2023-2024 OSM Work Plan Scoping:
Direction for use of Scoping Template for TACs

The OSM Vision

An integrated monitoring, evaluation and reporting system inclusive of and responsive to Indigenous Communities, that includes the acquisition and reporting of regional and sub-regional data on baseline environmental conditions, tracking any environmental impacts, and the assessment of cumulative environmental effects from oil sands development to inform management, policy and regulatory action and respects potential impacts to section 35 Rights.

Purpose and Process for use of this Form

The Technical Advisory Committee (TAC) scoping template has been developed to support 2023-24 Oil Sands Monitoring (OSM) Work Planning. The purpose of this form is to support the OSM Vision by defining TAC work scoping elements to support early communication between each of the TACs, SIKIC and other relevant committees within the OSM governance structure during work planning. The objectives are to transition OSM work planning toward a more collaborative and timely process which provides clarity regarding work plan expectations and certainty for all program participants.

Each TAC is required to fill out one integrated template, in consultation with their membership. In completing the template, TACs should refer to Motion 6A from the Oversight Committee, as well as its supporting attachment.

2023-24 Annual Work Plans are to be developed in response to the scopes of work issued by TACs.

- Work Plan proposals are to include additional detail on how the work outlined in the completed scopes of work templates will be implemented (e.g., budget, methods, data, deliverables, etc.)
- Proposals for new work will not be considered unless specifically solicited by the scope of work, as developed by TACs. Thus, relevant Project Leads are to be engaged in the completion of the scoping template.
- New CBM work will be considered provided it clearly articulates a link to Key Questions, methodologies, and timelines. Work planning is to include collaboration between ICBMAC and the TACs, to ensure community concerns are being addressed.
- For clarity, proposal submission does not guarantee full or partial funding.

SIKIC support personnel have been designated for each TAC, to provide guidance and support throughout the process of template completion.

Work Planning Process for 2023-2024

1. Template shared with TACs (and ICBMAC, to inform collaboration) at 2023-2024 Work Planning Workshop *(July 14)*
2. TAC Leads complete template – in consultation with their membership, with engagement from 2023-24 work plan Project Leads, and assistance/guidance from identified SIKIC support personnel *(July-August)*
3. TAC Leads submit completed Scope of Work template to the Program Office *(August 29)*
4. SIKIC reviews and provides request of further information or clarifications to TACs, and identifies opportunities for cross-program integration *(August 30-September 9)*
5. TACs finalize annual Scope of Work template and submit to the Program Office *(September 12-16)*
6. Launch of 2023-24 Work Plan Process, with completed Scope of Work templates included as direction for Project Leads to follow in developing 2023-24 work plans (*September 19*)
7. Project Leads submit 2023-24 Work Plans to the Program Office *(October 20)*
8. Program Office provides submitted workplans to TACs for review and workplan completeness check in response to scope of work *(early November)*

TEMPLATE FOR TAC SUBMISSION OF PRELIMINARY SCOPING INFORMATION	
Submission Details	
Date Submitted:	
Submitted by (TAC name and leads):	**Air and Deposition TAC (AEP – Erin Horb; ECCC – Sandro Leonardelli)**
Theme Area Objective	
What is the overall monitoring purpose of this Theme Area?	The overall purpose of the Air and Deposition theme is to understand the source of contaminants to the air, as well as their transport, transformation processes, and fate. There are two core work plans that fulfill this purpose: i) Atmospheric Pollutant Active Monitoring Network (A-LTM-S-1) and ii) Integrated Atmospheric Deposition Monitoring (A-PD-6). The overall objectives of each work plan are summarized below. <u>Active Air Monitoring</u>: -Provide ambient data that will allow assessment of: (i) current state of air quality, (ii) changes in measured concentrations (relative to baseline(s)), and (iii) hot-spots and emerging issues (based on changes from baseline(s) and/or elevated levels relative to established criteria/objectives/thresholds). -Provide representative ambient concentrations in populated areas to inform human health risk assessments and provide the public with near real-time air quality indicators through the Air Quality Health Index (AQHI) or Fort McKay Air Quality Index (FMAQI). -Provide ambient concentrations to help understand the impact of multiple sources on air quality (including odours) in the Oil Sands region, including the ability to distinguish between oil sands specific sources of emissions and emissions from other natural and anthropogenic sources. <u>Deposition</u>: -Determine levels and changes of atmospheric deposition for specific pollutants that pose a likely risk for forest, river, lake, and wetland ecosystem function (OSM Objective #1 and #2) -Quantify the contribution of OS emissions to deposition of pollutants of concern, particularly at ecological monitoring sites, and provide these data to ecological effects monitoring projects, (OSM Objectives #1 and #2) -Improve integration within and across themes, including continued model comparison and delivering deposition maps required by other themes. (OSM Objective #3) *In addition to the specific work plan objectives listed above, it is important to note that:

