 10)	7.1	27.8
Lower Camp (AMS 11)	9.8	41.7
Millennium (AMS 12)	17.8	69.2
Syncrude UE-1 (AMS 13)	4.5	18.2

Table 11. Relative humidity measurements at WBEA monitoring sites in 2003 (percent)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	67.70	96.16
Fort Chipewyan (AMS 8)	64.15	100.00

Table 12. Solar radiation measurements at WBEA monitoring sites in 2003 (watts per square meter)

STATION	ANNUAL AVERAGE	1-HOUR MAXIMUM
Fort McKay (AMS 1)	106.75	894.02
Fort Chipewyan (AMS 8)	74.86	510.29

Table 13. Wind direction at WBEA monitoring sites in 2003 (percent time from each direction)

STATION	NORTH	NE	EAST	SE	SOUTH	SW	WEST	NW
Fort McKay (AMS 1)	20.20	5.09	3.66	9.11	25.79	9.98	10.80	14.69
Mildred Lake (AMS 2)	22.96	3.88	4.88	17.79	19.80	9.10	10.74	10.40
Buffalo Viewpoint (AMS 4)	22.48	3.88	3.32	29.96	12.18	8.41	10.96	8.69
Mannix (AMS 5) 20m	15.94	8.86	4.68	18.69	19.67	7.43	13.09	9.85
Patricia McInnes (AMS 6)	12.66	8.77	5.82	16.82	12.15	18.01	11.92	13.49
Athabasca Valley (AMS 7)	19.14	4.02	5.54	27.93	8.46	13.16	8.86	12.01
Fort Chipewyan (AMS 8)	7.86	7.61	24.98	8.10	6.90	8.38	16.85	19.28
Barge Landing (AMS 9)	19.00	8.81	2.87	11.14	24.21	14.40	8.60	10.97
Albian Mine Site (AMS 10)	18.88	11.26	5.35	7.00	23.91	14.61	9.33	9.65
Lower Camp (AMS 11)	20.84	7.87	6.05	33.28	4.78	3.13	10.08	13.27
Millennium (AMS 12)	22.78	2.93	5.21	19.09	22.13	2.60	4.34	20.61
Syncrude UE-1 (AMS 13)	20.32	7.38	3.80	6.97	19.83	18.45	13.93	7.84

Governance Committee (GC)

Ann Dort-MacLean, *President*
 Ted Ostrowski, *Vice President*
 Faruq Suleman, *Treasurer/Secretary*
 Lisa Schaldemose / Colin Beddoes, *Exec. Dir.*
 Andrew Cummins, *Director*
 Eric Davey, *Director*
 Dick Ebersohn
 Samantha James

Fort McMurray Environmental Association
 Syncrude Canada Ltd.
 Suncor Energy Inc
 Wood Buffalo Environmental Association
 Suncor Energy Inc.
 Athabasca Tribal Council
 Regional Municipality of Wood Buffalo
 Albian Sands Energy Inc.

Communications Committee (CC)

Randy Provencal, *Chair*
 Laura Carlson
 Eric Davey
 Pam Lays
 Julie McLaughlin
 Lee Nehring / DJ Villeneuve
 Lisa Schaldemose

Syncrude Canada Ltd.
 Suncor Energy Inc.
 Athabasca Tribal Council
 Wood Buffalo Environmental Association
 Wood Buffalo Environmental Association
 Albian Sands Energy Inc.
 Wood Buffalo Environmental Association

Terrestrial Environmental Effects Monitoring Committee (TEEM)

Darrell Martindale, *Chair*
 Laura Blair
 Colin Cumberland
 Eric Davey
 Calvin Duane
 Melody Lepine / Willie Courtoreille
 Liana Luard
 Pat Marcel
 Russell Miyagawa
 Ron Pauls
 Ken Shipley / Lisa Schaldemose
 Linda Vaughan
 Laura Whittle
 Dan Woynillowicz

Albian Sands Energy Inc.
 Alberta Environment / Approvals Branch
 Petro-Canada
 Athabasca Tribal Council
 Canadian Natural Resources Limited
 Mikisew Cree First Nation
 Alberta Environment / Sustainable Resource Development
 Athabasca Chipewyan First Nation
 Toxics Watch
 Syncrude Canada Ltd.
 Fort McKay First Nation & Fort McKay Métis Local 122
 TrueNorth Energy LP
 Suncor Energy Inc.
 Pembina Institute for Appropriate Development

