2014 Northwest Territories

Air Zones Progress Report

Based on:

Air Quality Monitoring Data from 2011 – 2013

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October 2015

1.0 Introduction

The Air Quality Management System (AQMS) was developed collaboratively under the Canadian Council of Ministers of the Environment (CCME), to be a comprehensive and consistent approach to managing air quality across the country. The Government of the Northwest Territories (GNWT), along with the other jurisdictions, endorsed the implementation of AQMS in 2012. The primary components of AQMS include the following:

- Canadian Ambient Air Quality Standards (CAAQS)
    - Standards for fine particulate matter ($PM_{2.5}$) and ground level ozone (O_3) have been developed, and work is currently underway on standards for nitrogen dioxide (NO_2) and sulphur dioxide (SO_2).
    - CAAQS are the driver for air quality management across the country.
- Base-Level Industrial Emission Requirements (BLIERs)
    - BLIERs are quantitative and qualitative emissions requirements for new and existing major industrial sectors and some equipment types, intended to ensure that significant industrial sources in Canada meet the same base-level of performance.
    - The Draft Multi-Sector Air Pollutant Regulations, under the *Canadian Environmental Protection Act*, are the first step in addressing BLIERs.
- Air Zone Management
    - Air zones are local management areas to enable air quality objectives to be met based on local influences, such as emissions sources, geographical, socio-economic, and meteorological factors.
    - Provinces and territories establish their respective air zones.
- Air Shed Management
    - Six air sheds have been established across Canada to address regional-scale considerations, and facilitate discussions amongst jurisdictions and between Canada and the United States regarding transboundary pollution.
- Mobile Sources
    - Mobile sources are a major contributor of air pollutant and greenhouse gas emissions in Canada, so AQMS is building on existing initiatives to reduce emissions from this sector. This includes advanced transportation technology, maintenance and inspection programs, options for addressing the in-use diesel fleet, and greening fleet programs.

Air Zones and air zone management bring together many of the individual components of AQMS, and provide a reporting mechanism for the system. This report will serve as the GNWT's first Air Zone Progress Report.

2.0 Air Zones

An air zone is a finite geographic area that typically exhibits similar air quality issues and trends throughout it. Air quality is influenced by a variety of factors, but most notably by emission sources, and geographical and meteorological factors. Air zones are meant to be the basis for understanding the state of air quality and allow the ability to control the emission sources contributing to that air quality; as such, monitoring is an important component of air zone management.

2.1 NWT Air Zone Delineation

The Northwest Territories (NWT) consists of vast expanses of land, with intermittent and small population pockets, and widely distributed industrial emission sources. Furthermore, topography and geographic influences are dictated by the division of the tree line, foothills terrain, and lake/surface waters. Capturing air zones that exhibit similar air quality issues and trends throughout it is challenging, and as such, the GNWT is currently using their existing administrative zones as the basis for air zone delineation, as per Figure 1.

Figure 1: NWT Air Zones

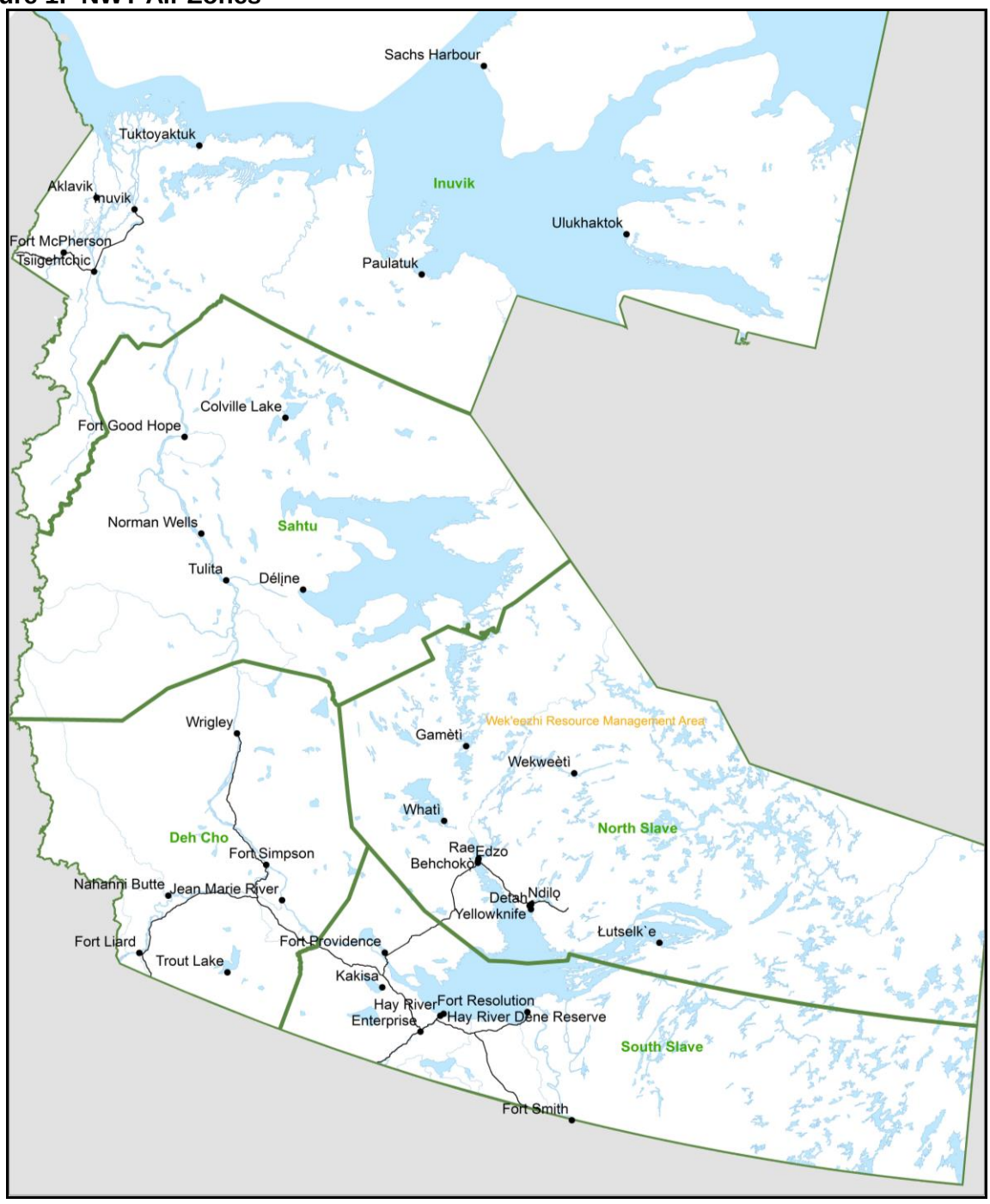

Figure 1 presents the five (5) Air Zones of the NWT, including:

1. Inuvik Air Zone
2. Sahtu Air Zone
3. North Slave Air Zone
4. South Slave Air Zone
5. Deh Cho Air Zone

Inuvik

The Inuvik Air Zone includes 8 communities, with a total population of approximately 7,000 in 2013. Only 3 of the communities are accessible by road (connected by the Dempster Highway). Emission sources outside the communities may include marine traffic on the Beaufort Sea, offshore drilling, construction of the Inuvik to Tuktoyaktuk Highway, and the Ikhil gas project.

Sahtu

The Sahtu Air Zone includes 5 communities, with a total population of approximately 2,500. The communities are accessible and connected seasonally by winter road. Emission sources outside the communities include the Imperial Oil oil and gas facility and associated pipeline operations, and oil and gas exploration.

North Slave

The North Slave Air Zone includes 8 communities and the City of Yellowknife, with a total population of approximately 21,500. Four of the communities and Yellowknife are accessible and connected by all-weather roads, one community is accessible only by air, and the remaining three are accessible seasonally by winter road. Emission sources outside of the communities are most extensive in the North Slave, with operating diamond mines (Ekati, Diavik, Snap Lake), diamond mines under construction (Gahcho Kue), a number of mining projects at various stages of exploration/development (NICO, Avalon, etc.), and the Giant Mine Remediation Project. The Tibbitt to Contwoyto Winter Road is also a source of emissions seasonally, hosting thousands of truck hauls to the mines in an approximately 3 month period every winter.

South Slave

The South Slave Air Zone includes 7 communities, with a total population of approximately 7,000. All communities in the South Slave are accessible and connected via all-weather roads and/or highways. Emission sources outside the communities (during the 2011 to 2013 timeframe) include the Cameron Hills oil and gas operations and associated pipeline, a small sawmill operation, and construction projects such as the Deh Cho Bridge and the Taltson Hydro Dam.