	-Much of the air monitoring in the oil sands region supports industrial EPEA approval compliance-based ambient air monitoring. -An overarching goal of the OSMP is to understand cumulative effects in the region; both of these work plans support this goal. -The Air TAC will work on defining terms such as baseline, limits of change, and power analysis, which have yet to be defined or implemented within the context of the OSMP. This work will support the program-wide transition to an Adaptive Monitoring Framework (AMF).
What Key Questions (attached) or areas of limited knowledge is the work being designed to answer? Please identify potential linkages to relevant sections of the forthcoming State of Environment Report.	<u>Active Air Monitoring:</u> -Has air quality changed from baseline(s)? -Are there effects on receiving environment (endpoints relating to ecological health, odours, human health, endpoints relating to Indigenous rights: wellbeing, culture and rights)? -What are the frequency and extent of odour events? -Do we have the right technology to detect and predict odour events? How does meteorology contribute to odour? Does air quality impact Indigenous wellbeing and ability to be out on the land? -What are regional sources of contaminants in air? -What are the pathways and fate of contaminants? -How do management of odours, tailings pond emissions, mine fleets, and stack emissions affect air quality? -What is ambient air quality compared to limits of change, including government standards and Indigenous indicators? ***The Air & Deposition TAC has suggested the following additional questions:** -Do we have the right technology to detect and predict dust events? How does meteorology contribute to dust? What are the major sources of dust impacting air quality and deposition? <u>Deposition</u>: -Has deposition of airborne contaminants changed? -Is there an effect on the receiving environment? -What is the extent of deposition of compounds of concern? -What are the sources (and amounts) of compounds that may lead to atmospheric deposition? -What are the pathways and fate of airborne particles? Can we use predictive modeling to understand the current state and make predictions? -BATEA to help with supressing particulates resulting in dust? -What is the deposition load compared to limits of change? -What are the impacts of contaminant deposition on human health and harvesting of country foods?

