

INSTITUTE FOR OIL SANDS INNOVATION AT THE UNIVERSITY OF ALBERTA

Breakthrough Energy Research | Advanced Environmental Technologies



LETTERS OF INTENT FOR OIL SANDS RESEARCH

DEADLINE: 20 DECEMBER 2018

Format

Each Letter of Intent should be sent by email, as either an MS-Word document or PDF file using the attached template. The letters must use an 11-point or larger font size and be no more than one page in length. Faculty members are encouraged to submit more than one Letter of Intent, if they wish to propose distinctly different research ideas.

Scope of Research

The mandate for the Institute for Oil Sands Innovation (IOSI) is to find efficient, economically viable and environmentally responsible methods to develop Canada's oil sands resources. Research at the University of Alberta, partner universities and government research laboratories, in collaboration with IOSI's partners, will seek innovative new methods to produce bitumen from shallow oil sands deposits (<100 m) and process it to yield value-added products. These new technologies must have the potential to offer substantial benefits in terms of improved energy efficiency, reduced cost, and reduced environmental impact, relative to commercially available technologies.

Purpose of the Letter of Intent

Letters of Intent will be used to identify research ideas of interest to IOSI. We then work with the researcher to develop a full proposal to be considered for funding. We may also help to identify expertise to enhance projects through collaboration. The timeline for applications and proposals is as follows:

Letters of Intent Due	December 20, 2018
Request for full proposals	February 8, 2019
Full Proposals Due	March 15, 2019
Start of new projects	Variable

Research Theme Areas, and IP ownership

1. Extraction

Various aspects of both water-based extraction and non-aqueous extraction (NAE) from oil sands. IP generated from research in this theme area is retained by the University of Alberta.

Water-based

- a. Improve bitumen liberation and recovery in HT + PSC with an emphasis on high fines ores
- b. Improve fundamental understanding of slurry conditioning in hydrotransport (HT)
- c. Improve fundamental understanding of caustic / surfactants (naturally occurring or additives) on operability (e.g., liberation, flotation) and bitumen quality (e.g., TAN, Ca-Naphthenates)
- d. Methods to reduce TAN, Ca²⁺, Sulfur, etc. in the bitumen without affecting extraction performance

Solvent-based

- a. Identify new breakthrough / step-out technologies to extract bitumen at lower cost / lower energy to the currently available hot water extraction technology for oil sands mining. Bitumen product must meet 300 ppmw solids spec (on a dry bitumen basis).

2. Product Cleaning and Partial Upgrading

Research topics include bitumen froth treatment, cleaning of bitumen generated from NAE, and partial upgrading of bitumen. IP generated from research in this theme area is retained by the University of Alberta.

- a. Reduce/eliminate diluent use
- b. Improve maltene recovery in Paraffinic Froth Treatment (PFT)
- c. Improve fundamental understanding of froth quality (e.g., clay content, froth ageing, asphaltene content, etc.) on Paraffinic Froth Treatment (PFT)
- d. Innovative deasphaltene process. Identify lower cost / lower energy technologies to Paraffinic Froth Treatment to reduce solids content from ~1 wt% solids down to below 300 ppmw (on a dry bitumen basis)
- e. Improve viskreaking product stability at high conversions
- f. Asphaltene modification to retain 100% bitumen yield – as oil or by-product
- g. Suppress addition reactions during thermal cracking
- h. Selective C-S bond breaking without gas production. Maximize yield by selective removal of sulfur

3. Online Instrumentation for Oil Sands

Development of sensors and online monitoring technologies for smooth and robust commercial oil sands operations. IP generated from research in this theme area is retained by the researchers and researcher-affiliated organizations.