Deh Cho

The Deh Cho Air Zone includes 6 communities, with a total population of approximately 3,500. Four communities are accessible and connected via all-weather road and two are accessible by seasonal winter road. Emission sources outside the communities include the Cantung Mine, and exploration/mining projects such as Prairie Creek.

2.2 NWT Air Quality Monitoring

The Department of Environment and Natural Resources (ENR) of the GNWT operates the NWT Ambient Air Quality Monitoring Network, consisting of four monitoring stations located in Yellowknife, Inuvik, Fort Smith, and Norman Wells. Each station is capable of continuously sampling and analysing a variety of air pollutants and meteorological conditions. The

Yellowknife and Inuvik stations are operated in partnership with the National Air Pollution Surveillance (NAPS) program – a joint federal/provincial/territorial monitoring network with the objective of tracking regional air quality trends throughout Canada. A secondary overall objective of the NWT network is to establish baseline levels of sulphur dioxide (SO_2), nitrogen oxides (NO_x),ozone (O_3)and fine particulate matter ($PM_{2.5}$) ahead of development, as well as to track the trends and cumulative impacts from source emissions should they occur. The network provides continuous, real-time data for use by various levels of government, industry, the public, and researchers.

The existing air quality monitoring network provides the basis for Air Zone monitoring in each of the NWT Air Zones, with the exception of the Deh Cho. There are no current plans to commence air quality monitoring in the Deh Cho; however, it may be considered in the future.

2.3 Air Zone Management Framework

At this time, Canadian Ambient Air Quality Standards (CAAQS) have been developed for fine particulate matter ($PM_{2.5}$) and ground level ozone (O_3). Under AQMS, Air Zones monitoring data is to be measured against the CAAQS in accordance with the air zone management framework, in order to establish what level of action is needed in a given Air Zone. Management Levels and associated thresholds have been established to ensure that action is taken to control/regulate emissions before the CAAQS have been reached.

Figure 2: Air Zone Management Framework

Management Level	O_3 (ppb)		$PM_{2.5}$ Annual (ug/m^3)		$PM_{2.5}$ 24-hr (ug/m^3)	
	2015	2020	2015	2020	2015	2020
Red	Actions for Achieving Air Zone CAAQS					
Threshold (CAAQS)	>63	>62	>10	>8.8	>28	>27
Orange	Actions for Preventing CAAQS Exceedance					
Threshold	>56		>6.4		>19	
Yellow	Actions for Preventing Air Quality Deterioration					
Threshold	>50		>4		>10	
Green	Actions for Keeping Clean Areas Clean					
Threshold	<50		<4		<10	

Note: the O_3 metric is based on the 4th highest 8-hr rolling average value per year, averaged over three years; the $PM_{2.5}$ 24-hour metric is based on annual 98th percentile, averaged over three years; the $PM_{2.5}$ annual metric is the annual average, averaged over three years.

The CAAQS metrics are used for Air Zone achievement determination and the purposes of this report.

3.0 NWT CAAQS Achievement

This Air Zones Progress Report covers the years of monitoring data from 2011 through 2013, inclusive. The Fort Smith AQ monitoring station was installed in 2013, therefore only 3 monitoring stations in the NWT will have valid data for the purposes of this report; Yellowknife for the North Slave Air Zone, Norman Wells for the Sahtu Air Zone, and Inuvik for the Inuvik Air Zone.

3.1 Data from Transboundary Sources and Significant Events

The CCME Guidance Document on Air Zone Management, 2012, recommends that $PM_{2.5}$ and O_3 air quality be reported based on the calculated metric values, but for Air Zone management

purposes, the management level of an Air Zone for each pollutant would be determined after the removal of data influenced by transboundary sources or significant events. This is done so that air quality management strategies are based upon factors in the realm of territorial control.

The dominant influence to air quality in the NWT at the regional scale is smoke from forest fires. This seasonal influence varies from year to year, affecting $PM_{2.5}$ levels across Air Zones for short or long durations, and is sourced from both fires within or outside of our borders. This is an air quality event that the GNWT has little control over managing, unlike anthropogenic emission sources. As such, forest fire smoke is considered both an exceptional event and a transboundary emission source.

ENR documents the smoke events in the monitored communities, and is therefore able to present two sets of CAAQS metrics; those that include all monitored data, and those that have removed the data affected by the aforementioned exceptional events. The dates of excluded data are listed in Appendix A. The results are presented in the following figures:

Figure 3: NWT 24-Hr $PM_{2.5}$ CAAQS

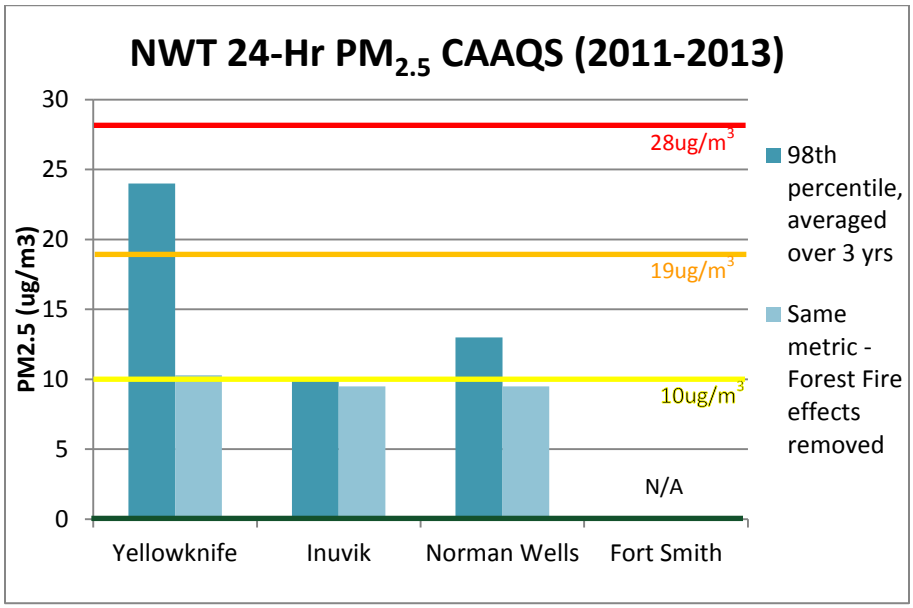

Figure 3 presents the CAAQS metrics for 24-hour $PM_{2.5}$, with associated CAAQS threshold levels. The data presented includes the complete data set, as well as the removal of exceptional events (i.e. forest fire smoke events).
The results indicate that all three applicable Air Zones achieved the CAAQS. It is evident that the effect of forest fires on 24-hour $PM_{2.5}$ levels in the NWT, in Yellowknife in particular, was strong and demonstrably influenced the CAAQS results. For Air Zone Management Purposes, Inuvik and Norman Wells were within the "green" zone, both with values of 9.5ug/m^3, and Yellowknife was within the "yellow" zone with a value of 10.3ug/m^3. In accordance with the Air Zone Management Framework, actions for preventing air quality deterioration may be warranted in Yellowknife, and actions for keeping clean areas clean may be warranted in Inuvik and Norman Wells.

Figure 4: NWT Annual $PM_{2.5}$ CAAQS

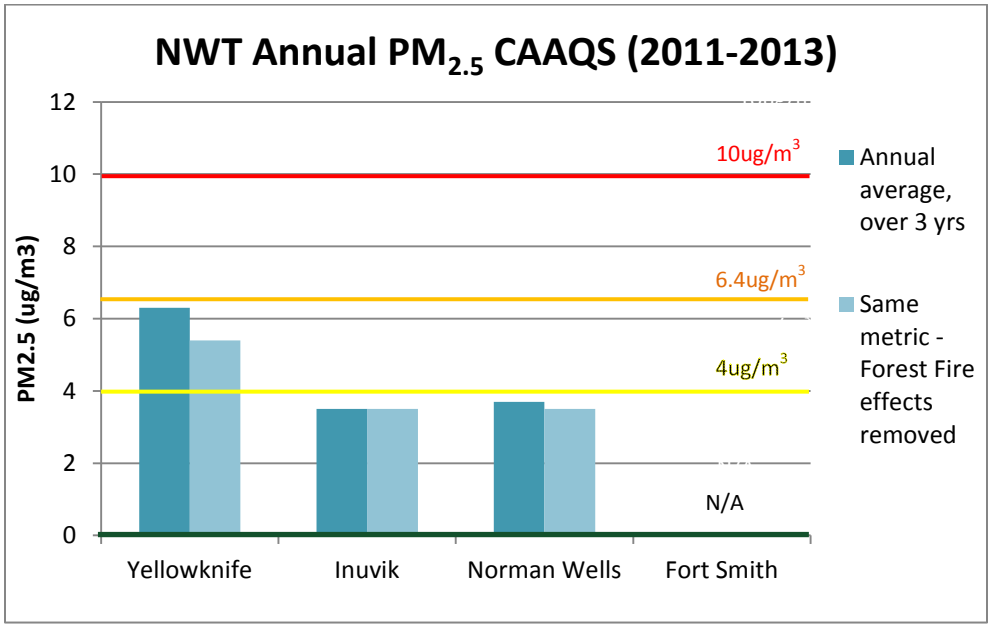

Figure 4 presents the CAAQS metrics for Annual $PM_{2.5}$, with associated CAAQS threshold levels. The data presented includes the complete data set, as well as the removal of exceptional events (i.e. forest fire smoke events).

The results indicate that all three applicable Air Zones achieved the CAAQS. The effect of forest fires on annual $PM_{2.5}$ results is not as significant as that observed on the 24-hour $PM_{2.5}$ levels in the NWT; however, a slight influence to the CAAQS results is present. For Air Zone Management Purposes, Inuvik and Norman Wells were within the "green" zone, both with values of 3.5ug/m^3, and Yellowknife was within the "yellow" zone with a value of 5.4ug/m^3. In accordance with the Air Zone Management Framework, actions for preventing air quality deterioration may be warranted in Yellowknife, and actions for keeping clean areas clean may be warranted in Inuvik and Norman Wells.

Figure 5: NWT O_3 CAAQS

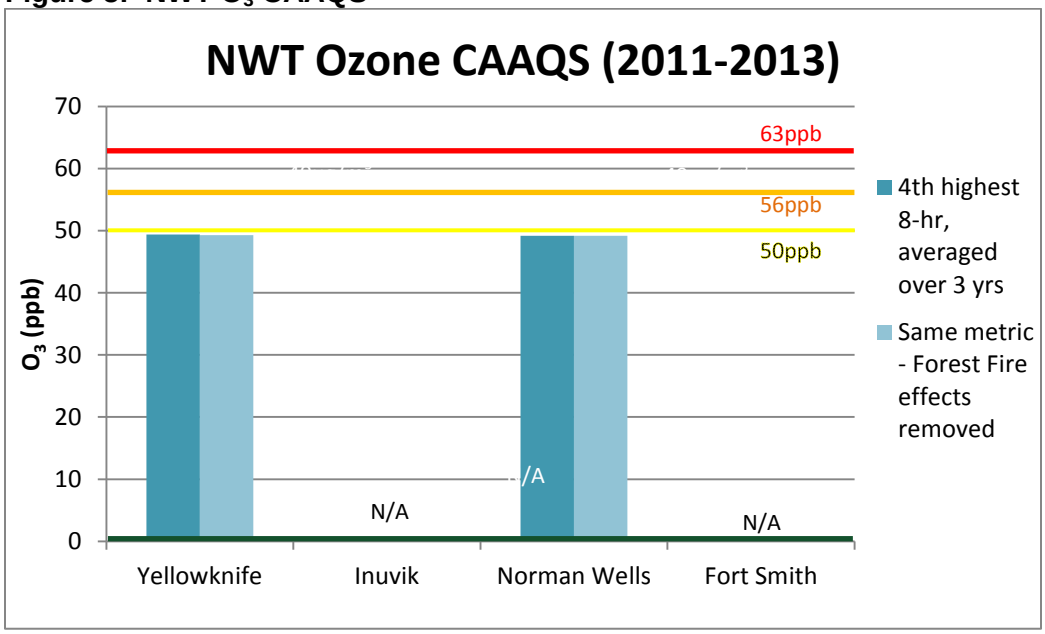

Figure 5 presents the CAAQS metrics for Ozone, with associated CAAQS threshold levels. The data presented includes the complete data set, as well as the removal of exceptional events (i.e. forest fire smoke events). Inuvik data was invalidated based on the criteria of insufficient data availability.

The results indicate that the two (2) applicable Air Zones achieved the CAAQS. There was no effect of forest fires on Ozone CAAQS calculations, (typical episodes of elevated ozone occur in the spring rather than the summer, the latter being the season influenced by exceptional events. For Air Zone Management Purposes, Yellowknife and Norman Wells were within the "green" zone, with values of 49.3ppb and 49.2ppb respectively. In accordance with the Air Zone Management Framework, actions for keeping clean areas clean may be warranted in these two air zones.

The CAAQS metrics for the five NWT Air Zones, with effects from forest fires removed, are summarized in Table 2.

Table 2: Summary of NWT Air Zone Monitoring Results

Air Zone	Monitored Community	Metric Values			Air Zone Management Level
		24-hr $PM_{2.5}$	Annual $PM_{2.5}$	O_3	
Inuvik	Inuvik	9.5ug/m^3	3.5ug/m^3	N/A	Keep clean areas clean
Sahtu	Norman Wells	9.5ug/m^3	3.5ug/m^3	49.2ppb	Keep clean areas clean
North Slave	Yellowknife	10.3ug/m^3	5.4ug/m^3	49.3ppb	Prevent air quality deterioration
South Slave	Fort Smith	N/A	N/A	N/A	N/A
Deh Cho	-	-	-	-	-

4.0 Air Management Actions

Air quality management and pollution prevention activities in the NWT are approached consistently across the territory, with program-based initiatives, project-specific assessments, and guideline/regulatory development.

Multiple programs under the GNWT Biomass Strategy provide examples of PM-reducing initiatives across the territory. These include the Energy Efficiency Incentive Program (EEIP) which provides rebates on new purchases of certified wood and pellet stoves, woodstove installation training to expand/promote woodstove installations and change-outs in the communities, and education workshops to encourage the use of proper burning techniques. These programs support woodstove best practices, and ultimately cleaner emissions.
The GNWT has contributed over $250,000 since 2010 to support these initiatives.

Project-specific assessments are typically industrial applications proceeding through the environmental assessment process or environmental permitting/licensing process. The GNWT's goal is to ensure emission minimization from industrial sources through this process. As such, the GNWT requests cumulative emissions modeling to account for all sources in a regional study area, best available technology procurement for emission generating equipment, best management practices for emission generating activities, and comprehensive monitoring and adaptive management procedures as the primary components of a proponent's Air Quality Management Plan.

The reporting period represents pre-Devolution timeframe, during which time the jurisdictional authority for air quality protection in the NWT was generally unoccupied. The regulatory role that the GNWT assumed included Guideline development for emission sources that related to activities generally occurring within communities. Since Devolution on April 1st, 2014, the GNWT has committed to occupying the field of air quality by developing a regulatory framework for air quality and emissions management, with a goal of pollution prevention and environmental protection. Air Zone management is one aspect of focus in that development.

The GNWT's ambient air quality monitoring efforts have been a large focus of the Air Quality program in order to provide valuable data for use by governments, the public, researchers, and industry. Further to this Air Zones Progress Report, detailed monitoring data and interpretation is available in the NWT Air Quality Reports, published annually and presented at the following link: http://www.enr.gov.nt.ca/node/3062.

Going forward, the GNWT will continue to focus on actions for preventing air quality deterioration and actions for keeping clean areas clean, in alignment with our CAAQS management levels.

APPENDIX A – Excluded Data

Forest fire smoke events are considered exceptional events and as such, monitoring data in affected communities during 2011 to 2013 monitoring period were removed for the purposes of determining Air Zone management levels. For $PM_{2.5}$ calculations, the 24-hour period was removed from the data set if the following conditions were met: $PM_{2.5}$ data greater than or equal to 10ug/m^3 for periods of 3 hours or greater in a given day, or, $PM_{2.5}$ data greater than or equal to 5ug/m^3 for periods of 10 hours or greater in a given day; and, smoke was qualitatively observed in the community and documented in the records.

The following dates were affected by exceptional events and were excluded from the data set for CAAQS calculations:

	2011	**2012**	**2013**
Yellowknife	May 15 – 18, 20, 21 June 19-23, 25, 27, 29 July 27-31	Jul 1-2, 8-10, 15-17 Aug 3-4	Jun 13-16, 23-25, 28-30 Jul 1-4, 6-11, 26-27 Aug 7-22 Sept 4-5
Norman Wells	July 1-2	Jun 27 Jul 1-2, 8-10, 28-31 Aug 10-11, 18-21	Aug 4-5, 13-14, 16-18
Inuvik	-	-	-