# 5-year Air Quality and Deposition Monitoring Plan

## Peace River Area Monitoring Program
## Annual General Meeting
## September 27, 2018

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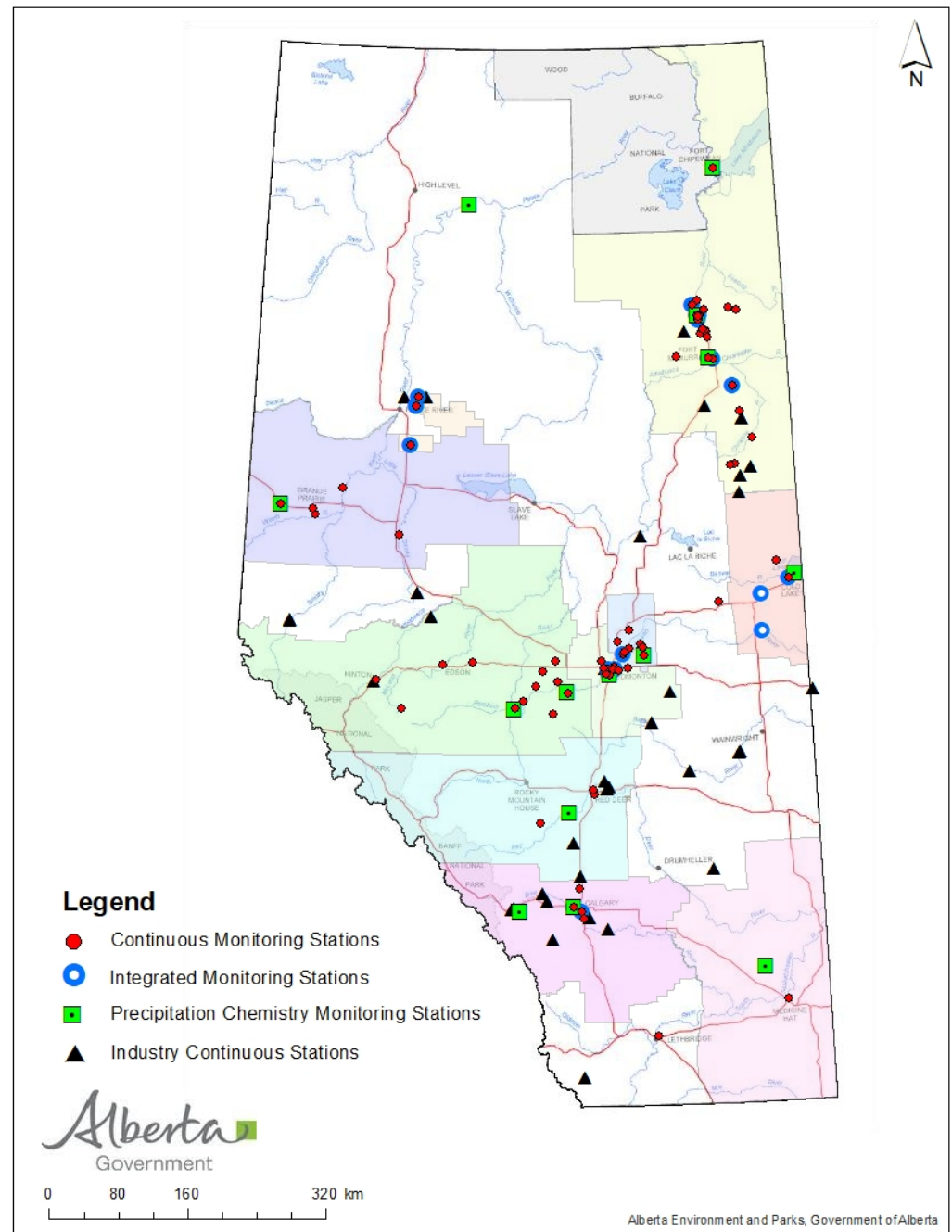Alberta Environment and Parks