	This work will continue to support the State of Environment Report, as requested. Contributions to the forthcoming State of Environment Report include: -Chapter 3 –State of Air: • (Ambient) NO_2, SO_2, $PM_{2.5}$, THC, H_2S/TRS, PACs, Trace Elements • (Modelled) PACs, Acidic Deposition -Chapter 4 –State of Aquatics: • Snow Deposition: Elements and Polycyclic Aromatic Compounds
Theme Area Work Planning: Summary of Current Status	
What is the existing data showing? a. Has baseline been established? If so, is there change relative to baseline? b. Have thresholds or limits of change been identified? c. Are there unanticipated results in the data?	Adaptive Monitoring Framework (AMF) terms such as baseline, limits of change, and power analysis, which have yet to be defined or implemented within the context of the OSMP. Previous studies, reports, and review papers have defined baseline and change in different ways, and have presented unanticipated results. The development and implementation of these terms specific to the OSMP is now proposed for 2023-24, which will require funding of a new Technical Analyst. There are multiple ways to define 'change', which is reliant on how 'baseline' or 'background' is defined. These terms have not been explicitly defined in accordance with AMF. Development of these terms, for specific air quality parameters, is a priority for the TAC in 2023-24. Existing data will be leveraged to help define 'baseline', which considers different time periods and geographical locations. It is likely that each contaminant will require a distinct baseline. Baseline will be used to develop limits of change so that monitoring programs can be adapted to identify and understand unanticipated results. Below is a summary of some relevant thresholds and previous work that may be leveraged to support the TAC's on-going efforts to define baseline, thresholds, and limits of change. <u>(Government) Thresholds/limits:</u> -**Alberta Ambient Air Quality Objectives and Guidelines (AAAQO/Gs)** exist for many air pollutants and are used to determine adequacy of a facility design, establish required stack heights/release conditions, assess compliance, and evaluate facility performance. -**Canadian Ambient Air Quality Standards (CAAQS)** exist for $PM_{2.5}$, O_3, NO_2, and SO_2 and are a key driver for the national Air Quality Management System. -**Lower Athabasca Region Air Quality Management Framework** triggers and limits for NO_2 and SO_2 to provide guidance on long-term decision making and management. <u>(Indigenous) Thresholds/limits:</u> **-Fort McKay Permissible Levels** which cover SO_2, NO_2, O_3, $PM_{2.5}$, PM_{10}, benzene and TRS

	-**Moose Lake Access Management Plan: Air Quality Targets** currently exist for SO_2, NO_2, $PM_{2.5}$, O_3, H_2S, TRS <u>Ecosystem Thresholds/limits:</u> -Critical Loads of Acidity in Alberta's *Acid Deposition Management Framework* -Critical loads of acidifying and eutrophying deposition defined in the literature <u>Other Thresholds/limits:</u> -World Health Organization (WHO) air quality guidelines <u>Change</u>: -Change relative to baseline or reference sites has been reported by over 100 studies for all contaminants emitted from OS sources (Horb et al., 2022), although the magnitude and spatial extent of change varies by contaminant. These previous studies have been summarized through OSM workshop reports (Swanson, 2019; Wentworth and Zhang, 2018) and literature reviews published in peer-review journals (e.g., Brook et al., 2019; Davidson et al., 2020; Harner et al., 2019; Horb et al., 2022) <u>Some unanticipated results reported include</u>: -Eutrophication in jack pine stands has been reported by the WBEA's Terrestrial Environmental Effects Monitoring (TEEM) program (summarized in Davidson et al., 2020) -Exceedance of acidic critical loads across Northern Alberta and Saskatchewan has been modelled (Makar et al., 2018) -Numerous studies have reported discrepancies in top-down measured emissions and reported inventories in the Oil Sands Regions, including for CH_4 (Baray et al., 2018), VOCs (Li et al., 2017), CO_2 (Liggio et al., 2019), and SO_2 (McLinden et al., 2020)
How is the work being designed to answer the following: a. With consideration of baseline and normal variability, has change been observed in the media? b. Is there evidence that the observed change is attributable to oil sands development? *(please describe source-pathway-receptor and/or conceptual models)* c. If change has been observed that is not attributable through the above models, is there a need for investigation of cause studies?	The proposed work builds on an already well-developed framework for surveillance monitoring, mechanisms for confirming change, and modelling to support understanding of the transport and fate of airborne contaminants. Baseline, change and attribution are currently assessed in air and deposition using the following approaches: -Monitoring air pollutant concentrations and deposition rates in a gradient away from known sources -Comparing air pollutant concentrations and deposition rates between near-source sites and reference sites -Analyzing detailed chemical composition through source apportionment and fingerprinting techniques -Analyzing historical trends in air pollutant concentrations and deposition rates -Conducting chemical transport modelling (i.e., GEM-MACH) As noted above, in the 2023-24 work plan, we will: -continue surveillance monitoring,

