Cumulative Effects:

Concerns of Fort McKay regarding the

Impacts of Emissions to Air from Industrial Development

Prepared for the Fort McKay Sustainability Department

September 2012

Lori Adamache, MSc, PEng

David Spink, MSc, PEng.

Recommendations to the Panel to Address Cumulative Effects due to Air Emissions:

1. **Prevention and minimization of pollution:** Proponents and operators must be required demonstrate how emission control technology is selected to achieve best practices and best available technology economically achievable. Regulations, policies, guidelines and management frameworks require the implementation of best practices or best available technology economically achievable, yet details are lacking to satisfy Fort McKay. Regulators need to enforce justification of selected emission control technology and provide transparency.
2. **Require use of relevant indicators to Fort McKay, including Fort McKay's Air Quality Law, in assessments of cumulative effects:** Comparing current and predicted air quality to provincial and federal regulatory objectives does not provide an assessment of potential health and odour impacts. Fort McKay believes the application of the precautionary principle should apply to its community and reserve lands. Proper assessments of cumulative effects should compare cumulative air quality to health based and ecosystem protective objectives, like those proposed by the World Health Organization. Fort McKay's Air Quality Law outlines its expectations with respect to air quality indicators to be used in assessments.
3. **Cumulative effects should evaluate change from pre-development, not just the increment due to new projects:** It is important to Fort McKay that the air quality in their community and traditional lands remain as close to natural background as possible. The true impact of projects is not depicted when a new project compares its impact to existing and approved emissions. Comparison to the pre-development and current cases provide a more comprehensive picture of what the community has to live with and the magnitude of this change should be understood and minimized.
4. **Monitoring and evaluating impacts need to be done in partnership with Fort McKay:** As development is surrounding the community and on their traditional lands, Fort McKay wants meaningful input into indicators and active participation in monitoring and evaluating the changes to those indicators. There needs to be clear links to how the collected data will be interpreted and translated into management plans, policy development and, if needed, remediation.
5. **Odour management strategy:** Fort McKay community members endure odours within their community and on their traditional lands. Regulators need to partner with Fort McKay to further the understanding of substances and circumstances that are contributing to odours in and around Fort McKay. A regulatory mechanism is required to reduce odours, not just monitor and report.

Fort McKay's Vision for Air Quality:

The air smells fresh and contributes to the health of the land and animals and to the health and well-being of the people of Fort McKay.

Fort McKay's Air Quality Concerns: Pre-Amble

The Fort McKay Specific Assessment (FMSA)[1] completed in 2010 was conducted to provide as assessment of the effects of oil sands development from the perspective of Fort McKay First Nation. The FMSA included a section on air quality and air related impacts. This submission is intended to complement the FMSA, but with a focus on recommendations for assessing the impacts, as well as managing and minimizing cumulative effects of air emissions in the Community and Traditional Lands of Fort McKay. It is intended to provide information to assist the Panel in assessing cumulative impacts on air quality relevant to Fort McKay, specifically within the Community. This report introduces Fort McKay's Air Quality Law and explains the reasons for its creation.

Air quality information presented in the FMSA incorporated air monitoring data up to 2008. Air quality data for selected parameters are included in this submission up to 2011. In addition, the estimated pre-development air concentrations from the FMSA for the parameters are shown for comparison, as well as predictions from a recent Environmental Impact Assessment (EIA) for the planned development case (PDC). The intent of the following graphs is to illustrated why Fort McKay has concerns regarding the assessment approach used in EIAs and the potential changes that are predicted to occur in the Community of Fort McKay. These graphs show the need for effective and proactive management to ensure that the impacts to air quality are minimized.

The FMSA outlined Fort McKay's concerns regarding specified air quality parameters. These concerns will not be reiterated in detail in this submission. The FMSA considered the impacts of sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and fine particulate matter ($PM_{2.5}$). These parameters were chosen as they are emitted from oil sands operations around Fort McKay. In addition, there can be health and ecosystem impacts associated with these compounds. They were also chosen as indicators of trends in air quality. These parameters are continuously monitored in Fort McKay and updated information is included in this submission.

Sulphur Dioxide Trends:

Sulphur dioxide (SO_2) emissions originate from point sources, primarily, in the oil sands region. Mobile sources are considered a minor source as fuel standards have facilitated the reduction in sulphur in diesel fuels. Existing upgraders emit the largest proportion of SO_2 to the atmosphere, but central processing facilities at in-situ facilities are a growing and distributed source.

Figure 1 shows the pre-development SO_2 ambient concentration as modelled for the FMSA. Data from 1998 to 2011 for SO_2 are shown for the Fort McKay air monitoring station operated by Wood Buffalo Environmental Association (WBEA)[2]. Finally, the revised Shell 2012 PDC estimate SO_2 concentration is shown for comparison[3].

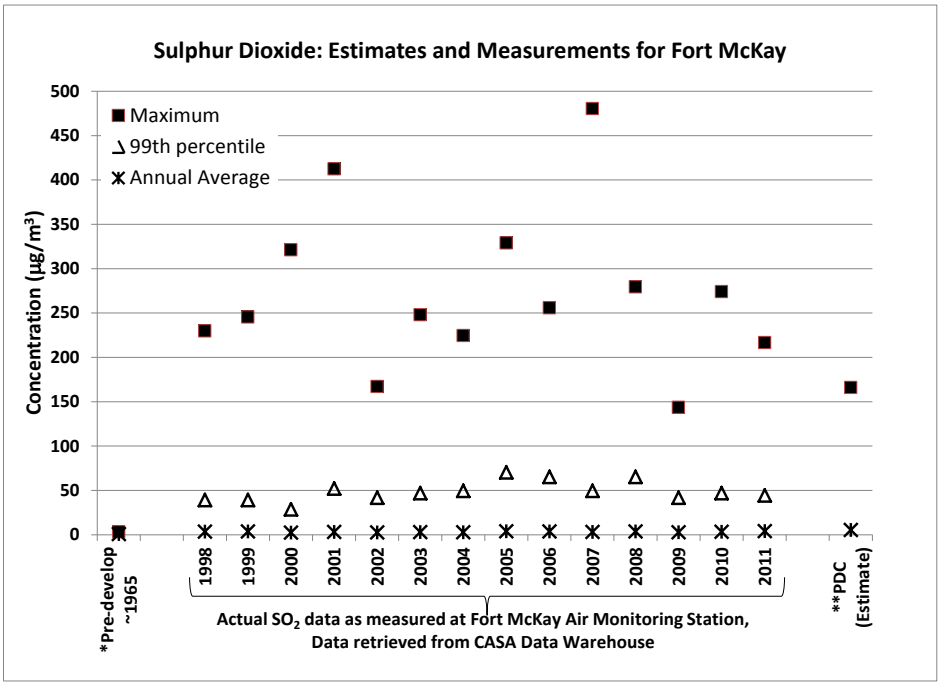
The pre-development case shows that the maximum and annual average SO_2 concentrations would be very low as the current main sources are industrial. While the annual average for SO_2 has not seen a significant increase since 1998, events or upsets at the industrial facilities can create elevated levels close to and or exceeded the provincial air quality objectives. When assessments are conducted, the focus is on steady state operations and their associated emissions. The short term elevated SO_2 events in the community are more concerning to Fort McKay. These can result in odours and haze within the community. The PDC estimate was based on steady state emissions

[1] FMSA. (2010). Fort McKay Specific Assessment (Supplemental Information for the Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project application). Fort McKay Industry Relations Corporation. March 2010

[2] WBEA (2012). http://www.wbea.org/. Last visited September 26, 2012.

[3] Shell Canada Ltd. (2012). Response to Supplementary Information Requests as of January 30, 2012. May, 2012. Calgary, Canada.

and therefore would not predict the upset scenarios that result in peak concentrations within the community. The peak 1-hour SO_2 concentration is shown on the graph for comparison (Appendix 3.2).



*Pre-development (~1965) from FMSA (2010)

**PDC Peak Estimate from Shell (2012), Appendix 3.2

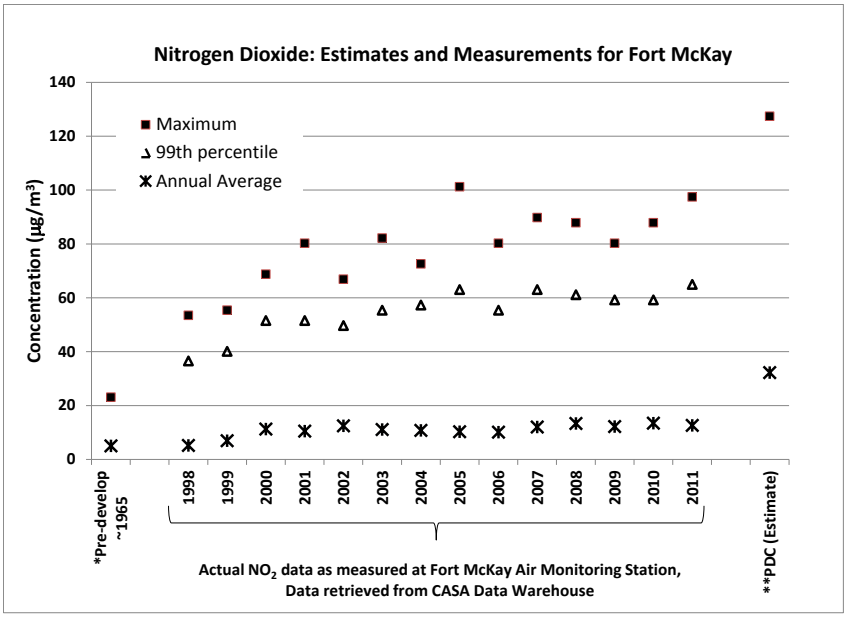
Figure 1: SO_2 air quality for Fort McKay, including a pre-development scenario and a planned development estimate of SO_2 concentrations in Fort McKay (actual data retrieved from CASA Data Warehouse)[4]

Nitrogen Dioxide Trends:

Nitrogen dioxide (NO_2) is also monitored at the Fort McKay air monitoring station operated by WBEA. NO_2 is one of the three parameters that are part of the Air Quality Health Index (AQHI). Sources of oxides of nitrogen are more distributed than SO_2. Mobile mine fleets and transportation contribute to ambient level of NO_2 in addition to emissions from point combustion sources.

Figure 2 compares the pre-development, actual monitoring data as well as the predicted NO_2 concentrations in the PDC. NO_2 concentrations are showing an upward trend in the annual concentrations, as well as the maximum and 99th percentile. The PDC predicted NO_2 concentration in Fort McKay is concerning to the community. If all development occurs with emission controls and as proposed, the concentration of NO_2 is anticipated to double. While there are uncertainties in these predictions, the assessments are showing significant NO_2 increases due to increased emissions of oxides of nitrogen. Emissions controls for sources of oxides of nitrogen need to be a priority for improvement and management.

[4] Clean Air Strategic Alliance. (2006). CASA Data Warehouse. Available on line at http://www.casadata.org/. Last visited September 21, 2012.



*Pre-development (~1965) from FMSA (2010)

**PDC Peak Estimate from Shell (2012), Appendix 3.2

Figure 2: NO_2 air quality for Fort McKay, including a pre-development scenario and a planned development estimate of NO_2 concentrations in Fort McKay (actual data retrieved from CASA Data Warehouse)[5]

Fine Particulate Matter:

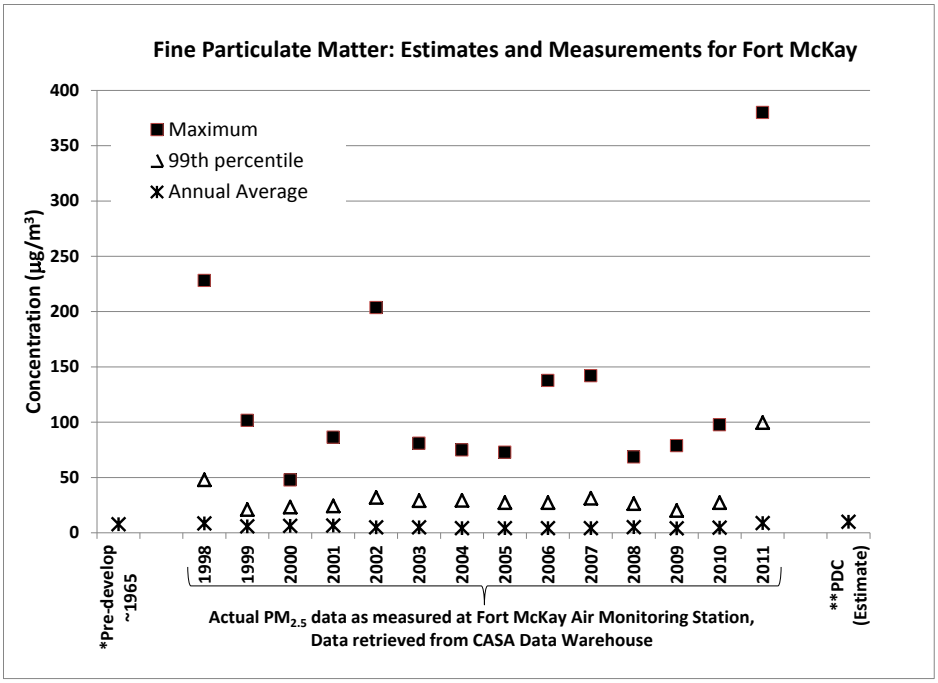
$PM_{2.5}$ concentrations were also assessed in the FMSA. Combustion sources and transportation, including mine fleets, will contribute to $PM_{2.5}$. $PM_{2.5}$ ambient concentrations can be significantly impacted by forest fires. Figure 3 shows the pre-development estimate of $PM_{2.5}$ concentrations within the community of Fort McKay. The maximum concentrations of $PM_{2.5}$ vary year to year, especially during years in which there are forest fires in the region. In 2011, there were forest fires within the region and these affected both the annual average and maximum $PM_{2.5}$ concentrations within Fort McKay.

Continued management of industrial sources must be a priority of minimize the impact of $PM_{2.5}$ emissions on ambient concentrations. The PDC estimate of $PM_{2.5}$ shows an increase in ambient concentrations within the community (approximately double the 2010 annual average $PM_{2.5}$ concentration).

These parameters are discussed further in this submission as well as recommendations to manage the cumulative effects on the community of Fort McKay. These parameters can be used as indicators for potential trends of other substances within the Community.

Odours are prevalent within and around Fort McKay, but reliable methods to monitor odours are still under development. Management and minimization of odours includes identification of the odour-causing substances and then determining means to mitigate the sources and impacts. The issue of odours is also discussed further in this report.

[5] Clean Air Strategic Alliance. (2006). CASA Data Warehouse. Available on line at http://www.casadata.org/. Last visited September 21, 2012.



*Pre-development (~1965) from FMSA (2010)

**PDC Estimate from Shell (2012), Appendix 3.2

Figure 3: $PM_{2.5}$ air quality for Fort McKay, including a pre-development scenario and a planned development estimate of $PM_{2.5}$ concentrations in Fort McKay (actual data retrieved from CASA Data Warehouse)[6]

[6] Clean Air Strategic Alliance. (2006). CASA Data Warehouse. Available on line at http://www.casadata.org/. Last visited September 21, 2012.

Contents

Cumulative Effects – Concerns of Fort McKay regarding the Impacts of Emissions to Air from Industrial Development

1 INTRODUCTION:

Cumulative air emissions from oil sands development in the Athabasca Oil Sands Region is a concern for Fort McKay First Nation. Not only do the emissions have an impact on the day to day life of the residents in the community of Fort McKay, but air emissions from oil sands developments affect the enjoyment and use of their Traditional Lands.

Fort McKay understands that the oil sands development is an important economic force for Alberta and Canada. Development of the resource, though, should be planned and managed so that the effects on the Community of Fort McKay and its Traditional Territories are minimized. This development has had, and will continue to have, impacts to the air quality and lands due to emissions to air, which include exhaust and dust from increased industrial and commuter traffic. These impacts are experienced most by those living in the central part of the oil sands mining and in-situ development – Fort McKay residents.

In its review of many project environmental impact assessments, and its ongoing discussions with oil sands companies and regulators, Fort McKay has identified a number of cumulative effect assessment and management deficiencies. Fort McKay believes these issues need to be addressed if cumulative effects are to be managed in a meaningful way. This submission outlines some of the air emission and air impact related assessment and management issues that project review panels need to address on priority basis. These are:

- The lack of a rigorous and transparent process to ensure that "best practices" are applied to prevent or minimize air emissions from oil sands developments;
- The continuing misuse of Alberta Ambient Air Quality Objectives and Canada-Wide Standards in the assessment of air impacts;
- The use of inappropriate impact assessment evaluation criteria to determine the significance of predicted air impacts;
- Limitations and deficiencies in the monitoring and reporting of cumulative impacts;
- The lack of a clear link between cumulative environmental management and the results of modelled or monitored cumulative effect impacts; and
- No clear monitoring or management strategies to address regional and community odour issues.

Each of these issues is discussed in some detail in this submission.

It is important to note that the effects of industrial development on air quality and how these influence the quality of life of the residents of Fort McKay are relevant to the assessments of cumulative effects. This context is largely overlooked in Environmental Impact Assessments and in the management of cumulative impacts. This is one of the drivers behind the development of the Fort McKay Air Quality Law explained in this report. The focus, instead, is for proponents to demonstrate that their project does not contribute to the exceedences of any objectives or the triggering of any management action thresholds. When such exceedences or triggers are predicted the focus shifts to emphasizing the conservative nature of predictions and that proposed project only represents a small incremental contribution to the base development case. The community's reality is overshadowed by comparisons

of modelled values to regulatory limits – which have little relevance or meaning to community members and which represent compliance-type values not meaningful impact assessment criteria.

Scientific evaluation and compliance with policies and legislation are the foundation of the existing regulatory system. Yet, even these components are not being fully addressed in the Environmental Impact Assessments. This is discussed in this report.

Fort McKay developed a *Healing the Earth Strategy*, included in the *Fort McKay Specific Assessment*[7], in which it outlined its expectation with respect to air quality:

The air smells fresh and contributes to the health of the land and animals and to the health and well-being of the people of Fort McKay.

The World Health Organization[8] states that:

Exposure to air pollutants is largely beyond the control of individuals and requires action by public authorities at the national, regional and even international levels.

To this end, Fort McKay requests that regulators partner with them in advancing management of air quality on Fort McKay Traditional Lands so that the cumulative effects of air emissions due to development can support the health and well being of the Fort McKay First Nation. Recent developments, such as the *Joint Alberta and Canada Implementation Plan for Oil Sands*[9], focus on monitoring and reporting. While these are important components, managing and minimizing impacts from air emissions to the environment are not included as part of the plan. To Fort McKay, effective management involves using meaningful indicators of air quality for comparison and taking action to minimize the impacts to those indicators. It also includes having plans to remediate or restore if unacceptable impacts occur.

The provincial government recently enacted the *Lower Athabasca Regional Plan*[10] to facilitate cumulative effects management. For air quality, there is a management framework that is intended to manage NO_2 and SO_2 ambient concentrations resulting from NO_x and SO_2 emissions. In addition, the provincial *PM and Ozone Management Framework*[11] is intended to manage and minimize air quality impacts. Within the Rural Municipality of Wood Buffalo, the Cumulative Environmental Management Association (CEMA) has also developed, with input from Fort McKay representatives, the CEMA *Acid Deposition Management Framework*[12], *Ozone Management Framework*[13]

---

[7] FMSA. (2010). Fort McKay Specific Assessment (Supplemental Information for the Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project application). Fort McKay Industry Relations Corporation. March 2010

[8] World Health Organization. (2012). Air Quality Fact Sheet No313. Last updated September 2011. Available on-line at http://www.who.int/mediacentre/factsheets/fs313/en/index.html. Last visited September 20, 2012.

[9] Government of Canada.(2012).Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring. Minister of the Environment. February 3, 2012. Available on line http://environment.alberta.ca/documents/Joint_Canada-Alberta_Implementation_Plan_for_Oil_Sands_Monitoring.pdf. Last visited September 22, 2012.

[10] Government of Alberta.(2012). Lower Athabasca Regional Plan 2012-2022. Approved August 22, 2012. ISBN No. 978-1-4601-0538-2 (OnlineVersion), Available at https://www.landuse.alberta.ca/Documents/LARP%20Lower%20Athabasca%20Regional%20Plan%202012-2022%20-%20Approved%20-%202012-08.pdf.

[11] Clean Air Strategic Alliance. (2003). PM and Ozone Management Framework. CASA, September 18, 2003, Edmonton, Canada. Available on line http://casahome.org.

[12] CEMA. (2004). Acid Deposition Management Framework Recommendation. Approved February 25, 2004. Available on line at http://cemaonline.ca/index.php/cema-recommendations/acid-deposition.

[13] CEMA. (2006). Ozone Management Framework for the Regional Municipality of Wood Buffalo Area. April 2006. Available on line at http://cemaonline.ca/index.php/cema-recommendations/ozone-management.

and *Nitrogen (Eutrophication) Management Work Plan*[14]. Fort McKay representatives have been active in the development of the frameworks. For successful implementation, Fort McKay must understand and have input into management strategies. If trade-offs are to be analyzed, those who live in the area and are most affected by the air emissions, need to understand and provide input into those decisions.

Fort McKay First Nation peoples have been a part of the Lower Athabasca Region for generations. They want to continue their traditions through future generations, long after oil sands are exploited and the land reclaimed. The current residents want to be able to enjoy their Traditional Lands and not have that enjoyment impeded by odours and noise, nor be worried about what impacts the air quality and air emissions are having on their health or on their traditional foods.

2 AN APPROACH TO CUMULATIVE EFFECTS MANAGEMENT: AIR EMISSIONS RELATED EFFECTS

For effective management of the cumulative effects of air emissions on air quality in a region, a comprehensive approach must be taken. Pollution prevention and minimization has to be the first step. Following that, evaluation of the residual air-related impacts means assessment using relevant indicators for Fort McKay. Evaluating the magnitude of effects must consider the change from pre-development, not just the change resulting from one project. Finally, if residual impacts occur within the community or on Traditional Lands beyond what is considered acceptable to Fort McKay, there must be a mechanism to reduce emissions from sources or remediate the impacts. Fort McKay wants to be involved in the development of those plans to ensure that Fort McKay's needs are addressed.

This approach is not new and is part of the current regulatory system. However, elements, in Fort McKay's opinion are not being effectively addressed.

- Prevention and minimization: Employment of best practices and emissions control technology for point and area sources.
- Assessment of effects: For Fort McKay, the assessment should be relevant to meet the community's needs. Uses of relevant indicators, objectives for comparison, application of Fort McKay specific air quality and deposition criteria are important for relevant assessments. Monitoring and reporting of results needs to be comprehensively designed, executed, timely and transparent to allow Fort McKay and other stakeholders to understand and interpret what is happening in the region.
- Management of residual impacts: If, despite best efforts on implementing air emissions controls, impacts occur, plans and actions need to be undertaken to manage or remediate any residual impacts.

Detailed analysis and description or assessment of application of each of the main factors follows.

2.1 Prevention and Minimization: Application of Emission Control Technology and Best Practices:

[14] CEMA. (2008). Proposed Interim Nitrogen (Eutrophication) Management Recommendations and Work Plan for the Regional Municipality of Wood Buffalo Area. NO_xSO_2 Management Working Group Cumulative Environmental Management Association. February 26, 2008. Available on line at http://cemaonline.ca/index.php/cema-recommendations/interim-nitrogen.

Position: All *Environmental Protection and Enhancement Act* (*EPEA*) approvals and renewals must require facilities to employ best available control technologies economically achievable or best practices to control emissions to air. Proponents of new projects should be required to demonstrate that they have evaluated emission control technologies for their chosen design and that the selected emission control technology is the best overall choice. The best overall choice of emission controls should not merely satisfy the minimum requirements of regulations, but should demonstrate excellence in emission controls. For renewals, this means that continuous improvement plans are developed and available to Fort McKay and other stakeholders for review. As equipment is replaced or upgraded, companies must also demonstrate that they are employing emission controls that meet best practice standards.

Fort McKay's *Healing the Earth Strategy*[15] indicates:

For air quality management, the emphasis is on retaining air quality at levels as close to natural levels as possible and ensuring air quality does not adversely impact the health and/or well-being of residents of Fort McKay. There is also a focus on ensuring that best efforts are made to improve emissions management thereby reducing the impact of development on the Community's air quality.

2.1.1 Emissions control as part of Management Frameworks:

In the CEMA management frameworks: *Acid deposition Management Framework*, *Ozone Management Framework,* as well as the *Nitrogen Management Work Plan*, there is an underlying assumption that all projects will be employing best available control technologies or best management practices. Preventing or minimizing emissions is a fundament air quality management principle and is the first line of defence against reaching trigger points at which management actions are required.

Fort McKay, through its involvement in the regional multi-stakeholder group CEMA, has had input into management frameworks to address some of the cumulative impacts from air emissions. However, the fundamental principle upon which these management frameworks were based (employing best available control technologies or best management practices) is not being proposed by all new projects and it is not clear how it is enforced by regulators. This undermines the collaborative approach that was used at these multi-stakeholder tables. The use of best available technology economically achievable (BATEA) or best available demonstrated technology (BADT) and best management practices are fundamental requirements. All of the management frameworks have this as a basis; however, not all projects are specifying or modelling BATEA in their EIAs.

As an example, the CEMA *Acid Deposition Management Framework*[16] states:

The framework is based on the following conceptual acidifying emissions management approaches:

- *reasonable, cost effective measures in the design and operation of projects to minimize acidifying emissions. This will include the evaluation of Best Available Demonstrated Technology (BADT) in new project design, existing project expansions, and equipment replacement.*

[15] FMSA. (2010). Fort McKay Specific Assessment (Supplemental Information for the Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project application). Fort McKay Industry Relations Corporation. March 2010

[16] CEMA. (2004). Acid Deposition Management Framework Recommendation. Approved February 25, 2004. Available on line at http://cemaonline.ca/index.php/cema-recommendations/acid-deposition.

The Clean Air Strategic Alliance (CASA) *PM and Ozone Management Framework*[17] adopted by Environment and Sustainable Resource Development (ESRD) states the following:

The PM and Ozone Management Framework builds on many programs, mechanisms and initiatives that are already helping to manage and/or reduce ambient concentrations of PM and ozone in Alberta. These initiatives are occurring at many different levels: regional, national, provincial and federal and are in addition to the regulatory and administrative toolkit already available to government, such as approvals and environmental assessment.

The framework goes on to state that one of the many existing mechanisms is the *Industrial Release Limits Policy*[18] that *requires that new developments regulated by Alberta Environment use best available economically feasible technology.*

Despite these mechanisms and apparent requirements, emission control technology is often not even specified for all emission sources in applications and EIAs for the Lower Athabasca Region. The evaluation of different technologies, though required by the Terms of Reference, is not demonstrated in the EIAs.

Fort McKay has highlighted these issues in every EIA review where they have encountered the absence of environmental control technology evaluations. A standard request to regulators is that *project proponents are required to justify that their emission controls represent BATEA in order to reduce the potential for air quality exceedences of Fort McKay's air quality criteria and AAAQOs*. Fort McKay also notes in its Statements of Concern that *Fort McKay requests that regulators enforce the application requirements, which includes emissions control technology specification and justification for BATEA: Applications that do not specify emission control technology must be considered incomplete.*

The regulators accept the application as complete without the technology component included. Details of technologies used to control emissions are not always shared with Fort McKay and so the evaluation of BATEA is neither open nor transparent. The fundamental principle of air quality protection and management, minimizing air emissions to the extent reasonably and practically possible, appears to be lacking within the regulatory system. Instead, evaluation of emissions against compliance-based emission limits (the maximum allowable under regulation) is conducted. Exceedances that are predicted through modelling are explained away by proponents as being a result of uncertainties in modelling or that the emissions used in the model are higher than they will actually be. The actual or expected case is not modeled for comparison and no commitment is made as to how proponents intend to achieve those "actual emissions".

2.1.2 Environmental Impact Assessments:

Fort McKay would expect that proponents assess and justify how they plan to mitigate their emissions through the application of best available technology economically achievable (BATEA). Assessments must demonstrate that they have considered emission control technology and include the analysis of the options. The final choice of emissions controls for all sources of emissions to the atmosphere should be clearly outlined with justification for the chosen option included.

[17] Clean Air Strategic Alliance. (2003). PM and Ozone Management Framework. CASA, September 18, 2003, Edmonton, Canada. Available on line http://casahome.org.

[18] Alberta Environment (now Environment and Sustainable Resource Development). (2000). Industrial Release Limits Policy. November 2000. Edmonton, Canada. Available on line at http://environment.gov.ab.ca/info/library/6970.pdf.

In many cases, there are only general commitments to meet the minimum requirements of the applicable standards or regulations. When proponents or operators state that they will meet the minimum requirements, stakeholders, including Fort McKay, and regulators cannot be assured that technology options for emission minimization have been considered. Meeting the minimum requirements does not constitute implementation of best practices or best available technology.

If proponents are not required to fulfill conditions for applications, the regulatory system cannot facilitate managing or minimizing cumulative effects from air emissions. This lack of information regarding emission control technology not only undermines the current system, but also impedes the regulatory process. This deficiency has been recognized by ERSD as stated in the draft Provincial Policy Complete Industrial Applications under the *Environmental Protection and Enhancement Act*[19]. The need for this draft policy is stated as:

"Historically, applications have been promoted to the status of Administratively Complete for the purposes of public review, but may have significant outstanding technical deficiencies."

2.1.3 Regulatory Requirements for BATEA:

Within the Alberta regulatory system, there are policies that require projects to specify BATEA or best control technology. These are referenced by Fort McKay during its reviews of air related effects. Some of the applicable policies and regulatory mechanisms are listed. Fort McKay's interpretation of the regulatory tools is also included.

Industrial Release Limits Policy[20]

Some statements from this policy include:

"This policy document details Alberta Environment's approach to setting industrial release limits. The key principles of the policy are based on pollution prevention, continuous improvement, application of the most effective demonstrated pollution control technology, and the use of science based ambient environmental quality guidelines to ensure release limits protect the environment and human health."

"Industrial release limits will be established based on limits achievable using the most effective demonstrated pollution prevention/control technologies or the limits required to meet risk based and scientifically defensible ambient environmental quality guidelines, whichever are the more stringent."

"This system was designed to ensure that air emissions are minimized through the use of demonstrated technology and that residual emissions are dispersed so that guideline values are not exceeded. Guideline values are used in setting release limits for industrial facilities."

To Fort McKay, this means that emission sources should be employing the best available control technology available at the time a project is being proposed. While economic considerations are a factor in the choice of emissions controls, they should not dominate the choice of technology. Adopting new technologies for emission controls should be encouraged through the regulatory system. Oil sands companies are investing in research and

[19] ESRD. (2012). Provincial Policy Complete Industrial Applications Under the Environmental Protection and Enhancement Act. Draft Version 07. March 29, 2012. Edmonton, Canada. Available on line at http://environment.gov.ab.ca/info/library/8582.pdf. Last visited September 18, 2012.

[20] ESRD (formerly AENV). (2000). Industrial Release Limits Policy. November 2000. Edmonton, Canada. Available on line at http://environment.gov.ab.ca/info/library/6970.pdf.

development, yet are reluctant to step out to try new technology to reduce emissions. The general commitment to implement current industry practices does not mean that innovative approaches are being considered. To ensure that the long term impacts to air quality for Fort McKay are minimized, the best technology that can be applied, should be applied.

Reasonable and current industry practice may not reflect best practices for emission control technology. While companies commit to comply with guidelines and standards, these standards do not always keep up with technological improvements to control and minimize emissions.

Interim Emissions Guidelines for Oxides of Nitrogen (NO_x) for New Boilers, Heaters and Turbines using Gaseous Fuels for Oil Sands Region in the Rural Municipality of Wood Buffalo North of Fort McMurray based on a review of Best Available Technology Economically Achievable (BATEA) [21] (Interim Guidelines)

The recent Royal Society report on oil sands[22] referred to an Alberta Research Council (ARC) report[23] on BATEA for boilers and co-generation units and recommended that ESRD require the application of best available control technologies for NOx emission management in the region. The BATEA limits referred to in the ARC report are more stringent than current Canadian Council of Ministers of the Environment (CCME) Guidelines[24].

Fort McKay, along with Alberta Environment and industry representatives, participated in the development of the *Interim Guidelines*. The guideline states:

"*A review of information on the NOx emission control BATEA (Best Available Technology Economically Achievable) for stationary sources determined that the previous NOx emission requirements appear to be dated in comparison to what may now be achievable*."

The *Interim Guidelines* define both compliance limits and performance targets. Compliance limits are to be used as a regulatory tool, but:

***"Performance Target** – represents the approximate level of NOx emissions achievable by using the best available NOx control combustion technology economically achievable and operated under normal conditions and averaged over a year."*

And

"The design, selection and operation of equipment are to be based on meeting the performance target."

[21] ESRD (formerly AENV). (2007). Interim Emission Guidelines for Oxides of Nitrogen (NOX) for New Boilers, Heaters and Turbines using Gaseous Fuels Based on a Review of Best Available Technology Economically Achievable (BATEA) Interim Guideline. Final Draft September 2007.

[22] Royal Society of Canada Expert Panel. (2010). Environmental and Health Impacts of Canada's Oil Sands Industry- Report. December 2010 < http://www.rsc.ca/documents/expert/RSC%20report%20complete%20secured%209Mb.pdf>

[23] Chambers, A and Trottier, S. (2007). *Technologies for Reducing NOx Emissions from Gas-Fired Stationary Combustion Sources.* Prepared by Alberta Research Council for Alberta Environment. February 2007

[24] CCME.(1998). *National Emission Guideline for Commercial/Industrial Boilers and Heaters*. Canadian Council of Ministers of the Environment. Winnipeg, Canada. http://www.ccme.ca/assets/pdf/pn_1286_e.pdf

Despite these definitions, not all companies are committing to achieving the performance targets outlined in the application. The performance targets are supposed to represent BATEA as of the date that the *Interim Guidelines* were developed. Meeting the compliance limits, only, does not represent BATEA for these types of equipment.

It is Fort McKay's expectation that companies meet the intent of the *Interim Guidelines* and achieve the performance targets. If, for unforeseen circumstances, companies are not able to achieve the performance targets, they should be required to report on the causes and what is going to be done to minimize the emissions.

In support of the application of BATEA for NO_x management, it is noted that the recent Royal Society Report on oil sands recommended that ESRD require the application of best available control technologies for NO_x emission management in the oil sands industry.[25] In a response to the Royal Society Report the Government of Alberta[26] indicated that:

"*Within the oil sands region North of Fort McMurray, more stringent requirements on emissions of oxides of nitrogen are being implemented for new equipment. These are the most stringent in the province*."

It is Fort McKay's expectation that projects build to the intent of the *Interim Guidelines*, which means **performance target** emission rates are the expected "normal" operating mode. This will mean that the actual NO_x emissions from the stationary equipment will be much lower than the compliance limits (up to 70% lower). Most proponents model the compliance limits for NOx from boilers, heaters, gas turbines and heat recovery steam generators. While modelling for a worst case scenario is acceptable to design equipment and specify stack heights, it should not be considered acceptable for facilities to only commit to achieving compliance limits.

When exceedances of air quality objectives are predicted through modelling, proponents often state that the worst case scenario for emission rates was modelled and that the actual emission rates are anticipated to be less. If this is the case, proponents should be required to not only model the worst case scenario, but also an emission scenario that approximates expected emission rates from the facility. There will continue to be uncertainties in modelling as models are approximations based on assumption and inputs. However, the exercise of modelling the difference between the "worst case" and expected "normal" or representative emissions from the project would help proponents and stakeholders understand how important the emission rates are in the resultant air quality surrounding facilities and on a regional level.

2.1.4 Recent Developments in Regulation and Policy:

The regulatory tools outlined in the previous section have been in place in Alberta for years, so it is expected that companies should be held to the requirements of these regulatory tools. The regulatory system is evolving, however, and new tools are coming into effect. Fort McKay sees some benefits to some of the new regulatory tools as described below.

Interim Guide to Content for Industrial Approval Applications: New, Renewal and Amendment[27]

---

[25] Royal Society of Canada Expert Panel. 2010. Environmental and Health Impacts of Canada's Oil Sands Industry- Report. December 2010 <http://www.rsc.ca/documents/expert/RSC%20report%20complete%20secured%209Mb.pdf>

[26] Government of Alberta. 2010. Alberta's Oil Sands: Provincial Action. Dec. 17, 2010 < http://environment.alberta.ca/documents/Oilsands_provincial_action_December17_2010.pdf>

[27] ESRD (formerly AEW). (2012). *Interim Guide to Content for Industrial Approval Applications: New, Renewal and Amendment. Edmonton, Canada. April 1, 2012.* http://environment.gov.ab.ca/info/library/8581.pdf

Alberta Environment and Sustainable Resource Development (ESRD) issued the *Interim Guide to Content* where it has revised some requirements for technology selection and minimization. The *Interim Guide to Content* states that ESRD sees the need for *procedural or methods policies or legislation (such as the Air Quality Model Guideline or the Guidance for Assessing Best Available Technology Economically Achievable (BATEA) and Developing Technology-based Standards)* with respect to emission controls. The Interim Guide to Content is planned to be finalized in January 2013.

Specific to air emissions control, the *Interim Guide to Content* states applicants must:

Describe the application of process technology, environmental control systems, and management practices that will be used to minimize substance release to the environment, and include:

- *alternative processes and technologies for the release of substances that have been evaluated, and a rationale for their exclusion*, as well as other requirements.

This requirement is similar to Terms of Reference conditions that require proponents to discuss the technologies and criteria for selection of control technologies. Clearly, the regulators want proponents to provide this information in their applications. This is in line with the requests from Fort McKay. Unless the *Interim Guide to Content* requirements are enforced, ensuring and demonstrating effective air emissions minimization will not occur.

Policy **Continual Improvement Plans submitted in Industrial Approval Applications under the *Environmental Protection and Enhancement Act (EPEA) DRAFT*[28]**

This draft policy includes a requirement that both new applications and applications for renewal of an existing approval must submit a continual improvement plan to have the application considered complete. The regulators recognize that continuous improvement is foundational to effective environmental management. The intent of the policy is stated as:

- *Reinforce that continuous improvement is the responsibility of applicants and approval holders, and is a key principle under the Environmental Protection and Enhancement Act;*
- *Specify that the inclusion of a Continual Improvement Plan is a requirement for an application to be accepted as a Complete Application, and that processing of an incomplete application will be refused.*

In addition, the policy goes on to say: *The Continual Improvement Plan should capture any improvements made above benchmark requirements, use of Best Available Technologies and use of new and innovative technologies.*

Recent EIAs reviewed by Fort McKay have not included a Continual Improvement Plan as outlined in the policy. These project applications were started prior to the January 2012 posting of the draft policy. Continuous improvement, though, is considered a best practice by Fort McKay and should be a key part of all applications.

These new developments, along with the draft policy for complete applications[29], are encouraging. Fort McKay recognizes that both policies are subject to change as they are not yet finalized. Fort McKay encourages regulators

[28] ESRD (formerly AEW). (2012) *Policy* Continual Improvement Plans submitted in Industrial Approval Applications under the *Environmental Protection and Enhancement Act (EPEA) DRAFT*. Edmonton, Canada. January 3, 2012. http://environment.gov.ab.ca/info/library/8583.pdf.

[29] ESRD. (2012). Provincial Policy Complete Industrial Applications Under the Environmental Protection and Enhancement Act. Draft Version 07. March 29, 2012. Edmonton, Canada. http://environment.gov.ab.ca/info/library/8582.pdf.

and government to commit to and enforce these requirements to assist with the minimization of cumulative effects as a result of emissions to air. Transparency in applications and enforcement are essential for Fort McKay understand whether pollution minimization is occurring.

Lower Athabasca Regional Plan: Air Quality Management Framework for NO_2 and SO_2[30]

Approved on August 22, 2012, the Lower Athabasca Regional Plan includes management frameworks for cumulative effects. Within the Air Quality Management Framework, ERSD states that the framework manages air quality by *affirming the provincial environmental principles of:*

- *pollution prevention through employment of best available technology economically achievable*
- *emission minimization through best management and control practices, and*
- *continuous improvement and keeping clean areas clean*.

This reinforces the principles of environmental control. Yet, these principles have been lacking in recent applications and EIAs for projects in the Lower Athabasca Region. Fort McKay believes that minimization and pollution prevention are fundamental to managing cumulative effects related to air emissions. This first defense must be a priority for all projects.

2.1.5 Emission Control Regulations – Mine Fleets

In the recent Teck EIA[31], the NOx emissions expected from the mine fleet were anticipated to be about half of the NOx emissions from the total project. On a regional level, the mine fleets were estimates to contribute 30 to 40% of the NOx emissions. While the proportion may change as a result of more in-situ operations, NOx emissions from diesel fuelled heavy haulers will remain a significant source within the oil sands region.

Currently, mine fleets are comprised of Tier 0, 1 and some Tier 2 engines for >750hp trucks. Operators are required to purchase heavy hauler vehicles that are compliant with Tier 4 standards starting in 2015. Tier 2 engines have 63% lower $PM_{2.5}$ exhaust standard compared to Tier 1 trucks. The highest level currently in the US EPA standards[32] and now regulated in Canada[33], Tier 4, is required to be will have 64% and 92% lower NOx and $PM_{2.5}$ than Tier 1, respectively (see Table 1).

Transitioning from the engines with higher emission standards to lower emission standards is one emission reduction scenario that has been modelled by proponents in the region (Teck, 2011). While the improved emission controls for NOx and $PM_{2.5}$ are cited as a way that emissions, and subsequently NO_2 levels, in the region will be maintained at lower levels, there is currently no plan in place to achieve that objective. Companies state that through capital stock turnover, vehicles will be upgraded to the lower emitting standards. This has yet to be seen

[30] Government of Alberta. (2012). Lower Athabasca Region - Air Quality Management Framework for Nitrogen Dioxide (NO_2) and Sulphur Dioxide (SO_2). Edmonton, Canada. August 22, 2012. http://environment.alberta.ca/documents/LARP_Framework_AirQuality_FINAL.pdf.

[31] Teck. (2011). Frontier Oil Sands Mine Project Integrated Application. November 2011. Calgary, Canada.

[32] US EPA. (2012). Nonroad Compression-Ignition Engines -- Exhaust Emission Standards. US Environmental Protection Agency. http://www.epa.gov/otaq/standards/nonroad/nonroadci.htm. Last visited September 20, 2012.

[33] Government of Canada. (2012). *Regulations Amending the Off-Road Compression-Ignition Engine Emission Regulations* (SOR/2011-261). Canadian Environmental Protection Act. Environment Canada. http://ec.gc.ca/lcpe-cepa/eng/Regulations/DetailReg.cfm?intReg=201. Last visited September 20, 2012.

in practice. If suppliers are not able to produce the vehicles, or emission profiles are not achieved, increased levels of NOx are expected. In addition, there are no regulations, incentives or penalties being implemented by regulators to achieve more aggressive vehicle turnover to the lower emitting standards.

Table 1: Summary of US EPA Emission Standards for Compression-Ignition Engines

Tier of Vehicle >560kW	NOx (g/kW.hr)	$PM_{2.5}$(g/kW.hr)
Tier 1 (2000-2005)	9.2	0.54
Tier 2 (2006-2010)	6.4 (NOx + non methane hydrocarbons)	0.20
Tier 4i (2011-2014)	3.5	0.10
Tier 4 (2015 and beyond)	3.5	0.04

EPEA approvals require that operators purchase the latest Tier of engine in accordance with CEPA regulations. CEPA regulations are aligned with the US EPA heavy hauler engine requirements. The largest engines, those >750hp, are most frequently used by mining companies and make up the largest proportion of NOx emissions from the mine fleets. In setting NO_x limits for >750 hp mobile units the USEPA noted[34] that:

> "*We note that the magnitude of NO_X reductions determined in the final rule analysis is somewhat less than what was reported in the proposal's preamble and RIA, especially in the later years when the fleet has mostly turned over to Tier 4 designs. The greater part of this is due to the fact that we have deferred setting a long-term NO_X standard for mobile machinery over 750 horsepower to a later action. When this future action is completed, we would expect roughly equivalent reductions between the proposal and the overall final program, though there are some other effects reflected in the differing NOX reductions as well, due to updated modeling assumptions and the adjusted NO_X standards levels for engines over 750 horsepower.*"

The USEPA also noted that:

> "*The long-term NO_X standard for engines not used in generator sets (mobile machinery) will be addressed in a future action (we are currently considering such an action in the 2007 time frame).*"

This action has not occurred with the result that less stringent NO_x emissions are being applied to NO_x emissions from heavy haulers.

Individual companies indicate that they do not have the market influence to get manufacturers to produce customized vehicles. Fort McKay does not accept this argument and believes that working collectively with heavy hauler manufacturers mining companies could get lower NO_x emitting vehicles.

Another option that Fort McKay has proposed is to apply retrofit NO_x emission controls on purchased and existing heavy hauler units. In this regard Environment Canada [35] had a study conducted looking at retrofit possibilities for heavy haulers. The following is an excerpt from that report:

---

[34] USEPA. (2004). Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel. Federal Register / Vol. 69, No. 124 / Tuesday, June 29, 2004 / Rules and Regulations. http://www.gpo.gov/fdsys/pkg/FR-2004-06-29/pdf/04-11293.pdf

[35] Environment Canada. (2008). *Evaluation Of Vehicle Emissions Reduction Options For The Oil Sands Mining Fleet*. Prepared by M. J. Bradley and Associated. March 2008.

"*The authors could not uncover evidence of prior retrofit activity on large mining trucks, but many of these technologies, in particular SCR in combination with a DOC or DPF, have previously been applied to many diesel engines greater than 2,000 hp used for stationary power generation, and to power marine vessels and locomotives. Virtually all of these technologies are considered technically viable for application to large mining trucks. In addition, at least one engine manufacturer is already conducting validation tests of new, cleaner replacement engines installed in older mining trucks used in Alberta.*

The application of these technologies to large mining trucks could provide significant and cost effective reductions of both NOx and PM from the oil sands mining truck fleet. The authors investigated two retrofit/upgrade scenarios that can reduce NOx emissions by 40% or more compared to projected 2015 baseline levels. Under these scenarios total NOx emissions from the mining truck fleet could be reduced by 40,000 – 65,000 tonnes and total PM emissions could be reduced by 700 – 2,500 tonnes over a 12 year period from 2012 to 2024, compared to projected baseline emissions. The net present value of total costs over the same time period (capital and on-going operating costs) for these scenarios ranged from $113 million to $181 million. The average cost of emissions reductions achieved by these scenarios ranged from $1,600 - $3,400/tonne for NOx and $9,400 - $30,000/tonne for PM."

Fort McKay acknowledges that some testing and evaluation would be required to determine the practicality of retrofit NO_x controls but no companies have indicated willingness to test and evaluate such technologies.

Testing of existing vehicles has been conducted on select heavy haulers as part of the Wood Buffalo Environmental Association (WBEA) Terrestrial Environmental Effects Monitoring program[36]. Despite that testing occurring in 2008 and 2010, the data is not yet publicly available and so cannot be used to determine whether the emission estimates input for modeling are under or over estimated.

Fort McKay expects the use of best available technology economically achievable (BATEA) for emissions control for all emission sources, whether they be continuous or intermittent. Since the mine fleets represent such a significant and growing source of $PM_{2.5}$ and NOx emissions for the region, use of the most recent standards is an expectation. Proponents and regulators must continue to investigate options to reduce the mine fleet emissions beyond the minimum standards and demonstrate that the emission reductions are being achieved.

3 ASSESSMENT OF IMPACTS:

Position: For Fort McKay, the assessment of predicted impacts should be relevant in terms of meeting the community's information needs. To be meaningful to Fort McKay, assessments must use relevant indicators and criteria against which to compare predicted air quality and air related impacts. Fort McKay has developed its own Air Quality Law that defines acceptable ambient air quality for its reserves and includes specific criteria and objectives. A system for monitoring, evaluating and reporting of ambient air quality needs to be comprehensively designed, executed, timely and transparent to allow Fort McKay and other stakeholders to understand and interpret what is happening in the region. To ensure the system meets the needs of those who live in the region and are most affected, Fort McKay needs to be engaged in the development of such a system as well as its implementation.

[36] WBEA website (TEEM Program). 2012. Terrestrial Monitoring // TEEM Programs // Source Characterization. http://wbea.org/terrestrial-monitoring/teem-programs/source-characterization. Last visited September 20, 2012.

3.1 The AAAQOs and their Application

Alberta ESRD website states regarding the Alberta Ambient Air Quality Objectives (AAAQOs)[37]: *These objectives are intended to provide protection of the environment and human health to an extent technically and economically feasible, as well as socially and politically acceptable*. To Fort McKay, this is interpreted to mean that the AAAAOs are not considered fully protective of the environment and human health, but are intended to be used as regulatory tool to assess compliance. Fort McKay residents want their health and environment protected and therefore do not accept the AAAQOs as the proper tool for assessing the predicted or actual impacts to their Community or Traditional Lands.

The AAAQOs are not considered to be pollute up to levels and the ERSD website[46] includes the statement that *Alberta Environment ensures that emissions from human activities will be minimized and that air quality continues to be better than the Ambient Air Quality Objectives*.

In EIAs proponents commonly assess impacts to air quality by comparing predicted ambient air quality from modeling to the AAAQOs. In some cases, the current or pre-development concentrations of substances in ambient air are quite low. Some companies take the position that going from the very low ambient concentrations to AAAQO is acceptable. Fort McKay believes that this does not represent the concepts of good environmental management or keeping clean areas clean.

The AAAQOs were intended to be used as a regulatory tool. Going from very low ambient air concentrations to being just in compliance should not be considered an acceptable impact to air quality. ESRD documentation states that objectives are to be used to[38]:

- *to determine adequacy of facility design*
- *to establish stack heights and other release conditions*
- *to assess compliance and assess facility performance*.

If the AAAQOs are to be used as design, regulatory and compliance tools, then they were not intended to be used to assess the impacts to the environment or to human health. They are clearly meant as a tool to enable facilities to ensure that their air emission design and release controls and conditions, under probable operating and meteorological scenarios, are able to maintain a balance between health and environmental protection and design conditions for stacks and release rates.

Fort McKay also notes that ESRD (2011)[39] indicates that:

As the ambient air quality objectives are in many cases not entirely protective of human health and the environment, efforts are made to improve air quality in order to stay well below ambient air quality objectives and if the circumstances warrant, to lower the ambient air quality objectives over time.

ESRD documentation regarding PM and ozone management states[40]:

---

[37] ESRD. (2012). Ambient Air Quality Objectives. Available on line at http://environment.alberta.ca/0994.html, last visited September 20, 2012.

[38] ESRD (formerly Alberta Environment). (2011). Alberta Ambient Air Quality Objectives and Guidelines Summary. Edmonton, Alberta. April 2011. Last visited September 22, 2012.