# Presentation Format

- **Current Monitoring**

- **Content of 5-year Plan**
  - **Scope of Plan and Monitoring Questions**
  - **Long-term Air Monitoring Network**
  - **Focused Studies, Complementary Monitoring and Emerging Issues**
- **Next Steps for 5-year Plan**

- **Oil Sands Network Optimization Project**

# Current Monitoring

# Current Monitoring

- Continuous and integrated monitoring stations are operated by:
  - government (AEP),
  - airsheds, and
  - industry as required (approval requirement)

- Precipitation chemistry stations are operated by:
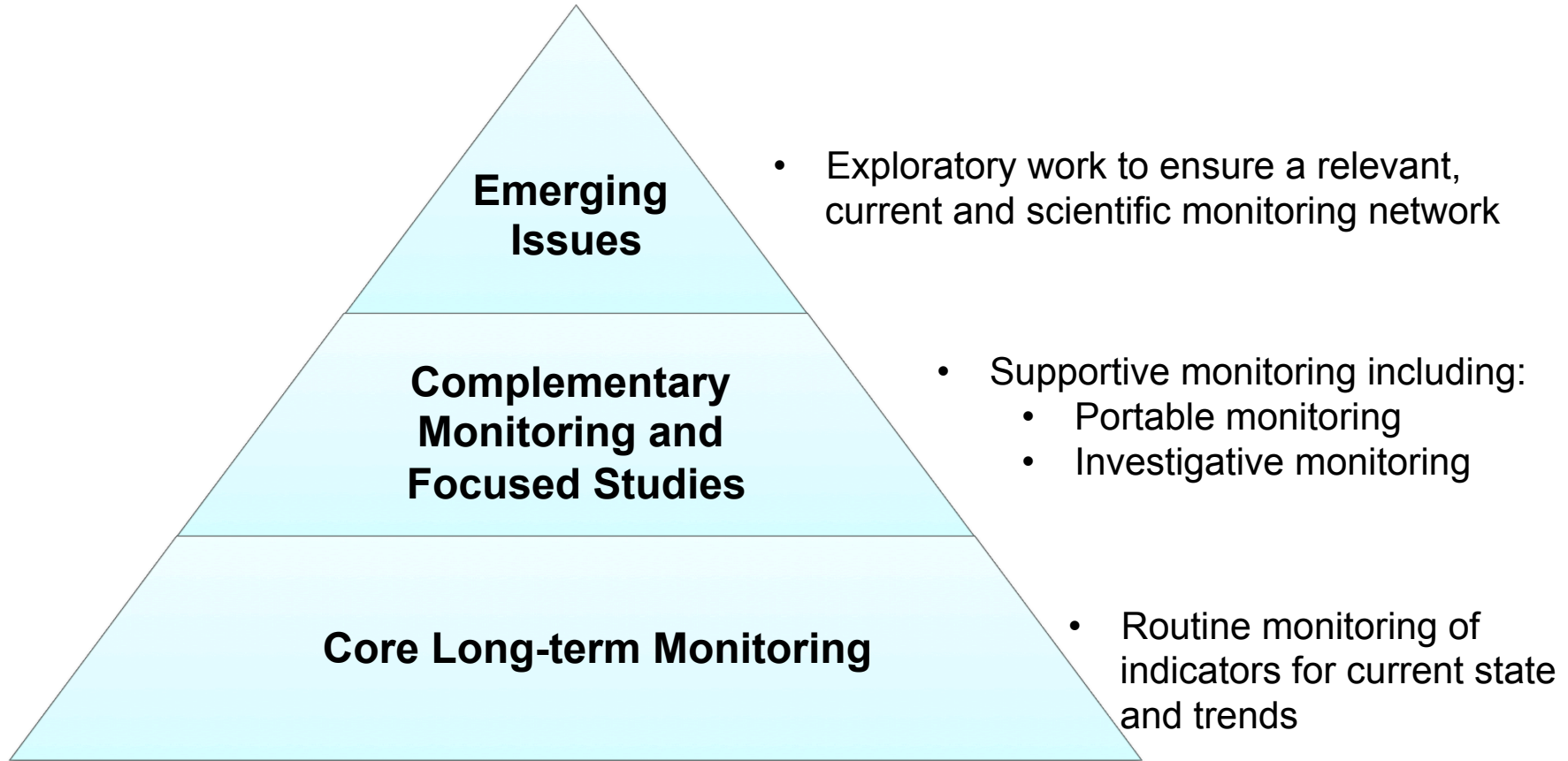  - government (AEP and ECCC) and some airsheds



Legend

- 🔴 Continuous Monitoring Stations
- 🔵 Integrated Monitoring Stations
- 🟩 Precipitation Chemistry Monitoring Stations
- 🔺 Industry Continuous Stations

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0   80   160        320 km

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# Distributed Model for Monitoring



Community, Regional and Near Fence Line Monitoring

National Air Pollutant Surveillance Program

Community and Regional Monitoring

Compliance based Fence Line Monitoring

Airshed Organizations

Environment and Climate Change Canada*

Alberta Environment and Parks

Air Quality and Deposition Monitoring

Industry

Long-term monitoring is conducted through a distributed model and thus changes must usually be enacted through a multi-agency process.

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# Content of the 5-year Plan

# Monitoring Plan Areas of Focus



Pyramid from top to bottom:

- **Emerging Issues**
  - Exploratory work to ensure a relevant, current and scientific monitoring network

- **Complementary Monitoring and Focused Studies**
  - Supportive monitoring including:
    - Portable monitoring
    - Investigative monitoring

- **Core Long-term Monitoring**
  - Routine monitoring of indicators for current state and trends

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# Monitoring Questions

**Question 1: How does ambient air quality and atmospheric deposition in Alberta compare to regional, provincial, and national triggers, limits, and standards indicated in management frameworks?**

- **How does air quality compare to regional plan limits and national standards (e.g. CAAQS)?**

**Question 2: What are the relevant sources, concentrations and/or deposition of atmospheric pollutants that may impact human health, odour or ecosystem function?**

- **What additional monitoring needs to be done to address air quality issues?**

**Question 3: Have the spatial distribution, concentrations and/or deposition of air pollutants changed over time, and how do these relate to factors such as changes in emissions and climate?**

- **What are trends and spatial variation in air quality?**

**Question 4: How will air quality and its effects on human health and ecosystem function change in the future under various emissions scenarios?**

- **What can we say about projected future air quality and deposition?**

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# Air Monitoring Station Classification

- Currently there is no single provincial classification system for long-term air monitoring sites

- Station classification helps identify the station's purpose or objective
  - Parameters that must be monitored
  - Appropriate data use and interpretation

- Future evaluations can test if the objective is still valid (or has been achieved) and/or if the station continues to serve the same purpose

- Classification process needs to be simple enough and use readily available information so that it can be re-run as new stations are being deployed

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# Station Classification – Monitoring Objectives

- Existing long-term continuous monitoring stations were classified into seven classifications (community, industry, regional)

| Type | Classification | Primary Monitoring Objective |
|---|---|---|
| Community | Large Population Centre | To report on indicators[1] and trends in air quality within a large population centre (≥50,000 people), with a focus on human health. |
| Community | Impacted Community | To report on indicators[1] and trends in air quality within a smaller population centre located near industrial operation(s), with a focus on human health. |
| Community | Small Community | To report on indicators[1] and trends in air quality within a smaller population centre that is not influenced by industry, with a focus on human health. |
| Near Industry | Near Fence | To provide data for air quality surveillance and regulatory assurance near an industrial emissions source. |

[1] Examples of indicators include the Air Quality Health Index and benchmarks reported through the Canadian Ambient Air Quality Standards and Land-use Framework Regional Plans.

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# Station Classification – Monitoring Objectives

- Regional classifications

| Type | Classification | Primary Monitoring Objective |
|---|---|---|
| Regional | Background | To report on indicators[1] and trends in air quality at locations that are not influenced by local anthropogenic emissions sources. These data can be used to assess background air quality conditions and to evaluate contributions from long-range/transboundary transport. |
| Regional | Hot Spot | To report on indicators[1] and trends in air quality at locations that are downwind of large emissions sources, such as urban centres and large industrial areas. These data can be used to assess the cumulative effects of multiple and varied sources. |
| Regional | Intermediate | To report on indicators[1] and trends in air quality at locations that are regionally representative, but that are not at regional background levels. These data can be used to evaluate the transport and transformation of emitted pollutants. |

[1] Examples of indicators include the Air Quality Health Index and benchmarks reported through the Canadian Ambient Air Quality Standards and Land-use Framework Regional Plans.

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# Classification of Existing Stations - Results

## Station Classification
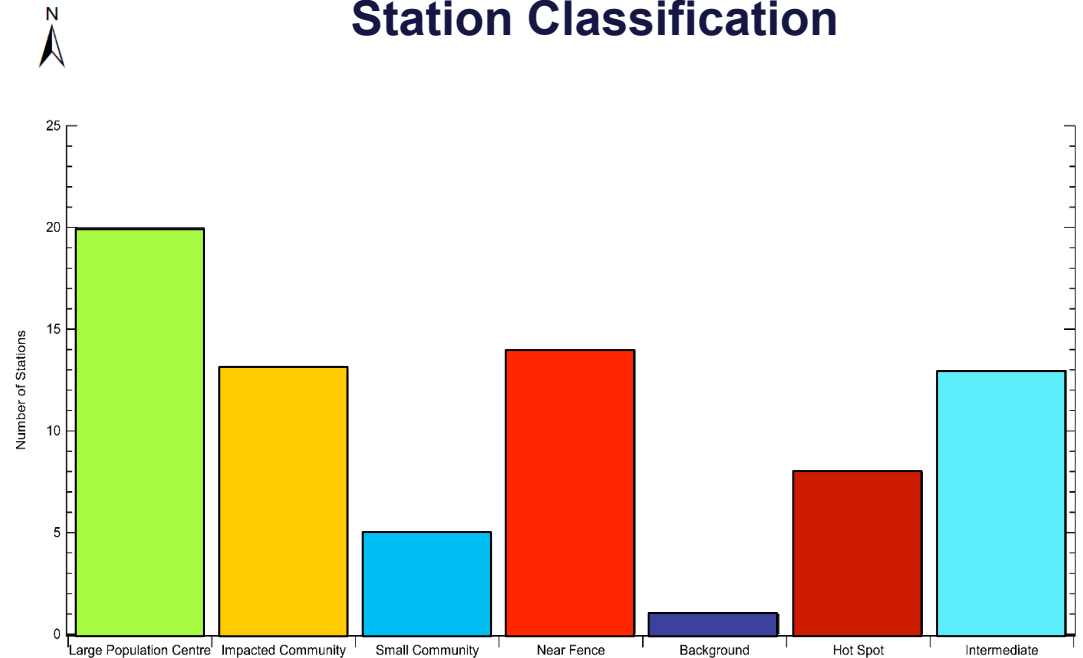


- Most stations are within a community or near fence line
- Some stations were reclassified based on input from Airsheds
- Reno, Station 986 and Station 842 are considered small community stations

# Gap Analysis

- Determine where/what additional monitoring may be needed

- Identified gaps could lead to the:
  - Initiation of focused studies for highest-ranked communities to assess monitoring needs
  - Gaps at the highest-ranked communities could be filled with traditional or complementary monitoring stations