	-develop limits of change and criteria for investigation of cause specific to the OSMP, -develop a common understanding of baseline air quality and deposition for the TAC, improve effects-based surveillance for air quality, and -improve our understanding of sources, and use an air quality model (GEM-MACH) and ambient monitoring to continue to determine linkages between emission sources and odour/air pollutant events in the region, hence fulfilling the AMF framework. This work will build upon previous efforts noted above that summarized the current state of knowledge, observed changes, and remaining monitoring gaps Brook et al., 2019; Davidson et al., 2020; Harner et al., 2019; Horb et al., 2022; Swanson, 2019; Wentworth and Zhang, 2018). These workshop reports and review papers have attributed the observed changes in air quality and deposition primarily to oil sands development. In addition, there are known gaps with respect to the sources, transport and fate of particular air pollutants. Some of these limitations can be addressed by characterizing and quantifying emissions from poorly understood sources. Attached is a figure from Horb et al. (2022) that illustrates the source-pathway-receptor conceptual model for air emissions. The number indicated within each box denotes the number of peer-reviewed publications from 2010-2020 that covered a given topic. The conceptual model shows the major sources for each air pollutant (stressor), and the relevant pathways each pollutant undergoes to elicit responses. It is important to note that ecological responses are covered by separate theme areas. Work is on-going to continually improve inter-theme integration to ensure other themes are provided accurate and sufficient air and deposition data to investigate stressor-response relationships. Monitoring is a direct measure of ambient air quality and of deposition of certain parameters in the oil sands region, and complementary tools, such as air quality and deposition modelling, satellite data, and intensive focused studies provide necessary information (i.e., calculated and predictive scenarios) to address previously noted monitoring gaps and inform decision-making. Continued discussion with other TACs will make the best use of GEM-MACH output and interpolated monitoring data, so that other TACs are able to evaluate AMF endpoints related to air quality and deposition. This discussion will be informed by the on-going model-measurement intercomparison focused study involving ECCC, WBEA, and AEP.
Theme Area Work Planning: Alignment with Adaptive Monitoring	

For your Theme Area, please respond to the following: a. Identify which elements of the work plan are core/surveillance monitoring, the stressor pathway associated with it and the power and specificity of the approach; b. Identify studies addressing investigation of cause, the trigger used to initiate the investigation, hypotheses and timeline; c. Identify which elements of the work plan are focused studies, with the question they are designed to answer, and timeline. *(Note: it is recognized that some of this information (power, limits of change etc.) is under development; where it is not clear, identify how this will be developed)*	Information on formalizing baseline(s), power and specificity is under development. This will be achieved through a dedicated TAC Analyst requested through the 2023/24 work plan. The analyst's main tasks will be to develop baseline(s), limits of change, and conduct relevant statistical analyses (e.g., power analysis) to inform adaptive monitoring. Another important aspect of the analyst's work will be to compile and synthesize the relevant historical results and information published in previous studies (sources, pathways). All of the long-term core/surveillance monitoring items (listed below) are associated with monitoring pollutants (stressors), pathways (transport/transformation/deposition), and/or sources: -Continuous ambient air monitoring stations (sources, stressors, pathways) -Integrated ambient air monitoring (sources, stressors, pathways) -Passive air monitoring (stressors, pathways) -Precipitation and dry deposition monitoring (stressors, pathways) -Lichen monitoring (sources, stressors, pathways) -Forest Health indicator monitoring (stressors, pathways, responses) -Snowpack monitoring (sources, stressors, pathways) -Wetlands indicator monitoring (stressors, pathways, responses) -GEM-MACH stressor maps and source identification (sources, stressors, pathways) -Community Odour Monitoring Program (sources, stressors, pathways, responses) The following is a list of activities that are intended to investigate cause and/or are focused (i.e., not intended to monitor indefinitely): - Fort McKay odour monitoring and dust monitoring focused studies (being submitted as separate work plans through the ICBMAC) -Smith's Landing First Nation (SLFN) data review to assess extent of contaminant transport from OS emission sources to SLFN (community-led; 3 year study) -Developing baseline(s) and limits of change for OSMP (triggered by OC and led by TAC; 3 year study) -GEM-MACH evaluation and model improvements (triggered by the SIKIC as a funding condition; 3 year study) - GEM-MACH to be used as a tool for investigation of cause and focus studies (as needed) -WBEA Network Assessment Working Group to evaluate and optimize the ambient air monitoring network (triggered by the SIKIC as a funding condition; up to 2 year study) -LICA Acid Deposition Monitoring Program Expansion Committee (triggered by expanding EPEA approvals and gap