- a. Identify process stream properties that are desirable to be measured and monitored in the oil sands operations
- b. Identify available sensing technologies as well as potential sensing technologies to meet the needs of industrial online measurements, monitoring and process control

Send completed form to [Jagvir Singh at jagvir@ualberta.ca](mailto:jagvir@ualberta.ca) by **1300h December 20, 2018**

List of priority items to focus on:

- a. Faster bitumen/solids/water estimation in place of Dean-Stark analysis. The highest priority is on “online bitumen content determination in tailings and middlings slurries”
- b. Large lump detection to improve crusher performance / reliability
- c. Metal detection upstream of the crusher
- d. Measurement tool for size distribution of lumps downstream of the secondary / tertiary crushers and lump measurements in HT close to the PSC inlet to understand ablation
- e. Online viscosity measurement for PSC middlings layer
- f. A clay analyzer would be very useful (potentially in place of a fines analyzer)
- g. Real time asphaltene measurement of froth to enable better online control of paraffinic froth treatment (PFT)
- h. Online slurry rheology
- i. Something that could tell us clay or fines distribution within a cell, or in a subaqueous environment (for tailings deposition)

General comments for online instrumentation:

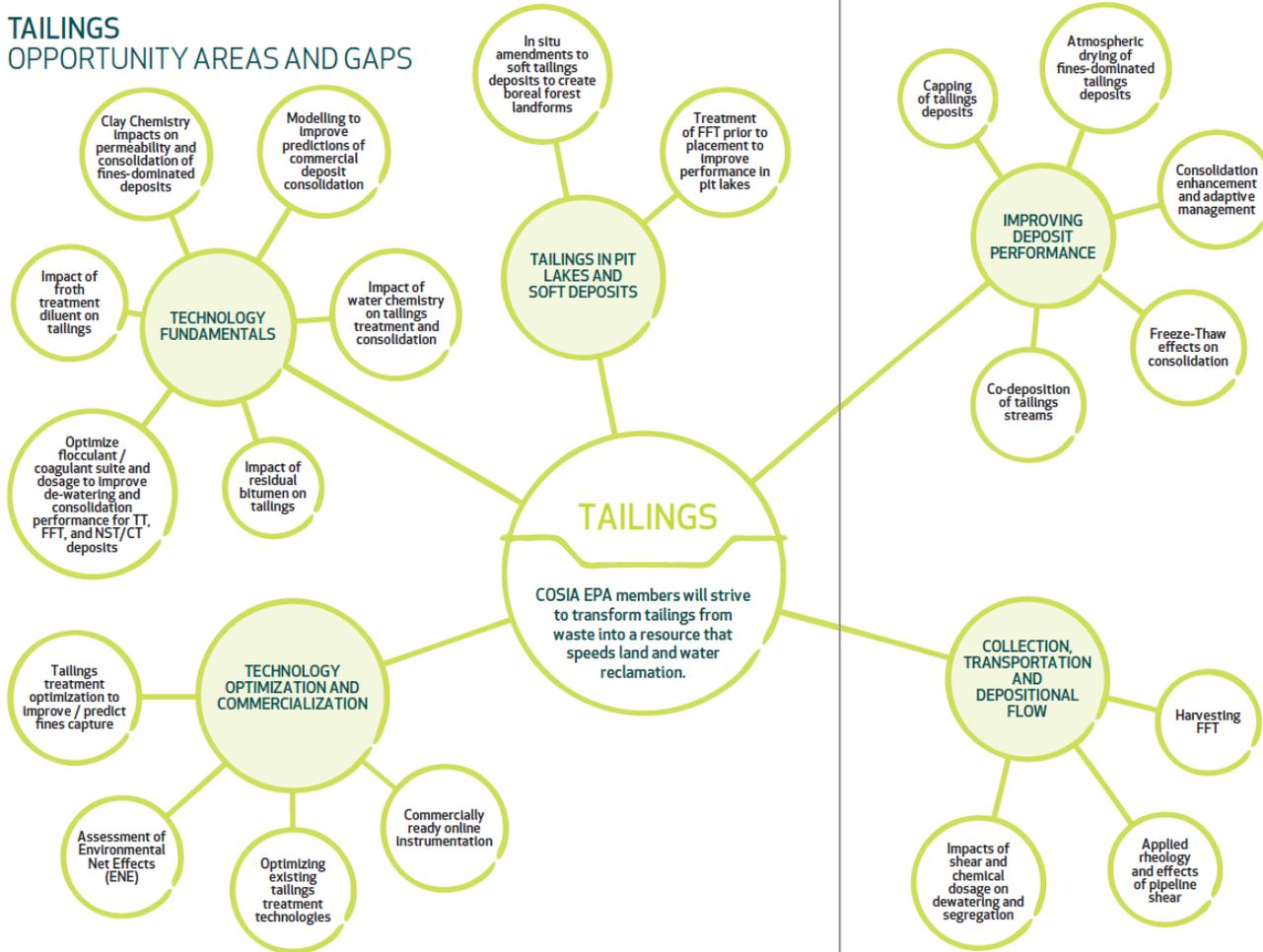
- a. In the online instrumentation theme, the research scope is between fundamental and prototyping, mostly aiming to solve problems. So the project is not completely fundamental. For example, one can propose to use LIBS on a particular stream of oil sands operation to get an understanding how it might work. The research projects are mostly early testing of a potential new technique.
 - b. Presently, some of the analyzers in use do not provide reliable and repeatable data. The parts failure rate is very high and require excessive maintenance
 - c. Fouling is a major issue with probes (sensors) being used in oil sand applications
 - d. Problems are caused by the accumulation of clays, bitumen, etc. Operating conditions are harsh (wide temperature variations), so reliability and easy maintenance is important. Should think about fouling possibility when looking at a new technique.
 - e. Erosion is very high in slurries because of sand, etc.
4. Tailings Fundamentals (in collaboration with *Canada’s Oil Sands Innovation Alliance*)