- Gap analysis performed for impacted community and regional stations

- Gap analysis used the same data as station classification, with criteria for population, distance to nearest station, industry emissions, modelled/satellite ambient concentrations
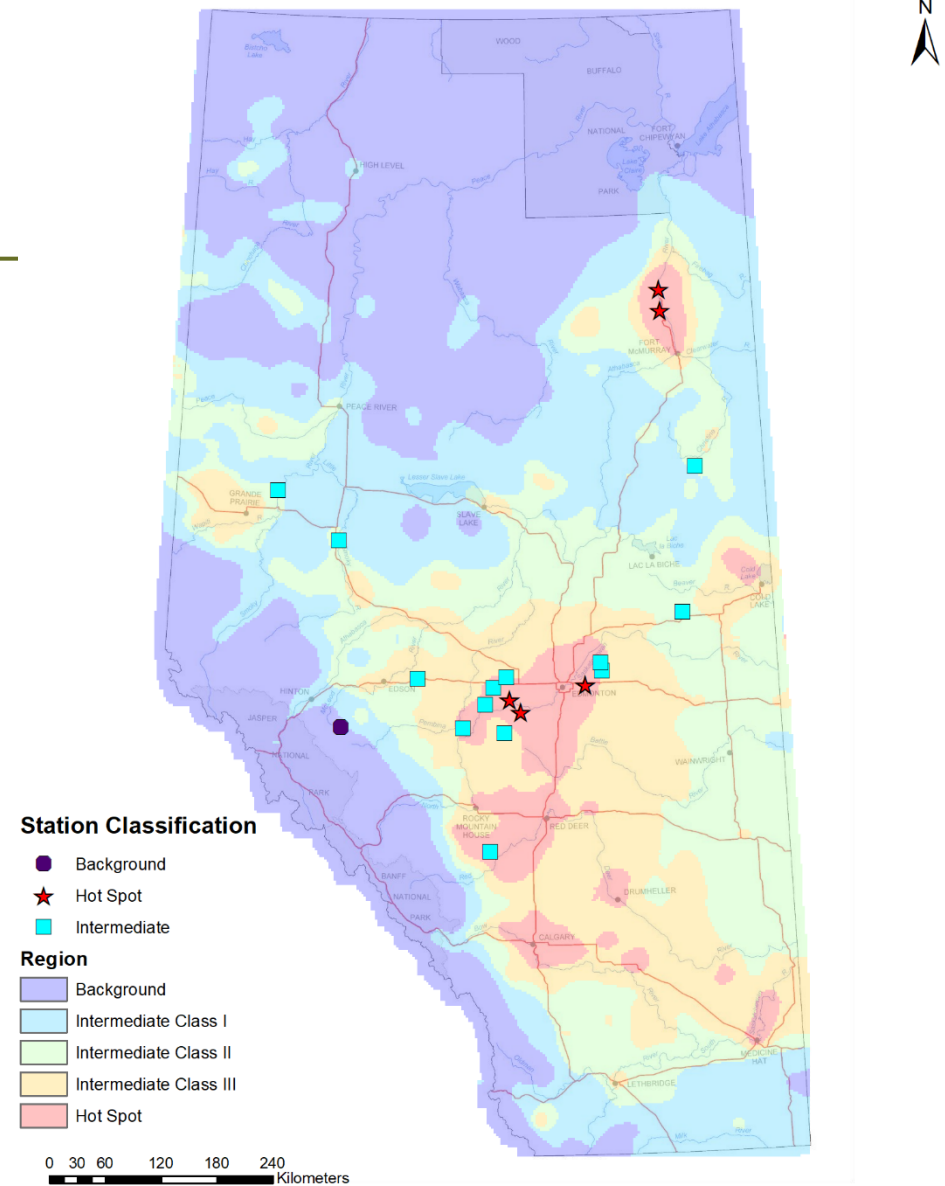
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# Preliminary Gap Analysis Results for Community Monitoring

- Every large population centre (≥ 50,000) has monitoring

- Ranked list of gaps for communities is the sum of the scores for each criterion

- High-ranked communities are medium-size communities, which are within the impact region of an industry, or downwind from urban centres and/or industrial areas

| Ranking of gaps in community monitoring | | |
|---|---|---|
| **Rank** | **Community** | **Total Score** |
| 1 | Lloydminster | 30.0 |
| 2 | Cochrane | 29.3 |
| 3 | Olds | 28.0 |
| 4 | Brooks | 27.6 |
| 5 | High Level | 27.3 |
| 6 | Camrose | 27.3 |
| 7 | Whitecourt | 26.3 |
| 8 | High River | 25.7 |
| 9 | Canmore | 25.0 |
| 9 | Drumheller | 25.0 |
| 9 | Leduc | 25.0 |
| 9 | Rocky Mountain House | 25.0 |
| 9 | Taber | 25.0 |
| 10 | Crossfield | 24.3 |