	identified in numerous reports/reviews; up to 2 year study to expand network) -Investigating impacts of increased nitrogen and sulphur deposition on greenhouse gas (CH_4 and N_2O) emissions (triggered by observed change in nitrogen fixation rates; 2 year study)
Theme Area Work Planning: Monitoring Approach for 2023-24	
For the 2023-24 core program, provide a summary of the required core program components, key methods to be used, and deliverables with anticipated completion dates.	The core/surveillance monitoring activities are summarized above. Below are the key methods associated with each activity. The deliverables and anticipated completion dates are given in the "Forward-Looking Implementation Outline" section towards the end of this template. -**Continuous Ambient Air Monitoring Stations**: air pollutant concentrations and meteorology are monitored continuously and reported in-near real time. Parameters are monitored using commercially available analyzers that comply with Alberta's Air Monitoring Directive. Some stations have semi-continuous air monitoring of speciated VOCs and RSCs. -**Integrated Ambient Air Monitoring**: air samples are collected periodically using a variety of techniques (e.g., filters, canisters). Samples are analyzed for detailed chemical composition in a laboratory. -**Passive Air Monitoring**: gases are passively collected onto a sampler and analyzed in the lab to give longer-term (e.g., monthly) average concentrations. -**Precipitation and Dry Deposition Monitoring**: pollutants in precipitation are collected in samplers and analyzed in a lab to calculate wet deposition. Air pollutants are also sampled with integrated techniques (see above) and are analyzed to calculate dry deposition. -**Lichen Sampling**: lichen samples are collected every 6 years from hundreds of sites and analyzed for contaminants. Results are interpreted to understand sources, patterns, and magnitude of air pollutants. -**Forest Health Indicator Sampling**: indicators of forest health (e.g., soil pH, vegetation, tree characteristics) are sampled every 6 years at sites co-located with deposition monitoring, in order to investigate terrestrial ecological responses to deposition. -**Snowpack Sampling**: snowpack samples are collected every year (intensive sampling at more sites every 3 years) and analyzed for contaminants. Results accurately quantify wintertime contaminant deposition and input into ecosystems, as well as identify sources, patterns, and magnitude of air pollutants. -**Wetlands Indicator Sampling**: indicators of bog and fen health (e.g., vegetation abundance, plant/lichen tissue, water quality) are repeatedly sampled at roughly six sites every year throughout the growing season. Sampling is located with deposition monitoring, in order to investigate wetland ecological responses to deposition.