[39] ESRD. (2011). Using Ambient Air Quality Objectives in Industrial Dispersion Modelling and Individual Industrial Site Monitoring. Alberta Environment and Sustainable Resource Development. http://environment.alberta.ca/0952.html (last visited September 5, 2012)

[40] ESRD (formerly AENV). (2009). Particulate Matter and Ozone Management Fact Sheet. Edmonton, Canada. May 2009. Available on line at http://environment.alberta.ca/documents/Particulate_Matter_and_Ozone_Management_Fact_Sheet.pdf. Last visited September 18, 2012.

keeping with the principles of keeping clean areas clean, pollution prevention and continuous improvement, the Canada-wide Standard levels are not "pollute up to" levels. This is the reason that more stringent action levels have been established through the CASA Framework. These action levels allow stakeholders to develop management plans containing preventive measures aimed at avoiding future exceedances of Canada-wide Standard levels.

Air quality modelling in recent EIAs, such as Teck Frontier Mine Project (2011), predicts exceedences of AAAQOs and CWSs for certain air quality parameters (NO_2 and $PM_{2.5}$). AAAQOs are not fully protective of health or the environment and the CCME in 2007[41] developed a document entitled: *Guidance Document on Continuous Improvement (Ci) and Keeping-Clean-Areas-Clean (KCAC) - Canada-wide Standards for Particulate Matter and Ozone*. This document indicates that:

PM and ozone negatively affect human health and the environment

- *there is no apparent lower threshold for the effects on human health, and*
- *there are additional benefits to reducing and maintaining ambient levels below the standards*

and

The overall objective of the CWSs is to reduce the adverse health and environmental effects of PM and ozone. Therefore, allowing PM and ozone ambient levels to increase up to the current numerical CWS targets is counterproductive, and unacceptable in light of the absence of any apparent lower threshold for adverse effects and the knowledge that the numerical CWS targets may not be fully protective. Proponents of development should not regard the current CWS numerical targets as a permissive maximum. The clear intent of CI/KCAC is to ensure air quality is not significantly degraded and to improve air quality whenever feasible.

and

The broad vision for the CI/KCAC provisions of the CWSs for PM and ozone is: To ensure that, in the vast areas of Canada with air quality better than the CWS numerical targets for PM and ozone, air quality is not significantly degraded and is maintained or improved to the extent practicable, to minimize risk to human health and the environment for the benefit of future generations.

This information on ambient $PM_{2.5}$ and ozone standards and management of air quality related to these parameters is relevant to the oil sands because $PM_{2.5}$ and ozone levels are affected by the following emissions:

- direct $PM_{2.5}$ emissions,
- emissions the $PM_{2.5}$ and ozone precursor pollutants NOx and VOCs, and
- $PM_{2.5}$ precursor pollutants SO_2 and NH_3.

These types of air emissions constitute a large portion of the emissions from current and planned oil sands projects. As such the CI/KCAC principles apply to the project which dictates that all reasonable measures be taken to minimize the further degradation of regional air quality.

The Alberta Ambient Air Quality Objective for SO_2 has been exceeded at some of the stations located within the Lower Athabasca Region, including an instance in the community of Fort McKay. To be compliant with the regulatory requirements, no exceedances of the AAAQOs are acceptable.

[41] CCME. 2007. Guidance Document on Continuous Improvement (Ci) and Keeping-Clean-Areas-Clean (KCAC) - Canada-wide Standards for Particulate Matter and Ozone. PN 1389. Canadian Council of Ministers of the Environment. http://www.ccme.ca/assets/pdf/1389_ci_kcac_e.pdf (last visited July 5, 2012)

It is Fort McKay's position that the AAAQOs and CWSs are not to be used as pollute up to levels and that the goal is stay as far below these levels as possible. Yet, they continue to be used as benchmarks of good air quality and as acceptable "pollute up to" levels. In 2011, ESRD changed its SO_2 and NO_2 limits[42]. While the recent changes in the AAAQOs are viewed by Fort McKay as a positive step, the new limits are still not fully representative of good or safe air quality.

Factors such as technical feasibility, economics and social and political acceptability are irrelevant in assessing the impacts of a proposed project's air related emissions on the environment or human health. These are factors that need to be considered after the full impacts of a proposed project on health and the environment have been made and when mitigation options and project acceptability options are subsequently evaluated. To assess the potential impacts of projects on air quality, and related health and environmental effects, criteria that allow such effects to be identified need to be used.

It is for these reasons that Fort McKay developed its own air quality related "health" and "keeping clean areas clean" air quality criteria. This approach is consistent with the above noted CCME (2007)[43] document on continuous improvement and keeping clean areas clean.

3.1.1 Fort McKay proposed Air Quality Law: Air quality assessment and management

Fort McKay has its own air quality law to be used within the community and on reserve and traditional lands. The Air Quality Law was developed to address Fort McKay's key concerns regarding air quality and odours within the community. Fort McKay expects that all projects proposing development on their traditional lands or that may have an impact on the air quality in the Community of Fort McKay to use the criteria and objectives outlined in the law to evaluate and assess potential impacts. This practice has already been used by one recent EIA, Teck Frontier Project[44]. Fort McKay appreciates Teck's cooperation in providing community relevant potential air quality impacts assessment information. It is important to note that Teck also conducted a pre-development model so that Fort McKay and other stakeholder could assess the predicted impacts from the Teck, and other projects by comparing them to estimated pre-development air quality.

Purpose:

The purpose of Fort McKay's Air Quality Law is to ensure that the air quality on Fort McKay's reserve and traditional lands and well as within the community is protected:

"The air smells fresh and contributes to the health of the land and animals and to the health and well-being of the people of Fort McKay".

The Air Quality Law was developed to set standards for air quality that protect human and environmental health for air pollutants on Fort McKay Reserve Lands. The law will enable Fort McKay to convey to the Governments of

[42] ESRD (formerly AENV). (2011). Alberta Ambient Air Quality Objectives and Guidelines. Alberta Environment. June 15, 2011. http://environment.gov.ab.ca/info/library/5726.pdf (last visited January 11, 2012)

[43] CCME. 2007. Guidance Document on Continuous Improvement (Ci) and Keeping-Clean-Areas-Clean (KCAC) - Canada-wide Standards for Particulate Matter and Ozone. PN 1389. Canadian Council of Ministers of the Environment. http://www.ccme.ca/assets/pdf/1389_ci_kcac_e.pdf (last visited July 5, 2012)

[44] Teck. (2011). Frontier Oil Sands Mine Project Integrated Application. November 2011. Calgary, Canada.

Canada and Alberta Fort McKay's requirements for clean and healthy air, air quality monitoring and pollution control from industrial and other sources.

Technical Basis of Air Quality Law:

The air quality criteria or objectives within the law were based upon an analysis of standards and objectives that are protective or precautionary. The air quality criteria are intended to provide protection for human health, plants and animals on reserve lands and within the community. A key concern for Fort McKay regarding air quality is the prevalence of odours. The air quality criteria are intended to help reduce odours within the community.

A complete list of the air quality criteria is included as an attachment (Schedule A). Air quality criteria sources are cited in Schedule A and include the World Health Organization, European Union, CCME and Alberta regulations (references listed in Schedule A attached). Some professional judgement was exercised in setting air quality criteria, especially to protect against nuisance odours.

Implementing the Air Quality Law:

To implement the law, the Fort McKay Sustainability Department will have responsibilities to report on air quality changes with respect to concentrations of air pollutants listed in Schedule A of the law and report any exceedances. Fort McKay will request Alberta and Canada to develop air quality and air emission management plans in conjunction with Fort McKay to ensure the air quality remains within the limits outlined in the air quality law.

3.2 Evaluation of Impacts: Magnitude

The Canadian Environmental Assessment Agency's reference guide *Determining Whether A Project is likely to Cause Significant Adverse Effects*[45] includes these factors for evaluating impacts: magnitude of the impacts, the direction (positive or negative), duration and whether the impact is reversible or irreversible. While these characteristics are useful in understanding cumulative effects, it is important that they be used appropriately.

In some recent EIAs, proponents have compared the predicted ambient air quality from modelling to the ambient air quality objectives. One concern, already stated above, with this approach is that the AAAQOs were supposed to be used as an equipment and stack design tool for dispersion modeling inputs as well as used as a regulatory tool. As discussed in Section 3.1, the AAAQOs are not completely protective of human health, so are not applicable as an assessment tool for human and ecosystem health effects.

To define the magnitude of impacts, there are a range of techniques. Fort McKay would like to see standard definitions of "low", "moderate" and "high" magnitude of impacts. The definitions should consider the concept of keeping clean areas clean and compare the change in air quality with existing and pre-development air quality. It is not appropriate to compare to regulatory limits for defining the magnitude of a change.

Fort McKay's proposed definitions of cumulative magnitude on reserve and traditional lands:

- Low – less than 5% increase in ambient concentration compared to predevelopment
- Moderate – greater than 5%, but less than 10% increase in ambient concentrations compared to predevelopment

[45] Federal Environmental Assessment Review Office. (1994). *Determining Whether A Project is likely to Cause Significant Adverse Effect: A Reference Guide for the* Canadian Environmental Assessment Agency. http://www.ceaa-acee.gc.ca/D213D286-2512-47F4-B9C3-08B5C01E5005/Determining_Whether_a_Project_is_Likely_to_Cause_Significant_Adverse_Environmental_Effects.pdf

- High – greater than 10% increase in ambient concentrations compared to predevelopment or exceedances of air quality criteria, including those outlined in Fort McKay's Air Quality Law.

To determine the magnitude of impact on air quality, proponents should compare the project's impact to pre-development and to the existing emissions case to get a true sense of the project's contributions. Often, the base case (existing and approved) is used for comparison, but the base case is a future potential case. By comparing the project's impact to air quality against a future case does not give an indication of changes that are anticipated due to the project from the actual existing case, or the absolute change that will occur in air quality.

To be meaningful to those who are most impacted; those who live in the area surrounded by development should be able to provide input into how the magnitude and other criteria regarding impacts are defined. Project assessments and applications need to be meaningful so that stakeholders understand how the impacts of air emissions due to development will affect their lives.

3.3 Measuring the Impact: Monitoring, Evaluation and Reporting

There are two main elements of monitoring evaluation and reporting of air emissions. These elements include monitoring, evaluating and reporting on the effects (such as air quality), but also monitoring and reporting on emissions from the sources.

Ambient air quality concentrations for some pollutants are available from several continuous monitoring locations throughout the Lower Athabasca Region through the CASA Data Warehouse[46]. Near real time, raw data is available through the local airsheds before quality control and assurance is conducted. This does provide data for the locations of the continuous air monitoring stations. Other data, such as passive monitoring and effects monitoring are not as readily available. Some ambient air monitoring and air-related effects monitoring are conducted through the Wood Buffalo Environmental Association (WBEA) of which Fort McKay is a member. While the WBEA program is advertised as an independent, multi-stakeholder organization, Fort McKay First Nations and Metis are currently the only Aboriginal representatives within the association[47]. The association is dominated by industrial members. This limits meaningful input that Fort McKay can provide into the design of the air monitoring programs to meet the needs of the Community.

Environmental monitoring within the oil sands has received a lot of attention in the past few years. The Government of Alberta formed an Alberta Environmental Monitoring Panel (AEMP)[48] to review the current state of monitoring in the Lower Athabasca Region and make recommendations.

As part of the AEMP report A World Class Environmental Monitoring, Evaluation and Reporting System for Alberta[49], the panel included a summary of feedback and input they received as part of their process. One of the components they noted, among several, was the need for the monitoring system in the oil sands region to be relevant. In particular, the panel included in their report:

Relevance: *Information provided by the environmental monitoring, evaluation and reporting system must meet the needs of stakeholders.*

[46] Clean Air Strategic Alliance. (2006). CASA Data Warehouse. Available on line at http://www.casadata.org/. Last visited September 21, 2012.

[47] Wood Buffalo Environmental Association. (2012). About WBEA: Members. Available on line at http://www.wbea.org/about-wbea/members. Last visited September 21, 2012.

[48] ESRD. (2012). Alberta Environmental Monitoring Panel. http://environment.alberta.ca/03289.html. Last visited September 21, 2012.

[49] Alberta Environmental Monitoring Panel. (2011). *A World Class Environmental Monitoring, Evaluation and Reporting System for Alberta.* June 2011. http://environment.gov.ab.ca/info/library/8381.pdf. Last visited September 21, 2012.

For Fort McKay, being able to understand the impacts to their air quality and how it relates to their health and quality of life is relevant to the Community members. Impacts to air quality, including odours and impaired visibility, would be more meaningful if Fort McKay had input some of what was monitored and how the monitoring occurred. The Panel acknowledged this by including:

Since aboriginal peoples obtain their food, air and water from their land, and do not consider moving to be a viable option, they are particularly vulnerable to environmental degradation, and thus depend acutely on their accumulated knowledge and the systems through which they track changes in their environment.

The Panel went further to relate what they heard from their consultations with Fort McKay and other First Nations and Metis in the oil sands region.