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# Gap Analysis for Regional Monitoring

- Hot spot region better monitored

- Limited regional monitoring in the northwest and southern Alberta

- No monitoring in large background are in the Northwest

- Challenge: determining the "optimal" number of stations within a given region



**Station Classification**
- ● Background
- ★ Hot Spot
- ■ Intermediate

**Region**
- Background
- Intermediate Class I
- Intermediate Class II
- Intermediate Class III
- Hot Spot

0  30  60    120    180    240
Kilometers

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**Location of Current Regional Air Monitoring**

# Focused Studies (AEP led)

- Focused studies are shorter-term investigative projects (less than 5 years) designed to answer specific and relevant high priority question(s).

- Can help inform air quality or deposition management action(s) and/or guide the improvement of long-term monitoring activities.

- Focused studies will be initiated as a result of information need(s)
  - A need may be identified as a result of questions arising from, for example, routine data analysis, repeated exceedances of an air quality objective, threshold or limit, monitoring evaluation to inform the 5 year monitoring plan, stakeholder consultation, or public complaints.
  - Information needs from external stakeholders may be forwarded through AEP regional Operations representative.

- We are implementing a process that ensures that EMSD is aware of information needs from stakeholders.

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# Complementary Air Monitoring

- Complementary monitoring refers to monitoring platforms that provide information on air quality and atmospheric deposition that complements long-term air and deposition monitoring stations.

- Overview of complementary monitoring in existing networks
  - Passive samplers deployed within Airsheds
  - Integrated monitoring through NAPS
  - Regulatory monitoring
  - Oil sands monitoring

- Monitoring methods that are being or plan to be assessed by EMSD
  - Portable air monitoring platforms
  - Satellite remote sensing
  - Citizen science
  - Bulk deposition monitoring

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# Portable Air Monitoring Platforms

- Portable air monitoring platforms can house

  - Traditional gas analyzers (example: Airpointer)

  - Compact sensors (examples: purple air, Vaisala)

- Could be used where gaps in monitoring have been identified

- Systems cost from a few hundred dollars to close to 150K (a traditional station costs ~ 250K)

- The scientific community is currently working to compare and validate these devices



Elk Island Air Monitoring Station

Airpointer



**Vaisala**

aeroqual



**Purple Air**

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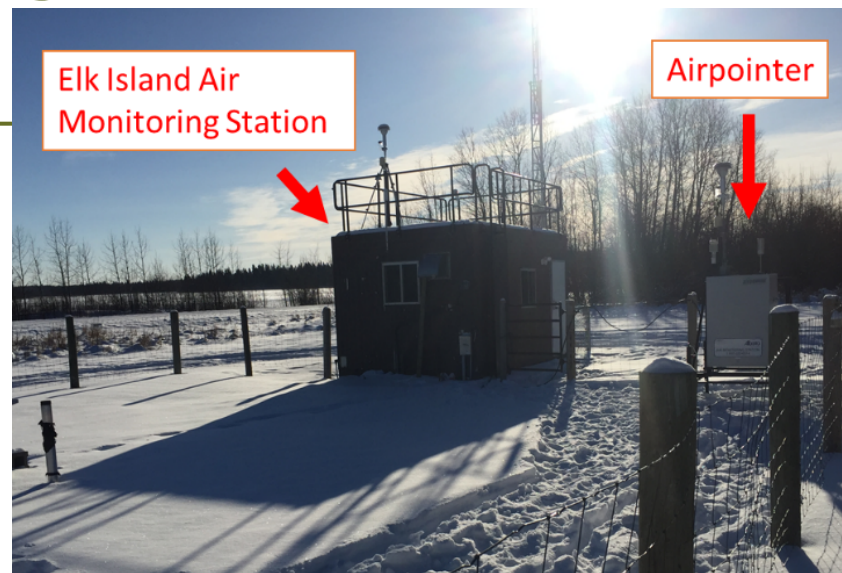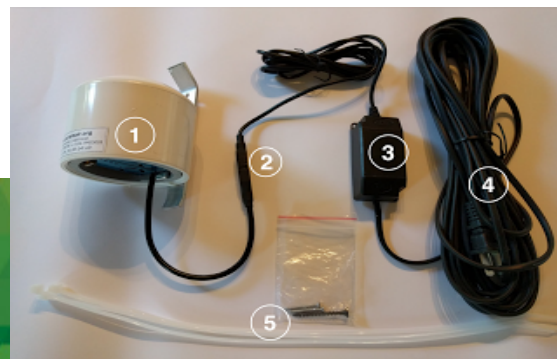
# Emerging Issues – Scope