	-**GEM-MACH**: a comprehensive chemical transport model that simulates emissions, transport, chemical transformations, and deposition of many air pollutants. As the GEM-MACH evaluation and improvement work (e.g., comparison to measurements) concludes, it will transition to an 'operational' tool that will support the OSMP through a variety of ways (e.g., produce annual deposition, conduct scenario modelling, identify the impact of specific sources on air quality and deposition). -**Community Odour Monitoring Program**: an application that members of the public can use to report and record odours.
Outline the plan for data sharing and accessibility, to ensure that all 2023-24 program year data will be provided and accessible no later than December 31, 2024. Include: a. State of the Environment Report inputs b. Raw data per any established delivery standards, and c. Other data analysis outputs to provide for Data Portal utilization	All of the aforementioned data are available at one or more of the following locations, and are posted as soon as feasible: -Alberta's Air Data Warehouse: https://www.alberta.ca/alberta-air-data-warehouse.aspx -WBEA website: https://wbea.org/historical-monitoring-data/ (continuous data) and https://wbea.org/network-and-data/integrated-data-search/ (integrated data) -LICA website: https://lica.ca/resources/ -PRAMP website: https://prampairshed.ca/air-monitoring/air-monitoring-network/ -OSM Data Catalogue: http://osmdatacatalog.alberta.ca/dataset -ECCC OSM Data Catalogue: https://catalogue.ec.gc.ca/geonetwork/osm/eng/catalog.search This work will continue to support to the State of Environment Report, as requested. Contributions to the forthcoming State of Environment Report include: -Chapter 3: State of Air: • (Ambient) NO_2, SO_2, $PM_{2.5}$, THC, H_2S/TRS, PACs, Trace Elements • (Modelled) PACs, Acidic Deposition -Chapter 4: State of Aquatics • Snow Deposition: Elements and Polycyclic Aromatic Compounds All data analysis outputs will be provided to the OSM Data Portal, as requested.
Theme Area Work Planning: Alignment with Relevant Regulatory Requirements	
Please indicate any potential linkages to EPEA Regional Environmental Monitoring Requirements.	Many of the ambient air quality monitoring stations, and activities related to deposition/effects monitoring, are required by EPEA approvals.
Theme Area Work Planning: Forward-Looking Implementation Outline	
What are your specific deliverables/outcomes for Years 1-3? (For an existing Core Monitoring project, examples could include: 1) continue data collection; 2) analyze existing data;	We've reformatted this section for readability, and grouped deliverables into core/surveillance and focused/investigation of cause. Y1 denotes 2023-24. Please note the timelines are estimates, and depend on funding. <u>Core/Surveillance Monitoring</u>:

3) produce technical report for the Program based on data analyses; 4) contribute to SoE reporting)	1) On-going sample collection, site maintenance, analysis, and data processing for routine monitoring (Y1-Y3) 2) Produce Technical Reports, including monthly data reports, annual Airshed reports and the OSM Annual Report (Y1-Y3) 3) Contribute to SoE Reporting (Y1-Y3) 4) Publish peer-reviewed papers using core/surveillance monitoring data (Y1-Y3) 5) Continue to hold monthly TAC meetings to discuss current issues and transitioning to an Adaptive Monitoring Framework (Y1-Y3) <u>Focused Studies/Investigation of Cause</u>: 1) Develop baseline(s) for core monitoring parameters to support transition to an Adaptive Monitoring Framework (Y1; dependent on funding for a TAC Analyst) 2) Define limits of change for core monitoring parameters (Y2; dependent on progress on baseline and TAC Analyst funding) 3) Submit peer-review paper and technical summary report for SIKIC on the GEM-MACH model-measurement comparison study (Y1) 4) Transition GEM-MACH to 'routine' tool to provide required products for the OSM Program (e.g., annual deposition maps, scenario testing, identifying source-pathway-receptor linkages) (Y1-Y2), followed by periodic model evaluation every three years. 5) WBEA Network Assessment Working Group final report and implementation of recommendations, pending SIKIC and OC approval (Y1) 6) LICA Acid Deposition Monitoring Program Expansion final report and expansion of network (Y1-Y2)
Additional Considerations	
An external technical review is expected in 2023 as part of the Program's five-year review. Identify any needed components to be ready for, and respond to, an external technical review. Outline any additional information that SIKIC should be aware of in reviewing this preliminary scoping information.	Without knowing what information will be required of the TAC for the purposes of an external review, it is not possible to identify any additional components or resources required. The TAC suggests that once the external review has been clearly defined, resources be provided to the TAC based on needs identified at that time. We recommend the OC and SIKIC consult with the TACs to help define scope and timelines for the five-year review.

ANNEX – Supporting Attachments

- OC Motion #2022-6A,B
- Evaluation of Key Questions to the EEM Framework
- CM Figure