The Panel's engagement sessions with the Fort McKay, Mikisew Cree, and Athabasca Chipewyan First Nations and with Métis representatives uniformly revealed their keen desire to be empowered to participate actively in environmental monitoring activities on their own terms. All groups held a deep respect for some western scientists with whom they have interacted over time. Based in part on this relationship, they are willing to engage in collaborative research projects that use western science techniques alongside TEK techniques to monitor and evaluate the health of fish, game, berries, air, land and water.

Collaboration and partnerships have yet to occur with the provincial government. The Panel's recommendations were issued in June 2011. A follow up report[50] was requested to examine how funding and governance could be managed effectively to ensure sustainable operation of the monitoring system. Fort McKay and other stakeholders have yet to hear what the follow up recommendations were and how they will be engaged in monitoring, evaluation and reporting.

In the meantime, the development of the monitoring, evaluation and reporting system for environmental monitoring has progressed in concept. The federal and provincial governments have worked together to develop the *Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring*[51]. Fort McKay wants to be part of the implementation of monitoring, including having a role in governance of the system. The plan includes the statement that:

Early in the process, the two governments will engage with industry, independent scientists, Aboriginal Peoples, and other stakeholders on the content of the Implementation Plan and on the appropriate mechanisms to incorporate the advice of industry, independent scientists, Aboriginal Peoples, and other stakeholders on an ongoing basis.

In addition, the provincial government has acknowledged the role First Nations can play in the Lower Athabasca Regional Plan[52] where it states:

---

[50] ERSD. (2012). Environmental Monitoring in Alberta. http://environment.alberta.ca/03379.html. Last visited September 22, 2012.

[51] Government of Canada. (2012).Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring. Minister of the Environment. February 3, 2012. Available on line http://environment.alberta.ca/documents/Joint_Canada-Alberta_Implementation_Plan_for_Oil_Sands_Monitoring.pdf. Last visited September 22, 2012.

[52] Government of Alberta.(2012). Lower Athabasca Regional Plan 2012-2022. Approved August 22, 2012. ISBN No. 978-1-4601-0538-2 (OnlineVersion), Available at https://www.landuse.alberta.ca/Documents/LARP%20Lower%20Athabasca%20Regional%20Plan%202012-2022%20-%20Approved%20-%202012-08.pdf.

Alberta recognizes that those First Nations and Métis communities that hold constitutionally protected rights are uniquely positioned to inform land-use planning.

Since both levels of government have signalled that they will engage First Nations in the planning exercises, Fort McKay is eager to partner with the governments to ensure that environmental monitoring meets their needs. They want meaningful engagement so that they can understand and have confidence in the outputs of the environmental monitoring system. Fort McKay will not merely accept the output of the monitoring system without having the opportunity to provide meaningful input. This is essential to achieve relevance and credibility in environmental monitoring.

3.4 Monitoring, Reporting and Evaluation of Sources

Monitoring the air related impacts in the environment is only one component of the system. In order to effectively manage the air quality, it is essential to understand the emissions to air from the sources. Within the oil sands region, there are hundreds of point sources as well as area sources, such as tailings ponds, mine faces and the general fugitive emissions that are released from facilities, including tank farms.

The recently released federal and provincial joint plan[53] acknowledges the need to better understand the sources of emissions to the air. It states:

Significant questions remain regarding the emissions from point and non-point sources, the chemical transformation of these emissions in the atmosphere, their long-range transport and their effects on the ecosystem and human health.

There are databases that include some information on air emissions from oil sands operations. EIAs include emissions inventories that they have used for inputs to modelling. While the details regarding the sources are included, the emission rates are often based on the regulatory limits (maximum allowable emissions from a source or facility). In some cases emission factors are used to estimate the emissions from sources.

Companies must also report their facilities' emissions to the National Pollutant Release Inventory (NPRI)[54] maintained by Environment Canada. While the database includes the total emissions from each facility in the oil sands region, it is not a comprehensive or detailed database. There are certain criteria that must be met, including size of a facility, number of employees and the emission rate must be above a set threshold (specific to the pollutant). In addition, not all sources are included at the facility level. As an example, mine fleets emissions are not reported by oil sands operations to NPRI as of 2012.

The high level overview of emissions does not provide sufficient detail for analysis of options for emission control and minimization. As stated within NPRI, companies can provide estimates for emissions from sources that do not have continuous monitoring. Details regarding how the emissions are calculated are not provided by NPRI to the public users.

[53] Government of Canada. (2012).Joint Canada-Alberta Implementation Plan for Oil Sands Monitoring. Minister of the Environment. February 3, 2012. Available on line http://environment.alberta.ca/documents/Joint_Canada-Alberta_Implementation_Plan_for_Oil_Sands_Monitoring.pdf. Last visited September 22, 2012.

[54] Environment Canada. (2012). National Pollutant Release Inventory. http://www.ec.gc.ca/inrp-npri/. Last visited September 22, 2012.

In addition, the individual sources are not itemized within NPRI. The chemical analysis of stack emissions and tailing pond emissions are not included within the public database. Companies are also required to submit annual reports to ESRD regarding their emissions. These are not available in a public database.

In recent years, WBEA has commissioned source studies to assist with source characterization[55]. While these studies according to the website were conducted in 2009 to 2011, data and reports have yet to be published regarding the findings of the studies at oil sands facilities.

In general, Fort McKay's expects that the emission intensities of new projects will be less than emission intensities for existing projects. Fort McKay also expects that emission estimates in EIAs and project applications will be validated by actual emission monitoring once the project is operational. Project approvals should include conditions requiring operators to measure and report actual compared to predicted emissions. Adjustments to approvals conditions may be warranted if emissions are higher than what were projected in the EIA or application. The following excerpt from a recent Federal monitoring plan report[56] for the region provides support for this position:

> "***Performance Monitoring*** *is site/facility-specific and would be conducted after development has occurred. This type of monitoring would be used, for instance, to verify and/or validate whether predictions made through Environmental Impact Assessment (EIA) process were accurate. Currently little performance monitoring is conducted and the indicators and parameters used during the EIA process have little to no connection to the local accumulated state and effects monitoring discussed above. It is critical that performance monitoring be conducted or there will be no mechanism to improve ability to predict impacts of specific developments or to identify whether EIA predictions were accurate".*

Although this statement is focused on impacts, it is necessary to have the quantity and composition of air emissions characterized if the impacts of these emissions are to be assessed.

4 MANAGING RESIDUAL IMPACT

Position: If, despite best efforts on implementing air emissions controls, impacts occur, plans and actions need to be undertaken to manage or remediate any residual impacts. This is a key part to the overall cumulative effects management. It is essential to be able to implement proactive management so that costly remediation or retrofits to reduce emissions are not required.

One obvious omission from the provincial and federal plans is that there is not a clear link to how the output of the new environmental monitoring system will provide input into regulatory changes or policy.

4.1 Understanding Air Quality Impacts: Predevelopment air quality to predictions under Planned Development cases:

Proponents of projects are required to model, as part of EIAs, a planned development case (PDC). The PDC is a best estimate, at the time the project is proposed, as to what a future emission scenario may entail if all planned projects proceed. As part of the *Fort McKay Specific Assessment*[57], Fort McKay also looked at a predevelopment

[55] WBEA. (2012). Terrestrial Environmental Effects Monitoring Program: Source Characterization. http://www.wbea.org/terrestrial-monitoring/teem-programs/source-characterization. Last visited September 22, 2012.

[56] Environment Canada. (2012) Lower Athabasca Water Quality Monitoring Program Phase 1. ISBN 978-1-100-18471-5 (March 22, 2011)

[57] FMSA. (2010). Fort McKay Specific Assessment (Supplemental Information for the Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project application). Fort McKay Industry Relations Corporation. March 2010

case for comparison for key indicators of air quality. In the recent EIA conducted by Teck[58], predevelopment and existing (or current) cases were modelled to understand how air quality has changed and may change into the future, if all development proceeds. Examining the changes that has occurred to date and then comparing to the magnitude of change anticipated into the future will highlight where Fort McKay has concerns regarding the plans to manage the cumulative impacts to air quality.

This section contains some comparisons of air quality. The pre-development case completed for the Fort McKay Specific Assessment (2010) is compared against two recently completed EIA PDC predictions: Teck (2011) and Cenovus (2011)[59] as well as the updated Shell 2012 PDC[60]. These two EIAs were completed around the same time for the same area. Their results are both used for comparison as there are differences in model outputs due to assumptions used in the emissions inventory and modelling. The PDC predictions for air quality are used to show the relative difference or magnitude of change that may occur at the receptor, Fort McKay. While Fort McKay is concerned about the cumulative impacts on its traditional lands, the comparison of community air quality is used as a benchmark of air quality trends. In addition, ambient data are collected in the community. This data can be used to understand the uncertainty in modelled or predicted air quality.

4.1.1 Sulphur Dioxide (SO_2) Comparison:

As outlined in the Fort McKay Specific Assessment (FMSA)[61]: *SO_2 is of interest and concern to Fort McKay because the air contaminant can have both direct and indirect effects on the quality of life in the community.*

SO_2 is monitored at the air monitoring station operated by WBEA and located in the community of Fort McKay. A comparison of predevelopment, existing and two recent PDC cases of predicted SO_2 concentrations are shown in Table 2. Select Fort McKay air quality criteria for SO_2 are also listed for comparison.

Table 2: SO_2 Concentrations in Fort McKay: Actual or Predicted under Emission Scenarios

Fort McKay Air Quality Criteria	Predevelopment FMSA ($\mu g/m^3$)	2008 Data from FMSA($\mu g/m^3$)	2011 Data (CASA)[62] ($\mu g/m^3$)	Existing modeled by Teck 2011 ($\mu g/m^3$) Estimated from isopleths	PDC (Teck 2011) ($\mu g/m^3$) Estimated from isopleths	PDC (Cenovus 2011) ($\mu g/m^3$) Estimated from isopleths	PDC (Shell 2012) ($\mu g/m^3$)* Appendix 3.2
1-hr Maximum							
300 $\mu g/m^3$	3.2	280	217	~150	~125	~100	166.3
24 hr Maximum							
20 $\mu g/m^3$	3.1	23	39	~30	~30	~30	26.9
Annual							
6 $\mu g/m^3$	0.9	5	4	~4	~8	~7	5.4

*Peak at receptor Fort McKay

The information shown in Table 3 illustrates the magnitude of change in SO_2 levels experienced to date in the community of Fort McKay. Variability in the maximum hourly concentrations from year to year can result from process upsets or flaring of sour gas that can occur at facilities located close to Fort McKay. The predicted or

[58] Teck. (2011). Frontier Oil Sands Mine Project Integrated Application. November 2011. Calgary, Canada.
[59] Cenovus TL ULC. (2011). Telephone Lake Project Application for Approval. December 2011. Calgary, Canada.
[60] Shell Canada Ltd. (2012). Response to Supplementary Information Requests as of January 30, 2012. May, 2012. Calgary, Canada.
[61] FMSA. (2010). Fort McKay Specific Assessment (Supplemental Information for the Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project application). Fort McKay Industry Relations Corporation. March 2010
[62] Clean Air Strategic Alliance. (2006). CASA Data Warehouse. Available on line at http://www.casadata.org/. Last visited September 21, 2012.

modelled values are based upon steady state operations. Upset conditions or flaring have the potential to create higher peak SO_2 concentrations within the community.

Effective management of SO_2 will not only involve specifying and implemented best practices with respect to sulphur recovery and emissions control, but also must look effective flare and upset management. Flaring and upsets causing higher than normal releases of SO_2 and other sulphur compounds can have a significant influence on air quality in the community. Odours are often detected and may be attributed to some of these compounds.

4.1.2 Nitrogen Dioxide (NO_2) Comparison:

Fort McKay outlined its concerns regarding the effects of oxides of nitrogen, including NO_2 in the FMSA. There continues to be uncertainty in the amount of emissions of NOx in the oil sands region. NOx emissions are generated from point combustion sources as well as from mobile mine fleets. The mine fleet emissions are estimated based on the mine fleet make up and expected operation. The variability in the emission estimates for PDCs of NOx are illustrated in Table 3. The existing case as estimated by Teck (2011) is shown for comparison.

Table 3: NOx emission estimates comparison

	Existing Case (~2010) Teck 2011	PDC FMSA 2010	PDC Teck 2011	PDC Cenovus 2011	PDC Shell 2012
NOx t/d	310	634	737.6	527.9	768.95

While there is a range of emission estimated for the planned or future cases, the values in Table 4 illustrate that emissions of NOx may be expected to double in the region. This will result in increases in ambient NO_2 levels.

A comparison of pre-development, existing and modeled NO_2 concentrations for the community of Fort McKay are included in Table 4. As can be expected, there will be some differences in the predicted NO_2 concentration in the PDC between the Shell (2012), Teck (2011) and Cenovus (2011) scenarios as they had different emission estimates. Selected NO_2 criteria developed by Fort McKay are included for comparison.

Table 4: NO_2 Concentrations in Fort McKay: Actual or Predicted under Emission Scenarios

Fort McKay Air Quality Criteria	Predevelopment FMSA (μg/m^3)	2008 Data from FMSA(μg/m^3)	2011 Data (CASA) (μg/m^3)	Existing modeled by Teck 2011 (μg/m^3) Estimated from isopleths	PDC (Teck 2011) (μg/m^3) Estimated from isopleths	PDC (Cenovus 2011) (μg/m^3) Estimated from isopleths	PDC (Shell 2012) (μg/m^3)* Appendix 3.2
1-hr Maximum							
200 μg/m^3	23	86	133	~130	~150	~200	127.4
Annual							
40 μg/m^3	5.0	13.2	12.6	~25	~40	>45	32.2

*Peak at receptor Fort McKay

The information in Table 4 illustrates the anticipated upward trend in NO_2 concentrations within the community. While there may be some uncertainty in the modeled values, the magnitude of increase in expected NOx emissions would indicate that the community can expect that NO_2 concentrations will increase in the area.

Management and minimization of NOx emissions in the region is required to minimize the impacts. Fort McKay sees NOx emission management through mine fleet upgrades and retrofits to existing facilities as options for emissions management. While new emission standards are coming into effect, the transition and retirement of

the existing mine fleets will not be immediate. A progressive plan to retire or retrofit existing higher emitting vehicles should be developed and implemented.

4.1.3 Fine Particulate Matter ($PM_{2.5}$) Comparison:

The concerns regarding $PM_{2.5}$ to the Community of Fort McKay are outlined in the FMSA. $PM_{2.5}$ is not only a concern from a health effects perspective, but it can have impacts on the overall quality of life for the Fort McKay First Nation. $PM_{2.5}$ can cause regional haze, impairing visibility, but can also be present as dust on local vegetation and traditional foods.

Similar to emissions of NOx, there are a range of estimates of $PM_{2.5}$ emissions from different data sources. These are illustrated in Table 5. The existing case estimate prepared by Teck (2011) is included as a comparison and to help interpret the differences in the modeled values.

Table 5: $PM_{2.5}$ emission estimates comparison

	Existing Case ~2010 (Teck 2011)	PDC (FMSA 2010)	PDC (Teck 2011)	PDC (Cenovus 2011)	PDC (Shell 2012)
$PM_{2.5}$ t/d	18.09	39.4	40.98	30.94	48.56

$PM_{2.5}$ emission estimates are subject to a degree of uncertainty as they are often based upon estimates and emission factors. The key message from the data in Table 5 is that $PM_{2.5}$ emissions are anticipated to increase significantly if all of the planned projects proceed.

Comparisons of $PM_{2.5}$ actual and predicted ambient concentrations are included in Table 6. For comparison, the predevelopment case developed as part of the FMSA (2010) is includes as well as selected Fort McKay air quality criteria. This information is included to show the magnitude of expected change as well as illustrate why Fort McKay is concerned about $PM_{2.5}$ emissions in the region.

Table 6 $PM_{2.5}$ Concentrations in Fort McKay: Actual or Predicted under Emission Scenarios

Fort McKay Air Quality Criteria	Pre-development FMSA ($\mu g/m^3$)	2008 Data from FMSA ($\mu g/m^3$)	2011 Data (WBEA 2011 Annual Report)[63] ($\mu g/m^3$)	Existing modeled by Teck 2011 ($\mu g/m^3$) Estimated from isopleths	PDC (Teck 2011) ($\mu g/m^3$) Estimated from isopleths	PDC (Cenovus 2011) ($\mu g/m^3$) Estimated from isopleths	PDC (Shell 2012) ($\mu g/m^3$)** Appendix 3.2
24-hr Maximum							
28 $\mu g/m^3$	18	23	164*	~25	~60	~30	36.8
Annual							
10 $\mu g/m^3$	7.8	5	10.3*	~7	~15	Not modeled	9.9

*****In 2011, there were forest fires in the region that influenced the annual average $PM_{2.5}$ concentrations.

****** Peak at receptor Fort McKay

The data for 2011 was influenced by regional forest fires, so cannot be considered representative of ambient concentrations of $PM_{2.5}$ in the community of Fort McKay. Forest fires will occur in the boreal forest region. The magnitude of increases between the estimated concentrations of predevelopment and PDC are the concern.

[63] WBEA. (2012). Wood Buffalo Environmental Association Annual Report 2011. Fort McMurray, Canada. http://wbea.org/library/annual-reports. Last visited September 23, 2012.

4.2 Managing and Mitigating Air Quality Impacts

The range of emission estimates and predicted ambient concentrations outlined in Section 4.1 highlights the need to better understand the emission sources in the region. The above comparison looked at two information sources in recent EIAs both submitted in 2011. The differences between the emission estimates and predicted value show that there are gaps in understanding what is happening at a regional scale.

Fort McKay has requested in most of its reviews of EIAs that a consistent approach or method be developed to guide proponents in developing emission inventories. To be able to effectively design and prioritize emission standards and policy development, an accurate and consistent method for emission inventories is required. This will assist regulators and stakeholders in determining the best methods to manage emissions of SO_2, NOx and $PM_{2.5}$.

The magnitude of the predicted increases in NO_2 and $PM_{2.5}$ demonstrate the need for proactive management of these emission sources. While implementation of BATEA or best practices is paramount, it may not be sufficient to mitigate the emissions to keep the ambient concentrations below the Fort McKay air quality criteria.

Emission reduction policies and plans take time to develop. As the planned development cases are estimating ambient concentrations that not only exceed the Fort McKay criteria, but the AAAQOs as well in some areas of the Lower Athabasca Region. To prevent the occurrence of these exceedances, plans and options must be developed and implemented in the near future. Fort McKay, located in the center of the development, must be engaged in the development so that they can be aware of the trade-offs and what is being done in the region.

5 ODOURS AND ODOUR MANAGEMENT: A POLICY GAP

Position: The prevalence and persistence of odours within the Community of Fort McKay is a demonstration of the lack of cumulative effects management with respect to odour-causing substances. Each of the components in an overall management approach is lacking to some extent.

- Pollution prevention and minimization: While some sources are controlled, there are large area sources, such as tailings ponds and mine faces, from which emission control is challenging. The volume of and types of compounds released from tailing ponds were not likely well understood when they were first employed. As a result, technology, measurement and best practices must catch up to the existing situation.
- Assessment: A standard approach to assessing the potential for odours from a project must be developed. This needs to include methods to identify the types of odour-causing substances and how they interact, appropriate thresholds for assessment of odour potential and monitoring methods for sources and ambient concentrations.
- Managing the residual impact: There is a gap in regulatory policy to manage and mitigate odours. While several organizations are working on components of odour management, an overall strategy must be developed which includes regulatory enforcement.

5.1 Odour-causing substance emission prevention and minimization

To effectively control and minimize the release of odour-causing substances, the sources of the substances need to be understood. Some classes of compounds are known to cause odours at low concentrations. Reduced sulphur compounds (RSC), volatile organic compound (VOC) and aromatic compounds as potential odour-causing substances.

The Teck (2011) application estimated that the most significant source of VOC emissions will originate from tailings management. The next most significant source of VOC emissions is expected to be from the mine face. Fort McKay agrees with the assessment that these are likely the most significant sources of VOC emissions. The emissions from the tailings ponds and mine face are based on emission factors and estimates from existing facilities. The estimates of VOCs and RSC from these sources, therefore, are subject to uncertainty. The age of the tailings ponds, what process or streams fed the ponds and operating conditions and meteorological conditions will affect the emission rate of VOCs and RSC[64]. All of these factors make it difficult to predict the compounds and their emission rates or control where and when emissions will result in off site odours.

Fugitive VOC and reduced sulphur emissions from central processing facilities located at in-situ facilities can result in odours. Tank venting can be controlled through vapour recovery units. VRUs appear to be a standard design requirement for central processing facilities. Due to the variable nature of the flows, both in terms of composition and rate, the VRUs may be subject to a range of operating conditions making reliability of the operation challenging. Venting from the tank vents may result, at times, and this can result in odours.

The challenges of the large area sources variable flows make the control of odour-causing substances a unique problem for the oil sands area. With development expected to continue and new mining project with associated tailings ponds planned, developing ways to minimize and control emissions is needed to reduce odour events in the community of Fort McKay.

5.2 Assessment of Odours:

Odours within Fort McKay, and on Fort McKay's Traditional Territory, are a concern to the Community and can impact enjoyment and quality of life.

Regarding regional odours, the 2010 Royal Society on Oil Sands[65] indicated that:

"Resolution of the odour problems being caused by oil sands developments is clearly necessary."

The report later stated that:

"Although odour has often been considered a nuisance rather than a health effect, chronic odours become a burden on community well-being which ultimately leads to stress with the possibility of associated health effects."

The Community's concerns regarding odours are discussed in detail in the Fort McKay Specific Assessment[66] which outlines the following expectations regarding regional odours:

- *there should be no detectable odours in the Community under normal industrial operating conditions,*
- *odour episodes under industrial upset conditions are of short duration and do not create a severe nuisance problem and never represent a health risk, and*
- *odours on Fort McKay Traditional Territory outside development areas are very infrequent.*

---

[64] Siddiqu, T., Fedorak, P.M., Foght, J. M. (2006). *Biodegradation of Short-Chain n-Alkanes in Oil Sands Tailings under Methanogenic Conditions*. Environmental Science and Technology, 2006, 40. 5459 – 5464.

[65] Royal Society of Canada Expert Panel. 2010. Environmental and Health Impacts of Canada's Oil Sands Industry- Report. December 2010 < http://www.rsc.ca/documents/expert/RSC%20report%20complete%20secured%209Mb.pdf>

[66] FMSA. (2010). Fort McKay Specific Assessment (Supplemental Information for the Shell Canada Limited Jackpine Mine Expansion and Pierre River Mine Project application). Fort McKay Industry Relations Corporation. March 2010

The assessment goes on to say:

Further, the Community of Fort McKay has a strong spiritual connection to the land, wildlife and vegetation, and odours are a persistent reminder that the land is being contaminated.

Odours are a constant reminder to the residents of Fort McKay of the industrial operations that surround them. This perspective is important to the assessment of the impacts of odours to Fort McKay. Very low ambient concentrations can result in detectable odours. Often these concentrations are well below the AAAQOs, but are still present in sufficient quantities and mixtures that odours are created.

For example Schiffman *et al.*[67] in a study on odours from swine operations noted that:

"The compounds identified were diverse, and included many acids, alcohols, aldehydes, amides, amines, aromatics, esters, ethers, fixed gases, halogenated hydrocarbons, hydrocarbons, ketones, nitriles, other nitrogen-containing compounds, phenols, sulfur-containing compounds, steroids, and other compounds. The vast majority of these compounds were present at concentrations below published odor and irritation thresholds. Yet human assessments indicated that odors (and irritant sensations) in the immediate vicinity of the swine houses (and even at distances beyond 1000ft) were strong. Comparison of the findings from chemical and human assessment points to the importance of the cumulative effects of hundreds of compounds in producing odor and irritation downwind of swine operations."

The variety of aliphatic and aromatic hydrocarbons, ketones, aldehydes and reduced-sulphur compounds associated with oil sands operations creates a similar type situation in the Fort McMurray area. Any odour impacts assessment must consider cumulative effects of all odour causing substances.

During 2010 and 2011, Fort McKay took canister samples of ambient air coincident with odours being detected in the community. A list of potential odour-causing substances was developed based upon the concentration measured during the events. 20 – 10 minute canister samples were taken during events from May 2010 to May 2011[68]. The list is included in Table 7. While the list is not exhaustive, it does provide an indication of the complexity of odour-causing substances and mixtures as well as the multiple potential sources.

Assessing the potential odour impact of multiple emission sources, each consisting of multiple potential odour causing substances, is challenging. Fort McKay requests that regulators, in consultation with Fort McKay and other regional stakeholders, develop a process to properly assess the impact of cumulative emissions to create local and regional odour issues. This assessment should include:

- ***Odour Thresholds***: using currently recognized and scientifically defensible odour threshold values.
- ***Odour Assessment***: The comparison of predicted single compound concentrations to an odour threshold for that compound and using that as a measure of whether or not the compound will create an odour potential fails to consider the effect of mixtures of odour causing substances. The use of a single-compound-by-single-compound approach fails to recognize that at lower concentrations, i.e., at or below threshold levels, the effects of odour-causing substances can be additive[69,70].

[67] Schiffman, S.S., Bennett, J.L. and Raymer, J.H. (2001). Quantification of odors and odorants from swine operations in North Carolina. *Agriculture and Forest Meteorology 108 (2001) 213-240.*

[68] Spink,D., Dennis, J. (2010). Odour Event Air Quality Monitoring in the Community of Fort McKay. A Report on the Fort McKay IRC Odour Event Canister Sampling Program. November 2010.

[69] Cometto-Muniz, J.E., Cain, W.S. and Abraham, M.H. (2004). Detection of single and mixed VOCs by smell and sensory irritation. *Indoor Air 2004:14 (Suppl 8): 108-117*

- ***Odourous Compounds***: using a comprehensive list of potentially odourous compounds being emitted in the region and from the project.

Odour threshold reliability and reproducibility has been addressed by the Texas Commission on Environmental Quality (TCEQ, 2010)[71].

