

FOCUSED STUDY ACTIVITY WORK PLAN

General Information

Work Plan Unique Identifier:	A-PD-6-1718
Focused Study Activity Title:	Integrated Deposition Monitoring Design
Focused Study Category:	Monitoring Design, Method Improvement, and Program Design
Geographic Location (<i>choose from drop-down menu. If Project Location is in more than one area choose from second drop-down</i>)	Entire oil sands region and surrounding areas
Monitoring Site(s) Coordinates (<i>latitude and longitude</i>)	N/A
Responsible Manager(s):	Stewart Cober Jaime Dawson
Organization and contact information:	Environment and Climate Change Canada (ECCC) Air Quality Processes Research Section, Air Quality Research Division (AQRD), Atmospheric Science and Technology Directorate (ASTD) 4905 Dufferin Street, Toronto ON M3H 5T4 Stewart.Cober@Canada.ca; tel. 416-739-4618 Jaime.Dawson@Canada.ca; tel. 905-336-4883
Date Study initiated:	April 1, 2017
Monitoring Category: (<i>From OSM long-term plan; choose from drop-down menu</i>)	<i>Deposition monitoring in air, water and biodiversity components</i>
Strategic Objective of Focused Study: (<i>From OSM long-term plan; choose from drop-down menu</i>)	Objective W3: Integration and Synthesis <i>Integration and Synthesis across air, water and biodiversity deposition studies</i>
Hypotheses: (<i>Briefly outline the specific hypotheses that your focused study is aiming to address</i>)	In 2017/18 OSM (Oil Sands Monitoring) work plans, there are 9 projects related to atmospheric deposition of various pollutants (i.e., stressors) and/or their potential impacts on ecosystems (i.e., receptors). These include projects in support of all three components (i.e., air, water, and biodiversity (wildlife)). The projects are listed in the Appendix below. Information on spatial and temporal patterns of pollutant deposition is necessary to assess ecosystem exposure and potential impacts. An integrated deposition monitoring program, informed by clearly articulated information needs for understanding ecosystem receptors, will support: <ul style="list-style-type: none"> (i) better estimates of atmospheric pollutant concentrations and emissions rates; (ii) improved data sharing and availability among

	<p>components;</p> <ul style="list-style-type: none"> (iii) increased awareness of key information gaps to understand receptor behavior; (iv) cost saving associated with shared infrastructure; and (v) standardized measurement protocols. <p>A coordinated, question-driven deposition program will allow an improved understanding of atmospheric deposition on environmental receptors including forests, wetlands, lakes, amphibians and birds, and will ultimately provide the scientific information required to support regulators, policy makers, industry and stakeholders.</p> <p>Appendix A: List of 2017/18 JOSM deposition projects</p> <ul style="list-style-type: none"> (1) A-MD-2-1718 Deposition and Effects (2) A-LTM-S-9-1718 Atmospheric Deposition to Lakes and Snowpack (3) A-LTM-E-8-1718 Acid-Sensitive Lake Monitoring (4) A-LTM-S-3-1718 Atmospheric Pollutant Deposition Monitoring Network – Forest Health (5) B-PD-12-1718 Forest Health Monitoring Program (Design Review) (6) WL-PD-10-1718 Wetland Ecosystem Monitoring (7) B-IC-8-1718 Colonial Waterbird Monitoring: Temporal and Spatial Patterns in Mercury Levels in Gulf and Tern Eggs and Possible Underlying Factors (8) B-IC-9-1718 Wildlife contaminants and Toxicology: Investigation of Pathophysiological Effects (9) WL-IC-11-1718 Amphibians and Wetland Health: Investigation of Wetland Ecosystem Health <p>This project plan has been developed based on the request of the OSM co-chairs. The work plan of this project for fiscal year (FY) 2017/18 has three components including:</p> <p>Component 1: Two webinars to be held in spring 2017 intended to gain familiarity of project results and methodologies included under this integrated work plan. The webinars will also provide the basis for a draft framework to be prepared and circulated by project leads over the summer period, ahead of the September face-to-face workshop</p> <p>Component 2: Workshop on “Evaluation and Integration of Deposition Studies” in September 2017 (Toronto)</p> <p>Component 3: Development of Standards and Protocols for the “Evaluation and Integration of Deposition Studies”</p> <p>Component 4: Literature review of cause-effects of atmospheric deposition of various pollutants for guiding future research activities</p>
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	of the “Evaluation and Integration of Deposition Studies”
<p>Deliverables:</p> <p><i>What tangible goal (s) and/or product(s) will the monitoring produce and when?</i></p>	<p>Component 1: Webinars on Current and Proposed Deposition Studies A framework document summarizing key points of the webinar presentations and proposing an integration strategy that will be discussed and finalized at the September workshop – draft framework document will be circulated during August 2017.</p> <p>Component 2: Workshop on “Evaluation and Integration of Deposition Studies” in September 2017 (Toronto) A workshop report summarizing existing deposition studies and providing recommendations for future work plan integration (2017/2018).</p> <p>Component 3: Development of Standards and Protocols for the “Evaluation and Integration of Deposition Studies” A report documenting Standards and Protocols (SOPs) of existing deposition projects in air, water and biodiversity (2017/2018).</p> <p>Component 4: Literature review of cause-effects of atmospheric deposition of various pollutants for guiding future research activities of the “Evaluation and Integration of Deposition Studies” A report summarizing deposition effects indicators, environmental regulations, and deposition knowledge requirements on the major groups of pollutants monitored in OSM including acidifying pollutants (Nitrogen (N) and Sulphur), PACs (Polycyclic Aromatic Compounds), trace metals, mercury, etc. (2017/2018).</p>