- **Topics related to air quality or deposition that are not effectively addressed by current monitoring, evaluation, or reporting activities _and_ are expected to significantly change over the next 10 years**

- **Some emerging issues include:**

  - **Wildfire Smoke**
    - Often evaluated using opportunistic monitoring with no strategic seasonal monitoring in place for regularly impacted areas

  - **CAAQS for 2020 and 2025**
    - Proactively compare currently measured values to future thresholds to investigate potential exceedances

  - **Ammonia monitoring**
    - Only gaseous CAC emission noted as increasing (APEI, 2016) and precursor of PM with possible impacts on ecosystems
    - Sparse monitoring in Alberta

  - **"True" $NO_2$**
    - Current $NO_2$ monitors have known, but unquantified, positive interference (other studies: <10% up to 130%)
    - $NO_2$ will be included in CAAQS in 2020

  - **Air quality changes associated with the phase-out of coal fired electricity generation by 2030**

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# Short-term Implementation Items most relevant to airsheds

- For the top five gaps in community monitoring, examine if there is existing or planned complementary monitoring that meets the community monitoring objective.

- Identify, design, and perform focused studies, using the process described in this plan.

- Finish analysis of passive sampler networks for remaining Airsheds (LICA, WBEA, PRAMP and PAZA) and communicate results to the Airshed. Continue to support all Airsheds in implementing network recommendations.

- Review literature for and evaluate the performance of Airpointer and other commercially available portable air monitoring platforms
    - (Vaisala AQT420, Purple Air Model PA-II, Aeroqual AQM65, Aeroqual AQS1, Aeroqual AQY1, etc.), including those equipped with compact sensors, for use in long-term and focused monitoring.

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# Short-term Implementation Items most relevant to airsheds

- Design, build, test and evaluate integrated a portable air monitoring platform equipped with compact sensors ("micro-station").

- Evaluate and report on the usefulness of satellite data to assess spatial and temporal variation of $NO_2$, $SO_2$, CO, PM, and/or $NH_3$ through literature review and data analysis.

- Evaluate current network for monitoring and assessing impacts of wildfire smoke, and suggest network improvements.

- Identify stations which are most likely to exceed the future CAAQS based on current ambient conditions and, possibly, predicted changes in emissions. Initiate focused study and/or adjust the long-term network based on this evaluation as necessary.

- Support and contribute to the development or replacement of the new Ambient Air Quality Data Warehouse.

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# Next Steps for 5-year Plan

- Internal review of the document has been completed

- Will be sent out for external review before the end of October

- Some PRAMP stakeholders have been attending the CASA-hosted webinars

- The plan will focus on guiding the work of EMSD over the next five years.

- An implementation table, with over 60 items, is contained in the plan.

  – Where appropriate, we are looking for opportunities to collaborate with regional Airshed groups and other organizations during implementation.

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# Oil Sands Air Monitoring Network Optimization

- **Purpose:** Identify redundancies and gaps in existing air monitoring networks

- **Scope:** Includes long-term continuous and passive monitoring in the Wood Buffalo, Cold Lake and Peace River oil sands regions

- **Process:** AEP and Environment and Climate Change Canada (ECCC) are using modelling techniques to identify gaps and redundancies in the current monitoring networks
  - We are looking for input from stakeholders, through the airsheds, on recommendations from a local and regional perspective

- **Deliverable:** The final recommendations report is due March 31, 2019

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# Thank you!

# Questions?

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