Ambient Air Technical Committee (AATC)

Diane Phillips, *Chair*
 Lisa Schaldemose, *Chair*
 Gary Cross / Kelly Barager
 Samantha James
 Julie McLaughlin
 Ed Rahn / Laura Whittle

Syncrude Canada Ltd.
 Wood Buffalo Environmental Association
 RSL Systematics
 Albian Sands Energy Inc.
 Wood Buffalo Environmental Association
 Suncor Energy Inc.

Staff

Lisa Schaldemose / Colin Beddoes, *Executive Director*
 Julie McLaughlin, *Environmental Engineer*
 Pam Lays / Lilly Upton, *Executive Assistant*
 Mandy Lays, *Bookkeeper*

WBEA Member List, 2003 (Appendix IV.)

Alberta Energy and Utilities Board (Frank Sagan)
 Alberta Environment (Kem Singh)
 Alberta Health and Wellness (Jonathan Robb)
 Albion Sands Energy Inc. (Samantha James)
 Athabasca Chipewyan First Nation (Pat Marcel)
 Athabasca Tribal Council (Eric Davey)
 Canadian Natural Resources Limited (Calvin Duane)
 Fort McKay First Nation (Ken Shipley/Lisa Schaldemose)
 Fort McKay Métis Local 122 (Ken Shipley/Lisa Schaldemose)
 Fort McMurray Environmental Association (Ann Dort-MacLean)
 Fort McMurray First Nation (Ian Walker)
 Mikisew Cree First Nation (Melody Lepine)
 Northern Lights Regional Health Association (Darcy Garchinski)
 Nunee Board of Health (Simon Waquan)
 Pembina Institute for Appropriate Development (Dan Woynilowicz)
 Petro-Canada (Collin Cumberland)
 Regional Municipality of Wood Buffalo (Dick Ebersohn)
 Suncor Energy Inc. (Andrew Cummins)
 Syncrude Canada Ltd. (Ted Ostrowski)
 Toxics Watch (Russell Miyagawa)
 Williams Energy (Canada) Inc. (Richard Funk)

Contractors for the WBEA, 2003 (Appendix V.)

AMEC Earth & Environmental
 Alberta Research Council
 Biosphere Solutions
 Fort McKay Environmental Services Ltd.
 Jacques Whitford Environmental Ltd.
 Maxxam Analytics Inc.
 RSL Systematics Ltd.
 Melody Hopkinson, Communications Consultant

Reports, 2003 (Appendix VI.)

- > Western Resource Solutions, *Analysis of the Water Quality of the Steepbank, Firebag and Muskeg Rivers During the Spring Melt (1989-2001)*, Dec. 2003.
- > AMEC, *Establishment of Site JP212 as a TEEM Jack Pine Acid Deposition Monitoring Site*, June 2003.
- > AMEC, *2001 Forest Health Assessment of the Jack Pine Soil Acidification Monitoring Plots*, June 2003.
- > AMEC, *Vegetation Stress Survey in the Vicinity of the Syncrude and Surrounding Oil Sands Leases 2001*, June 2003.
- > Golder Associates, *Trace Metals in Traditional Country Foods*, June 2003.

ABBREVIATIONS

BTEX - Benzene, Toluene, Ethylbenzene and Xylene are aromatic volatile aromatic compounds. When found in sufficient quantities can affect human health.

CASA - Clean Air Strategic Alliance is a multi-stakeholder society sponsored by the Departments of Health, Energy, and Environmental Protection which provides a forum to discuss and address issues related to air quality in the province.

Chlorosis - Yellowing of leaf tissue due to a lack of chlorophyll.

CH₄ - methane is a colourless, odourless gas, which is the most common hydrocarbon in the earth's atmosphere. It is of significance as a greenhouse gas responsible for global warming. About 20% of the total greenhouse effect is attributable to methane.

NO_x - oxides of nitrogen are formed when nitrogen combines with oxygen during the combustion of fossil fuels. Other sources are the natural degradation of vegetation and the use of chemical fertilizers. Oxides of nitrogen affect visibility and lead to ozone formation. For monitoring purposes nitrogen oxides are considered the sum of nitric oxide and nitrogen dioxide.

NO - nitric oxide is the major oxide of nitrogen produced by combustion. It is rapidly oxidized to nitrogen dioxide in the atmosphere.

NO₂ - nitrogen dioxide is the most abundant of the oxides of nitrogen in the atmosphere. It is a reddish-brown gas. The Alberta guidelines of a 1-hour average concentration of 212 ppb, a 24-hour average concentration of 106 ppb, and an annual average concentration of 32 ppb, are based on the prevention of human effects.

O₃ - ozone at ground level is generated from emissions of NO_x and hydrocarbons. At high concentrations, it may contribute to crop damage and cause respiratory problems. The Alberta guideline

for ozone is 82 ppb for a 1-hour average. In the stratosphere, it protects the earth from excessive ultraviolet radiation.

pH - the measurement of the degree of acidity on a scale of 1 to 14. One is very acidic, 7 is neutral and 14 is very alkaline. The natural pH of precipitation in the absence of pollution is thought to be 5.6.

PM₁₀ - particles less than 10 micrometer in diameter, small enough to be inhaled but do not reach the lungs.

PM_{2.5} - particles less than 2.5 micrometer in diameter, small enough to be inhaled and may reach the lungs. Concentrations greater than 30 µg/m³ are thought to adversely affect pulmonary function.

SO₂ - Sulphur dioxide is formed during the processing and combustion of fossil fuels containing sulphur. It is a colourless gas with a pungent odour, and can be detected by taste and odour at concentrations as low as 300 ppb. Historically SO₂ is the main component of acid rain.

TBS - Total reduced sulphur compounds are mainly of hydrogen sulphide with small amounts of mercaptans.

VOCs - volatile organic compounds can be emitted naturally or as by-products of industrial processes. Examples are terpenes produced by forests, ethylene from industrial and natural sources, and chloroform from industry.

UNITS OF MEASURE

- µm** - one one-millionth of a meter (10⁻⁶m)
- ppb** - parts per billion by volume
- ppm** - parts per million by volume
- µg/m³** - micrograms per cubic meter
- keq ha⁻¹yr⁻¹** - kiloequivalents per hectare per year
- kg ha⁻¹yr⁻¹** - kilograms per hectare per year

DEFINITION OF TERMS

Alberta guideline - concentration value adopted by the Province of Alberta with the intention of preventing deterioration of air quality. Guidelines for SO₂, NO₂, O₃ and several other pollutants are based on the prevention of adverse human health and vegetation effects. Guidelines may be for 1-hour, 24-hour, or 1-year average concentrations.

Ambient air quality - the concentration of pollutants in the ambient air. Generally, the concentrations of gases or particles to which the general population would be exposed, as opposed to the concentration of pollutants emitted by a specific source.

Average annual concentration - the sum of the 1-hour average concentration measurements for the year divided by the number of hours that

measurements were made within that year. It can be compared against the recommended guideline for the same period to assess absolute air quality or against other year's data to assess improvement or degradation of air quality in the same air.

Critical load - the highest deposition load that will not cause chemical changes leading to long-term harmful effects on the most sensitive ecological systems.

Target load - the maximum level of acidic atmospheric deposition that affords long-term protection from adverse ecological consequences and that is practically and politically achievable.

Volume-weighted pH - the average pH of precipitation throughout the year when the volume of rainfall and the H⁺ concentration of each precipitation sample is considered.

FOR MORE INFORMATION ON THE WBEA CONTACT:

Wood Buffalo Environmental Association
Box 5567
Fort McMurray, AB T9H 3G5
Phone: (780) 799-4420
Fax: (780) 715-2016
E-mail: wbea.airmon@shawlink.ca
www.wbea.org

FOR INFORMATION ON THE CASA PLEASE CONTACT:

Clean Air Strategic Alliance
10th Floor, 10035-108th Street NW
Edmonton, AB T5J 3E1
Phone: (780) 427-9793
Fax: (780) 422-3127
E-mail: casa@casahome.org
www.casahome.org

The Wood Buffalo Environmental Association is committed to the preservation of the environment and our resources. This annual report is printed on 100% post consumer recycled waste using vegetable inks. Please recycle.