Table 7: List of Potential Odour-Causing Substances based on Fort McKay Event Sampling

Compound Name	CAS #
2-ethyel hexanol	104-76-7
2,5-dimethyl thiophene	638-02-8
2-methyl thiophene	554-14-3
3-methyl thiophene	626-44-4
acetaldehyde	75-07-0
acrolein	107-02-8
allyl sulphide	592-88-1
beneze, 1-ethyl-2-methyl-	611-14-3
carbon disulphide	75-15-0
carbonyl disulphide	463-58-1
dimethyl disulphide	624-92-0
dimethyl sulphide	75-18-3
hydrogen sulphide	7783-06-4
isoprene	78-79-5
methyl ethyl ketone	78-93-3
naphthalene	91-20-3
nonanal	124-19-6
thiophene	100-02-1

When determining potential odour impacts scientifically defensible odour thresholds should be used. AAAQOs are regulatory instruments, not impact determination criteria. The acceptability of impacts can be considered relative to AAAQOs but cannot be used as no impact levels as Alberta ESRD[72] has indicated that AAAQOs do not represent "safe" or no impact levels.
In summary, for odour impact determinations to be meaningful, level 1 (see TCEQ (2010)) odour threshold like those from Nagata (2003), need to be used in odour impact assessments.

Monitoring Odours:

Continuous air quality monitoring within the Community of Fort McKay occurs at the WBEA operated air monitoring station, AMS#1. Potentially odour-causing compounds that are monitored at the station include SO_2,

[70] Kim, K-H and Park, S-Y. (2008). A comparative analysis of malodor samples between direct (olfactometry) and indirect (instrumental) methods. *Atmospheric Environment*: 42 (2008) 5061-5070

[71] TCEQ. (2010). *Interim Guidelines for Setting Odor-Based Effects Screening Levels.* Texas Commission on Environmental Quality. May 28, 2010. http://www.tceq.state.tx.us/assets/public/implementation/tox/esl/guidelines/odor.pdf

[72] Clean Air Strategic Alliance (CASA). (2009*). Priority Setting Workshop Proceedings*. Workshop Hosted by The Clean Air Strategic Alliance For Alberta Environment. March 2009. http://www.casahome.org/Projects/CompletedProjects/PrioritySettingWorkshop.aspx (last visited April 16, 2011)

total reduced sulphur (TRS), non-methane hydrocarbons (NMHC), ammonia (NH_3), oxides of nitrogen (NO, NO_2 and NOx) and ozone (O_3). While the analyzers located at the station can detect sub parts per billion (ppb) of some of the target odour-causing compounds, not all odour-causing compounds will be detected when odours are present. An analysis of 10 years of data from 1998 to 2007 the Fort McKay station was conducted to analyze trends in concentrations[73]. The analysis found the TRS levels, known to be a group of odour causing substances, had experienced an increasing trend over the 10 years of data collection. Though the increase was small and needs to be interpreted with caution, it serves as an indicator for increased potential for odours within the community of Fort McKay.

Often odours are detected in the community with only slightly elevated concentrations being detected on the analyzers at the air monitoring station. This is not unexpected as the analyzers were not designed to measure the very low concentrations that may still contribute to odours. Specific analytical equipment is required to detect and speciate all of the compounds that could be contributing to odours.

Integrated 24hour samples are taken at the air monitoring station as part of the WBEA air monitoring program and some results are summarized in the WBEA Annual Report for 2011[74]. In addition, Fort McKay has taken its own ambient air samples during odour events and analyzed for VOCs and RSC, among other substances.

The canister results have shown a range of compounds[75]. While some individual compounds may be below their odour threshold, the mixture of compounds may be contributing to odours within the community. To better understand, the community is developing its own community-based monitoring program. Testing of technology coupled with community member observation will be employed to determine more effective methods for monitoring and reporting odours.

The AEMP[76] notes in their review:

Aboriginal communities also spoke of the need for a regional monitoring system that can respond quickly to local incidents, odors, spills and upsets.

And

Aboriginal participants believe the current system is not capable of responding to perceived health risks posed by odors.

The panel also noted:

In the Lower Athabasca region, local odor problems occur at Fort McKay and in the vicinity of industrial operations due to release of reduced sulphur compounds and hydrocarbons. Oil sands activities are an increasing source of airborne contaminants, as industry's own reporting to the National Pollutant Release Inventory indicates.

[73] Kinzierski, W.B. (2010). *Ten-year trends in Regional Air Quality for Criteria Pollutants in the Athabasca Oil Sands Region*. Paper 2010-A-1079 AWMA. Edmonton, Canada.

[74] WBEA. (2012). Wood Buffalo Environmental Association Annual Report 2011. Fort McMurray, Canada. http://wbea.org/library/annual-reports. Last visited September 23, 2012.

[75] Spink,D., Dennis, J. (2010). Odour Event Air Quality Monitoring in the Community of Fort McKay. A Report on the Fort McKay IRC Odour Event Canister Sampling Program. November 2010.

[76] Alberta Environmental Monitoring Panel. (2011). *A World Class Environmental Monitoring, Evaluation and Reporting System for Alberta.* June 2011. http://environment.gov.ab.ca/info/library/8381.pdf. Last visited September 21, 2012.

Due to the transient nature of odours and the subjectivity with respect to intensity and sensitivities of individual responses, effort must be made to better identify the substances causing odours. In addition, it is necessary to find ways to reliably monitor odour events.

5.3 Managing the residual impact:

To manage the residual impact of releases of odour-causing substances, it is necessary to be able to identify the odour-causing substances and their sources, as well as to be able to monitor the releases at the sources and their resultant ambient concentrations. As already discussed, these issues are challenging to address.

If these mechanisms were in place, there would continue to be a need for regulatory tools to enable mitigation of the odour-causing substances. Currently, the Alberta Environmental Protection and Enhancement Act, Section 116 (1) states that:

Where the Director is of the opinion that a substance or thing is causing or has caused an offensive odour, the Director may issue an environmental protection order to the person responsible for the substance or thing.

The act, however, does not contain a definition of "offensive odour". The community of Fort McKay has recorded and reported odours within the community. The challenge is that the offensiveness of an odour is subjective and there are multiple sources located around the community. Identifying the source of the odours is difficult when the specific compounds creating the odour are unknown.

There are currently no policies in place within the ESRD to address or manage odours, specifically. It is partly for this reason that Fort McKay has proposed its own air quality by-law (Section 3.1.1) to help reduce odours within the community. Reporting odours to the regulators will not, by itself, reduce the frequency of odours in the community. Action must be taken to address the sources and regulatory mechanisms must be in place to ensure the sources comply.

Fort McKay cannot wait for the Government of Alberta to resolve how monitoring will change or occur within the Lower Athabasca Region and how that may influence policy development with respect to odour management. The community is being affected now by odours. The potential sources of the odour-causing substances surround the community. Fort McKay has begun working on developing its own community-based air monitoring with a focus on investigation of measurement and monitoring of odours and identifying the odour-causing compounds. The intent is to understand when odours occur, what substances or mixtures of substances are the sources of the odours and how community members are detecting the odours. The community recognizes the gap in the current regulatory system to address odours. It feels it must take action to resolve the issues and cannot wait for the regulatory system to catch up.

Fort McKay hopes that what it learns during its community-based monitoring can help it understand the substances and sources contributing to odours. This information can help inform how to more effectively manage odours so that the frequency and intensity of odours within the community is reduced.

6 CONCLUSION

The planned development cases in recent EIAs have predicted substantial increases in emissions of criteria air contaminants, specifically, NOx, $PM_{2.5}$ and VOC emissions. The resultant air quality in the Community of Fort McKay and on Fort McKay's traditional lands will be impacted by the cumulative emissions.

Effective air quality management requires minimization of the sources by employing best practices and technology on new projects and when equipment is replaced at existing facilities. This may, however, not be sufficient to maintain the air quality within Fort McKay's expectations, as outlined in their proposed air quality by-law. Additional steps including, emission reductions from existing operations may also be required.

To ensure the most effective steps are taken, a comprehensive monitoring system is required. The system must report on the sources of emissions as well as the resultant impacts within the environment, including air quality and odours. Fort McKay is centered in the oil sands regions and wants to be a partner within the monitoring system. This will help ensure that the most meaningful indicators are selected for monitoring and that there is transparency in understanding the results of the monitoring.

7 **ATTACHMENT:** SCHEDULE A:

FORT MCKAY FIRST NATION AIR QUALITY LAW 2012-A-1: **Fort McKay's Ambient Air Quality Permissible Levels**

Substance	**Averaging Period**	**Permissible Level** ($\mu g/m^3$ at 25°C and 101.325 kPa)	**Basis**	**Comment**
Sulphur Dioxide (SO_2)	1 hour	300[1,2]	WHO (2005)	The level is based on a 500$\mu g/m^3$ for 10 minute period level converted to a 1 hour limit and is a never to be exceeded value
	24 hour	20[1]	WHO (2005)	Not to be exceeded more than 6 times per year
Nitrogen Dioxide (NO_2)	1 hour	200[1]	WHO (2005)	A never to be exceeded level
	Annual	40[2]	WHO (2005)	A never to be exceeded level
Ozone (O_3)	8 hour daily maximum mean (May – September period)	124[3]	Modification of Canada-Wide Standard	A never to be exceeded level
	8 hr daily maximum mean (May – September period)	100[1]	WHO (2005)	Not to be exceeded more than 6 times per year during the May thru September (inclusive) period
Particulate Matter ($PM_{2.5}$)	24 hr	28[3]	Canada-Wide Standard	A never to be exceeded level excluding influences from forest fires
	99th% 24 hr annual value	25[1]	WHO (2005)	A never to be exceeded level excluding influences from forest fires
	Annual	10[1]	WHO (2005)	A never to be exceeded level excluding influences from forest fires
Particulate Matter (PM_{10})	99th% 24 hr	50[1]	WHO (2005)	A never to be exceeded level excluding influences from forest fires
	Annual	20[1]	WHO (2005)	A never to be exceeded level excluding influences from forest fires
Carbon Monoxide (CO)	1 hour	15,000[4]	AAAQO (2011)	A never to be exceeded level
	8 hour	6,000[4]	AAAQO) (2011)	A never to be exceeded level
Benzene	3 year running average of annual averages	1.0[5]	WHO (2000)	Represents an increased lifetime cancer risk level of 6 X 10^{-6}
Total Reduced Sulphur (TRS) and Odour Events	1hour	4.3[6&7]	WHO (2000) and Fort McKay's Experience with Odours and TRS Levels	Level is based on a WHO (2000) 30 minute H_2S level of 7 $\mu g/m^3$ which was converted to a 1 hour TRS limit and multiplied by 0.75. The 0.75 factor reflects the fact that odours are generally present when TRS levels are

Substance	Averaging Period	Permissible Level ($\mu g/m^3$ at 25°C and 101.325 kPa)	Basis	Comment
				above 4.3 $\mu g/m^3$

[1] Based on 2005 *WHO Air Quality Guideline update* (http://www.euro.who.int/Document/E87950.pdf) and for the 1 hour SO_2 limit the value is based on the 10 minute value adjusted using an Ontario Ministry of Environment methodology ((Ontario (2004). *Air Dispersion Modeling Guideline for Ontario*. Ontario Ministry of Environment. April 2004)

[2] The USEPA limit for SO_2 was considered in setting the number (see EPA. 2010. *Primary National Ambient Air Quality Standard for Sulfur Dioxide.* US Environmental Protection Agency. 40 CFR Parts 50, 53, and 58. [EPA-HQ-OAR-2007-0352; RIN 2060-A048. http://www.epa.gov/air/sulfurdioxide/pdfs/20100602final.pdf

[3]Based on the proposed CCME *Canada Wide Standard for ozone and $PM_{2.5}$* starting in 2015 but applied without averaging for ozone and also without averaging for $PM_{2.5}$

[4] Based on Alberta Ambient Air Quality Objectives (April 2011) (http://environment.alberta.ca/01005.html)

[5] Based on the *WHO Air Quality Guidelines for Europe* (2nd edition, 2000) (http://www.euro.who.int/document/e71922.pdf)

[6] For TRS this 30 minute value is considered equivalent to a 5.8$\mu g/m^3$ 1 hour value (or a 4.2ppb 1 hour value) adjusted using an Ontario Ministry of Environment methodology ((Ontario (2004). *Air Dispersion Modeling Guideline for Ontario*, Ontario Ministry of Environment. April 2004) and then further adjusted using a factor of 0.75 based on Fort McKay's experience relating continuous TRS measurements in the community to odour episodes.

[7] The TRS permissible level is an indicator of when odours would definitely be expected to occur. Depending on the nature of the odourants emitted, odours may occur at TRS levels much below the permissible level and TRS is therefore a very imprecise measure of odour potential and the possible intensity and character of odours. The general criteria and expectation for odours in Fort McKay is that nuisance odours related to industrial emissions will be infrequent and only occur during unplanned or plant upset events.