Various aspects of oil sands tailings dewatering, consolidation, and management. IP generated from research in this theme area is retained by the researchers and research-affiliated organizations.

The tailings letters of Intent will be reviewed by both IOSI and COSIA partners and we will jointly determine which LOI proposals will move to submission of a full proposal.

COSIA has identified several technology areas of interest to its members, where increased focus on fundamental understanding, technology development, or application of technologies from other areas would be of great interest. The full list of technology areas of interest is available as Figure 1 (reprinted from the COSIA website). Some topics of interest include:

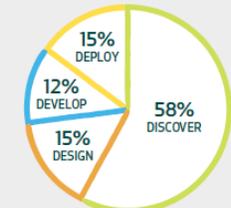
TAILINGS OPPORTUNITY AREAS AND GAPS



PROJECT PORTFOLIO

164	Contributed technologies (32 obtained in 2016)
\$705M	Cost to develop technologies (\$41 million in 2016)
75	Current (active) projects (33 obtained for 2016)
\$319M	Cost for current projects (\$185.5 million in 2016)
164	Completed projects (32 completed in 2016)
\$705M	Cost for completed technologies (\$41 million in 2016)

ACTIVE PROJECT PORTFOLIO BY 'D' PHASE



- DISCOVER:** Scientific research. Early translation to applied R&D. Application is speculative.
- DESIGN:** Proof-of-concept. Basic integration of pieces for component validation.
- DEVELOP:** System validation with testing in a relevant environment.
- DEPLOY:** System prototype at/near scale. Field demonstration. Integration into existing system.

- Potential technologies for treatment of in-process or legacy tailings generated from oil sands processing. Areas of interest encompass but are not limited to chemical, mechanical, thermal or electro-chemical treatment.
- Fundamental understanding of clay/fines/solids-bitumen-chemical interactions leading to development of effective tailings treatment approach.
- Effect of process conditions and chemicals on end of process tailings generation, settling and consolidation.
- Modelling to improve predictions of commercial deposit consolidation.
- Assessment of environmental net effects of tailings processes, including an understanding of knock-on impacts (energy consumption, cost, water use, NORM, etc.) and the full life-cycle assessment of the impacts of various technology options on these and other topics.
- Depositional flow and segregation of non-Newtonian slurries.
- Treatment of fluid tailings in pit lakes (both prior to placement and in-situ) to move toward suitable reclamation objectives.

The call for Tailings Letters of Intent is specifically for research projects and proposals that fall within the tailings area. Proposals for pilot operations, database preparation, projects that fall under the COSIA Water Environmental Priority Area (EPA) or other such items that do not fit within a research area of the Tailings EPA will be considered out of scope for this request. Information on the other areas of environmental priority or submission of other technology proposals can be found on the COSIA website. If you are unsure if your tailings project meets the criteria for submission of an LOI or if you have questions related to tailings, please contact Adedeji Dunmola at dunmola.adedeji@syncrude.com.