Detailed Study Plan

(Please provide detailed information on the specifics of your focused study including – (**keywords, hypothesis and the assumptions and constraints behind your hypothesis**))

Provide a maximum of 10 key words that describe this project. Use commas to separate them:

Network optimization, atmospheric deposition, air monitoring, precipitation chemistry, water monitoring, wetland monitoring, ecosystem effects, multiple pollutants, cumulative effects.

Describe how you will test your hypothesis:

The main goal of the project is to identify how the existing 9 deposition projects can be integrated more effectively. To achieve this goal, four components were developed for FY 2017/18 as described below. Future years’ work plan and budget requirements will, in part, be based on the deliverables derived from these activities.

Component 1: Webinars on Current and Proposed Deposition Studies

Two 2-hour webinars will be held in spring 2017 in order to facilitate a successful and efficient workshop in September. The primary goal of the webinars is to disseminate the current state of deposition monitoring in OSM to the relevant scientists. Throughout the webinars, Project Investigators (PIs) will each summarize their proposals with particular emphasis on: research questions/objectives, monitoring details (e.g., target analyses, sites, techniques, and ongoing measurements), monitoring gaps, and progress made to date.

A framework document will be written to summarize the key points of each project and propose a “straw-person” integration strategy. This will be circulated in August and will allow the September workshop (Component 2) to focus on identifying specific mechanisms by which integration can occur (e.g., coordinating common SOPs to be used, creating a process to share data, identifying sites that can be added/removed, utilizing model output for specific sites/species).

Component 2: Workshop on “Evaluation and Integration of Deposition Studies” in September 2017 (Toronto).

Based on a review of the existing FY2017/18 JOSM funded deposition-related project plans (see Appendix A), some redundancies/commonalities (e.g., multiple projects cover nitrogen and sulphur deposition), and some gaps/deficiencies (e.g., missing linkages among related studies in the air, water and wildlife components) were identified. Different methods/instruments are also used for obtaining similar information. Data sharing and inter-comparison of these studies are needed for assessing the efficacy, accuracy and uncertainties of the measurements. Co-located monitoring sites between the different components may also be preferred for better linking the receptor-focused and stressor-focused projects.

The purpose of the workshop will be to gather together OSM managers, project leaders and researchers to assess the feasibility of the proposed integration plan.

It is proposed to group the integrated deposition projects into four categories which are listed below. Within each category, monitoring sites, instruments, and methods need to be examined for efficacy, consistency and uncertainty. Optimum monitoring sites should be identified for maximizing the scientific output of the program, such as choosing co-located sites among the components at the long-term monitoring sites and/or at the most sensitive ecosystem places. The number of monitoring sites needs to be revisited in later years to ensure minimal redundancy and adequate coverage. For example, spatial distribution patterns may be generated from the first year’s data. These may advise on the number of sites necessary for future years’ monitoring, while still providing sufficient data coverage to address scientific questions. The four categories proposed include:

1. Monitoring air concentration, precipitation chemistry, and dry (or bulk) deposition.
 - Air concentration
 - Acidifying pollutants, inorganic ions, PM2.5 (fine particulate matter). A-MD-2-1718 component 4. A-LTM-S-3-1718.
 - Polycyclic aromatic compounds (passive and active sampling; relocation of sites to get more representative spatial distribution). A-MD-2-1718 components 1 and 2.
 - Trace metals, mercury A-MD-2-1718 components 2 and 3.
 - Precipitation chemistry
 - Precipitation chemistry for wet deposition (various pollutants). A-MD-2-1718 components 3 and 4.
 - Dry or bulk deposition measurements and inferential modeling. A-MD-2-1718 components 4 and 5, A-LTM-S-3-1718, WL-PD-10-1718.
2. Monitoring pollutants in different media
 - Pollutants levels in lakes. A-LTM-E-8-1718. A-LTM-S-9-1718.
 - Pollutants levels in snow pack (this measurement includes wet deposition plus some dry

- deposition to snow surface minus evasion. A theoretical relationship needs to be clarified so the usefulness of the data can be demonstrated). A-LTM-S-9-1718.
- Pollutants levels in forest (include soil properties). B-PD-12 -1718 (postponed).
- Pollutants levels in wetland. WL-PD-10-1718.
- 3. Monitoring receptor indicators
 - Wetland health study. WL-IC-11-1718.
 - Wildlife contaminants and toxicology B-IC-9-1718
 - Colonial waterbird egg contaminants and mercury cycling B-IC-8-1718
 - Remote sensing wetland ecosystem change detection method development. WL-PD-10-1718.
- 4. Stress-Receptor relationship studies
 - Stressors-receptor correlation analysis. B-PD-12-1718 and WL-PD-10-1718.
 - Ecosystem effects modeling – linking atmospheric deposition to ecosystem effects. This will be the ultimate goal of the OSM program, which aims to provide a comprehensive assessment of cause-effect relationship. This work will link data generated from the Integrated Deposition Project with other OSM projects monitoring receptors effects. This type of work is not emphasized in the existing work plans and should be included in future years.
 - Air component evaluation, integration, and synthesis reporting. R-1-1718.

The workshop will involve targeted discussions (possibly in the format of breakout groups) to determine which OSM deposition questions have been answered, what design components are working well, and potential monitoring adjustments/gaps that need to be addressed. The primary goal of the workshop is to identify clear mechanisms by which deposition monitoring can be better integrated.

The workshop will increase the understanding of the water and biodiversity components' needs specific to atmospheric deposition, and we will strive for commonality in future monitoring approach (e.g., parameters, SOPs, methods) amongst the three components.

Upon agreement and approval, a more detailed integration plan will be developed after the workshop. A major deliverable from this workshop will be an official report describing the current deposition work, the rationale for this work, and recommendations for integration/adjustments. Depending on the extent of integration, a subsequent workshop in 2018/2019 may be required.

Component 3: Development of the Standards and Protocols for “Evaluation and Integration of Deposition Studies”

High quality monitoring data require comparable measurement methods between different researchers and consistent data quality assurance and control procedures. To identify the similarities and differences between existing deposition studies, standards and protocols of these studies need to be collected, compared, evaluated, and properly documented.

The following activities are required:

- (i) Collect and document the standards and protocols used in air, water, and land/biodiversity deposition monitoring and research projects (including wetland monitoring).
- (ii) Track and inventory the standards and protocols that are being developed and tested for deposition studies mentioned above.
- (iii) Participate in the Deposition Integration Workshop, work with ECCC/AEP (Alberta Environment and Parks) scientists, monitoring organizations and other partners to assess standards and protocols used, and contribute to the integration of deposition monitoring activities.
- (iv) Working with ECCC/AEP managers/scientists to implement recommendations from the workshop and participate in future work planning processes to ensure consistent and

comparable standards and protocols for deposition studies and the optimization of efficiencies of the deposition monitoring programs.

Component 4: Literature review of cause-effects of atmospheric deposition of various pollutants for guiding future research activities of the “Evaluation and Integration of Deposition Studies”

To provide a scientific basis for integration of deposition projects, it should be clearly identified what deposition information is needed to assess ecosystem and human health exposure, such as the number of chemical compounds and associated negative impacts, and preferred spatial and temporal resolutions of deposition information. A brief literature review is recommended to summarize available information and document deposition requirements, effects indicators, and environmental regulations on the major groups of pollutants concerned in JOSM including acidifying pollutants (N+S), base cations, nitrifying pollutants, PACs, trace metals, mercury, etc.

Future years’ work plan:

- Adapt work plans/monitoring according to workshop findings (e.g., co-locate receptor/stressor sites, add/remove sites, add/remove measurements)
- Follow-up workshop(s) to facilitate the above
- Data products, data sharing, and scientific papers

Assumptions and Constraints behind the hypothesis and the testing method:

Deposition studies will use consistent and comparable methods for data acquisition. Modeled results will be validated with observations and other alternative models.

Integration of all the deposition projects requires close collaboration among all the project leaders.

Data Management

If this work generates data please summarize your project-level data management plan.

Deliverables	Timeframe
Data Collection Period: <i>Field work</i>	Not applicable
Data Analysis Period: <i>Laboratory analysis and QA/QC of data</i>	Not applicable
Data Release Date: <i>Metadata and data consistent, complete and meet basic standard format for publication in Open Data; on or linked to JOSM portal</i>	Not applicable

Reporting and Publications

Provide information on the anticipated reports / publications. (Insert additional rows if needed)

Expected Subject/Titles of Publications or Reports	Short Description of Publication or Report	Expected Year of Publication
Framework document – Summary of webinars and framework for workshop	As per expected subject/title	August 2017
Workshop report - Evaluation and proposed integration of OSM deposition studies	As per expected subject/title	2017/2018
Summary of Standards and Protocols of OSM deposition projects in air, water and biodiversity	As per expected subject/title	2017/2018

A review of causes and effects indicators for JOSM monitored pollutants	As per expected subject/title	2017/2018
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Technical / Professional Roles and Responsibilities

Identify members of the monitoring team/organization, their roles and responsibilities. Identify monitoring organization leads if different from overall monitoring activity lead. (Insert additional rows if needed)

Role	Responsibilities	Resource Name/Organization
Project co-lead / Principal Investigator	Project coordination and principal investigator	ECCC
Project co-lead / Principal Investigator	Project coordination and principal investigator	AEP
Component 1: Webinars on Current and Proposed Deposition Studies		
Science Specialists	Presentations on Deposition Studies at webinar series to facilitate knowledge sharing to inform evaluation and integration	ECCC / AEP / Wood Buffalo Environmental Association (WBEA)
Component 2: Workshop on “Integrated JOSM Deposition Program” in September 2017 (Toronto or Edmonton).		
Component 2 Project lead	Project coordination	ECCC / AEP
OSM Air Component leads	Workshop participation / Oversight of integration process	ECCC / AEP
OSM Wildlife component leads	Workshop participation to inform evaluation and integration	ECCC / AEP
OSM Biodiversity component leads	Workshop participation to inform evaluation and integration	ECCC / AEP
OSM Air Component Science Specialists	Workshop participation to inform evaluation and integration	ECCC / AEP
OSM Water Component Science Specialists	Workshop participation to inform evaluation and integration	ECCC / AEP
OSM Wildlife and Biodiversity Component Science Specialists	Workshop participation to inform evaluation and integration	ECCC / AEP
OSM Partners	Workshop participation to inform evaluation and integration	Various organizations
Component 3: Development of the Standards and Protocols for the “Integrated JOSM Deposition Program”		
Component 3 Project lead	Project coordination	AEP
Science Specialist	Analytical Chemist	AEP

Science Specialist	Environmental Statistician	AEP
Science Specialist	Standards and Protocols Specialist	AEP
Co-op student	Project support	AEP
Component 4: Literature review of cause-effects of atmospheric deposition of various pollutants for guiding future research activities of the "Integrated JOSM Deposition Program"		
Component 4 Project lead	Project coordination	ECCC
Contractor	Conducting literature survey	

Deliverables (Year 1) If your Focus Study is longer than 1 year then complete **Appendix 3** for multi-year deliverables breakdown

Provide a summary of tangible quarterly deliverables. Identify major project areas (deliverables) and results that can be identified as a tangible goal. This could include: field work, lab work/ analysis, evaluation, data, reports, publications, SOPs etc. Do not define process as your Deliverable e.g. ‘fly to Ft. McMurray to conduct fieldwork’ or ‘seek Director approval for report’.

Deliverable(s) (please provide enough information to support status reporting)
Q1 – April to June
Component 1: Organize and hold webinar series
Component 2: Prepare workshop travel needs, agenda, and logistic arrangements.
Component 3: Establish contacts with PIs (principal investigators) and scientists regarding SOP updates and documentation.
Q2 – July to September
Component 1: Circulate framework document to workshop participants
Component 2: Organize the workshop.
Component 3: Post and update deposition study SOPs as appropriate; participate in the workshop
Component 4: Process a service contract conducting literature review.
Q3 – October to December
Component 2: Draft workshop report.
Component 3: Contribute to the draft workshop report regarding SOP and integration discussions
Q4 – January to March
Component 2: Circulate and revise the workshop report.
Component 3: Update SOP inventories (existing and being developed); participate in work planning activities to support future integration of deposition studies.
Component 4: Draft a literature review report.

Detailed Financial Breakdown – Year 1 of 3 (2017-2018)



Also complete **Appendix 2** for the multi-year financial breakdown

Budget requirements – List areas that require budget expenditures: (ADD OR DELETE BUDGET CATEGORIES AS REQUIRED)	OS Funding	External Funding (outside JOSM)
O&M - Operations and Maintenance:		
Helicopter Costs	\$	\$
Field Costs	\$15,000 (AEP, component 2)	\$
Data Management	\$	\$
Internal Lab Analysis	\$	\$
Consumable Materials & Supplies	\$	\$
Sub-Total	\$15,000 (AEP, component 2)	\$
O&M - Travel		
Field Work	\$5,000 (AEP, component 2)	\$
Conferences (<i>identify conference</i>)	\$5,000 (AEP, component 2)	\$
Meeting (<i>identify meeting</i>)	\$28,513 (AEP/ECCC, component 1)	\$
Sub-Total	\$40,000	\$
O&M - External Contracts :		
Goods and Services Contract (<i>TBC</i>)	\$22,000 (ECCC, component 3)	\$
External Lab Analysis	\$	\$
Sub-Total	\$22,000	\$
Salaries:		
Principal Investigator	\$	\$20,000 (ECCC) \$33,000 (AEP)
Technical / Professional Assistants	\$50,000 (AEP, component 1)	\$

Budget requirements – List areas that require budget expenditures: (ADD OR DELETE BUDGET CATEGORIES AS REQUIRED)	OS Funding	External Funding (outside JOSM)
Field Staff	\$	\$
Sub-Total	\$	\$
Total Salaries	\$50,000	\$53,000
Total O&M	\$75,213	\$
2017-2018 GRAND TOTAL (*Before other related costs)	\$125,513	\$53,000

*Total O&M costs for ECCC (\$36,263) in 2017-18 with other related costs are \$37,750. Total Salary costs for AEP in 2017-18 are \$50,000. Total O&M costs for AEP in 2017-18 are \$39,250. The Grand Total for ECCC and AEP is \$127,000 in 2017-18.

Appendix 1 - Approvals

Project Submitted by:		
Name: Stewart Cober		
Organization: ECCC	Signature:	Date:
Project Approved by:		
Dr. Monique Dubé (AEP)		Dr. Kevin Cash (ECCC)
Signature 		Signature 
Date		Date

APPENDIX 2 – Detailed Multi-year Financial Breakdown (Complete the following detailed financial breakdown; add or delete categories as required)

Budget requirements	Year 1 (2017- 2018) APPROVED		Year 2 (201X- 201Y)		Year 3 (201X- 201Y)	
	Cash	In-kind	Cash	In-kind	Cash	In-kind
1) Salaries and benefits						
a) Investigators		\$20,000 (ECCC) \$33,000 (AEP)				
b) Technical/professional assistants	50,000 (AEP)					
c) Field Staff						
d)						
2) Operations and maintenance						
a) Facilities						
b) Equipment						
c) Lab analysis						
d) Data management						
e) Field work (and lab analysis)	15,000 (AEP)					
3) Consumable Materials and supplies						
a)						
4) Travel						
a) Conferences and meetings	5,000 (AEP)					
b) Field work	5,000 (AEP)					
c) Project-related travel	28,513					

	(14,263 (ECCC) / 14,250 (AEP))					
5) Dissemination & Engagement						
a) Publications/Reports						
b) Translation (if required)						
c) Communications						
d) Stakeholder Engagement						
e) Indigenous Peoples Engagement						
6) External Contracts						
a)	22,000 (ECCC)					
Grand Total (*Before other related costs)	\$125,513	\$55,000				

*Total O&M costs for ECCC (\$36,263) in 2017-18 with other related costs are \$37,750. Total Salary costs for AEP in 2017-18 are \$50,000. Total O&M costs for AEP in 2017-18 are \$39,250. **The Grand Total for ECCC and AEP is \$127,000 in 2017-18.**

APPENDIX 3 –Years 2 and 3 Deliverables (Complete the following detailed breakdown. Provide a summary of tangible quarterly deliverables. Identify major project areas (deliverables) and results that can be identified as a tangible goal.)

Year 2 (2018-2019)
Deliverable(s) (please provide enough information to support status reporting)
Q1 – April to June
<p>Future work is proposed to include the following:</p> <ul style="list-style-type: none"> Adapt work plans/monitoring according to workshop findings (e.g. co-locate receptor/stressor sites, add/remove sites, add/remove measurements) Follow-up workshop(s) to facilitate the above <p>However, the work plan and budget requirements will become known as progress is made in 2017/18.</p>
Q2 – July to September
Q3 – October to December
Q4 – January to March