Intellectual Property and Publication:

IP ownership depends on project theme areas. Irrespective of IP ownership, partner universities/organizations in IOSI projects share the benefits of commercialization with the University of Alberta and Imperial Oil. Publication is encouraged after IP has been protected. Results of projects under the Tailings Fundamentals theme will be openly shared, license-free, with the members of Canada's Oil Sands Innovation Alliance (COSIA).

Letters of Intent [Template] should answer the following questions:

Proposed Research or Process Concept

What research do you propose to undertake?

Expected Advantages Relative to Current Commercially Available Technologies

How would the proposed research lead to a substantial benefit for oil sands development, relative to current technology?

Funding, Resources, Equipment Required

How much time, resources, and new equipment would be required to do the research and take the technology, if applicable, to the stage where it is ready for pilot testing?

Note that preference is given to projects that include training of students and postdoctoral fellows, and that major equipment acquisition is discouraged as ideally the proponents should already have the facilities/expertise for the proposed research. Access to the IOSI labs and facilities as well as IOSI technical support is also possible and encouraged. Please contact Qi Liu at qliu@ualberta.ca or 780-492-8628 should you have any questions.

Institute for Oil Sands Innovation (IOSI)

Agreement on Conditions for Researcher Participation in IOSI Projects

Agreement to the following terms is required if your research idea is accepted as a funded project by IOSI.

Structure for the Institute for Oil Sands Innovation (IOSI) is provided through the Foundation Agreement between the University of Alberta (UofA) and Imperial Oil Limited (Imperial Oil). IOSI will work with researchers to establish and monitor the progress of research projects, and to ensure that procedures for publication, disclosure of intellectual property, and maintaining confidentiality are followed. Consistent with the Foundation Agreement, recipients of IOSI funding must agree to the following conditions:

- 1) Intellectual property (IP) – Creation of new IP in all IOSI projects will be governed by the Foundation Agreement which grants certain rights to Imperial Oil. This stipulates that new IP created by university researchers may not be commercialized independently, but rather must proceed through the UofA. This includes IP created by students working on IOSI-funded projects. University of Alberta and partner universities share in the financial benefits of commercialization of research results. The distribution of net revenues to researchers follows the policy of their university. For projects under the tailings process fundamentals theme, the results of the research will be openly shared, license-free, with the members of Canada's Oil Sands Innovation Alliance (COSIA) – Tailings EPA.
- 2) Confidentiality – All researchers shall make reasonable efforts to prevent disclosure to third parties of any confidential information provided by UofA, Imperial Oil or other collaborators in support of the project. Such information shall be identified in writing as confidential. This obligation does not apply if the information is already known to the researcher, or is revealed by third parties who have no duty to maintain such confidentiality, or after 10 years of receipt of the information.
- 3) Publication rights – The Manager of IOSI must be provided with copies of all theses, presentations, and manuscripts at least 30 days before submission for publication to permit review for possible IP protection. IOSI is responsible for working with Imperial Oil to review materials and obtain approval from the Executive Management Committee (EMC) for publication. If the EMC determines that protection of IP is warranted, the submission may be delayed for a period up to 6 months to secure that protection. On collaborative projects, disclosure of manuscripts to collaborators at least 60 days before publication is also necessary to allow review for any confidential information. Consequent requests to remove confidential information shall be provided within 45 days of receipt of the manuscript.
- 4) Project reviews – IOSI projects shall be subject to a staged review process to ensure progress and relevance. Reports to facilitate this process will be provided at the request of the Manager of IOSI. Continued funding may depend on successful review of progress by the IOSI Scientific Advisory Committee (SAC).
- 5) Principal investigator honorarium/salary/benefits – IOSI emphasizes on training of highly qualified personnel. Therefore, IOSI funds are not to be used to cover the honorarium or salary/benefits of the principal investigators.
- 6) Indirect costs – IOSI provides a flat rate of 20% to non-UofA research providers for indirect cost.
- 7) Termination – The Foundation Agreement provides for its termination by either party with 180 days written notice. In the event the agreement is prematurely terminated, the researchers agree to work with the EMC to effect an orderly termination of active research.

LETTER OF INTENT

Name:

Department and University:

Title of Project:

Proposed Research or Process Concept:

Expected Advantages Relative to Current Commercially Available Technologies:

Funding, Resources, Equipment Required

Research staff required (students, post-doctoral fellows etc.):

New equipment required:

Approximate time required:

Total funds required:

Comments: