



CTRS

Market Intelligence

MARKET ASSESSMENT

January 28, 2025

PROJECT REPORT FOR:

Shawn Lewenza
[TBC] Luminous BioSolutions

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Introduction

Shawn Lewenza is a professor at Athabasca University, with a PhD specializing in bacterial pathogens, biofilm formation, and antibiotic resistance. He has funding with Edmonton Unlimited to understand the opportunity with an engineered bacterial biosensor technology to monitor water samples for the presence of naphthenic acids generated from oilsands mining processes.

CTRS Solutions conducted a Market Assessment for Shawn Lewenza's patented environmental water monitoring technology. This innovative solution offers a cost-effective alternative to traditional chemical tests and is in the early stages of development.

CTRS performed a PESTLE analysis, market scans, and market size forecasting. Shawn has a different consultant working on a competitive scan. CTRS conducted four interviews with industry experts and stakeholders to provide additional insights and shed additional insights on what we found in the secondary research phase. The overall findings were analyzed and shared with Shawn Lewenza.



What is the market potential for a biosensor technology that detects naphthenic acids from oilsands?

There is limited potential for Shawn Lewenza to commercialize the naphthenic acid water monitoring technology. This report outlines the current research to support this conclusion.

Objectives

1

**Understand the
regulatory
environment for
testing naphthenic
acids in Alberta**

2

**Understand if there is
a financially viable
market for this
solution**

Methodology

We followed a systematic six-step approach for this project. First, we conducted a current **market analysis** by reviewing existing materials, including business plans and data from reputable sources. This step included examining reports, articles, and research focused on environmental water monitoring and oil sands operations to establish a solid foundation for the study.

Next, we used a combination of **open-source intelligence (OSINT)**, **proprietary databases**, and **CTRS' technology stack** to conduct secondary research. We gathered data on regulations, industry statistics, and market drivers to highlight the scale and scope of naphthenic acid monitoring. This research laid the groundwork for a **PESTLE analysis**, where we assessed political, economic, social, technological, legal, and environmental factors. We focused on regulatory mandates, technological advancements, economic drivers, and environmental concerns in oil sands operations. Shawn Lewenza outsourced the competitive analysis to another consulting group and while this information was shared with the CTRS team, it didn't yield the results anticipated due to a lack of reliable source for the information. As a result, we were unable to feed the competitive analysis into our market assessment.

After building this foundation, we interviewed four **industry experts** to gain firsthand insights into testing methods, industry practices, and emerging trends. Given what we were seeing in the research, we discussed distributing a survey, to gather a broader input from additional industry experts and validated our findings. It was not initially part of the contract, but CTRS was open to doing this work to further the depth of research for this project. However, Shawn Lewenza elected not to continue this survey with CTRS and instead do it himself at a later time. As such, CTRS was not able to gather additional primary research input and data to supplement the existing research.

We then completed a **market sizing** exercise to define the Total Available Market (TAM), Serviceable Available Market (SAM), and Serviceable Obtainable Market (SOM). These metrics clarified the market potential for naphthenic acid monitoring technologies. These findings are very conservative due to the limited data available and without being able to validate key inputs.

Finally, we combined and analyzed all the data. We identified information gaps and iteratively refined our findings to ensure credibility and actionable insights. This structured process enabled us to deliver our best efforts for a clear and strategic understanding of the market.

Research Overview

This project involved a systematic approach to understanding the market potential for naphthenic acid monitoring technologies. CTRS completed 125 hours of work which included discovery work, desk research, primary research, analysis and strategy and reporting.



MARKET SCAN

- Utilized open-source intelligence (OSINT)
- Performed a PESTLE analysis



PRIMARY RESEARCH

- Conducted four in-depth interviews
- Explored the option of a broader survey to validate findings
- Gathered qualitative insights



MARKET FORECAST

- Completed a market sizing exercise
- Created a customizable spreadsheet framework for future adjustments

Background

What are naphthenic acids?

Naphthenic acids (NAs) are a complex mixture of cycloaliphatic carboxylic acids typically found in crude oils, oil sands, and petroleum refining by-products. They are particularly prevalent in oil sands deposits, where they form a significant component of the "acidic" fraction of crude oil.

NAs are an important concern in oil refining and processing due to their corrosive nature, particularly at high temperatures. This corrosion can affect pipelines, refineries, and equipment, leading to significant maintenance challenges and costs.

To mitigate this, refineries often employ neutralizing agents, corrosion inhibitors, or methods like hydroprocessing to reduce the naphthenic acid content in oils.

Environmental Impact

Naphthenic acids can be toxic to aquatic life, leading to environmental concerns, especially in areas where oil sands are mined, such as Alberta, Canada. Tailings ponds from oil sands processing can contain NAs, making proper management and treatment of these ponds critical.

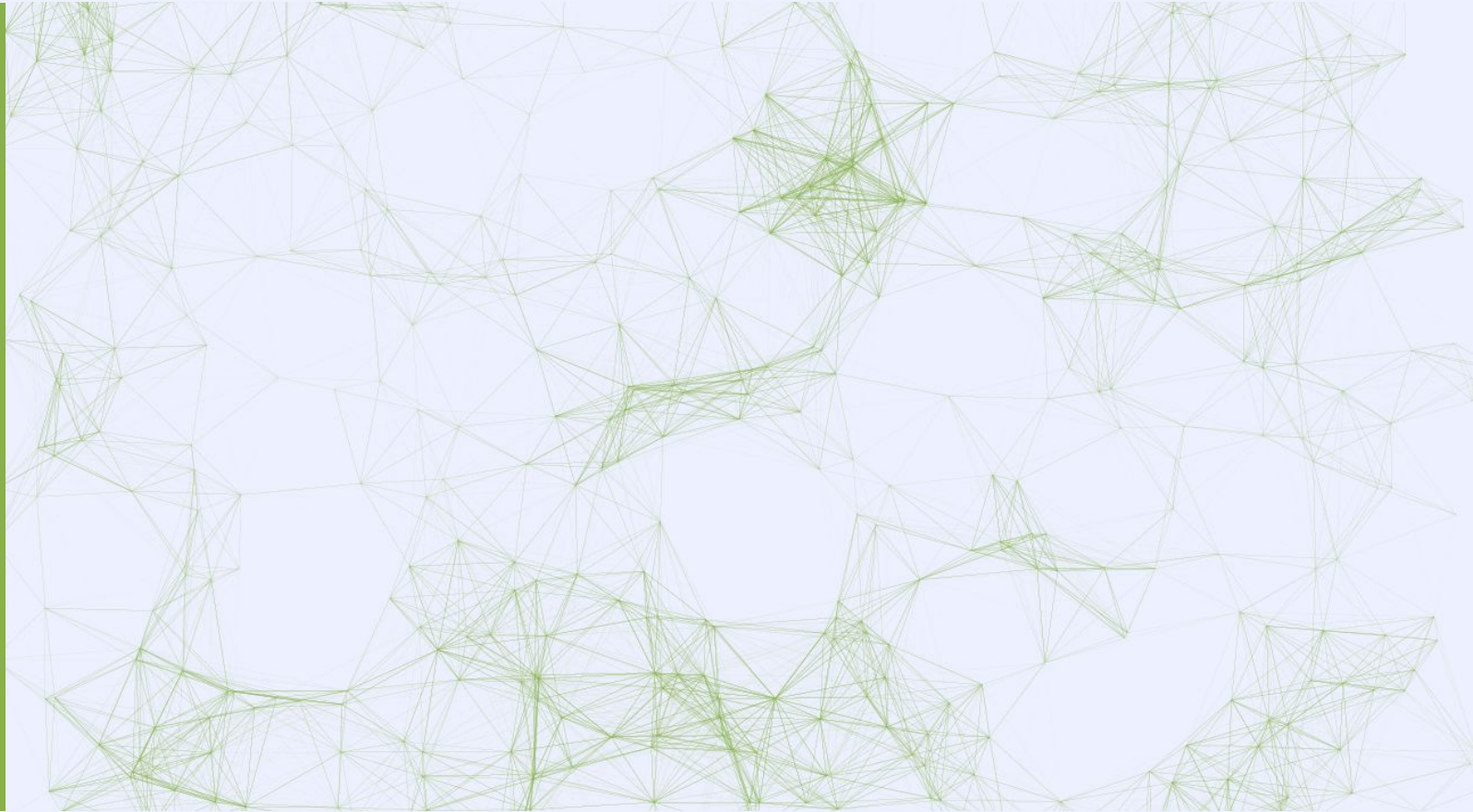
These acids are persistent in the environment, making their breakdown and removal from water sources a major research focus.

Analysis of naphthenic acids

Due to their complex structure, accurately analyzing and quantifying NAs is challenging. NA is comprised of thousands of naturally occurring compounds, which can have the same chemical formula but different structures (isomers), making analysis complex. Techniques like gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) are often used to characterize them, though no single technique can fully resolve their complexity.

These techniques can be considered the gold standard for accuracy, however, they take time and can be expensive, approximately \$800-\$1000 per sample. Biosensors are another method of testing naphthenic acids which is faster, cheaper and has the benefit of the potential to be used onsite. This is the market opportunity that Shawn Lewenza is exploring.

MARKET SCAN



PESTEL Analysis



Market Scan Findings

SUMMARY OF MARKET SCAN

- There are no current regulations requiring the testing for naphthenic acids.
- There is a clear need for improved systems which present a strategic opportunity for Shawn to position his technology as a much-needed solution, however, will require navigating the political climate in Alberta and Canada.
- According to [IBIS World](#), the environmental testing industry in the U.S. (NAICS 541380) has experienced steady growth, with a compound annual growth rate (CAGR) of 1.8% over the past five years, reaching an estimated \$2.5 billion in revenue in 2024.
- There is still more work to be done on assessing the risk of naphthenic acids and educating the public about its level of harm.
- Public concern for the environment in Canada has declined significantly [since 2015](#), dropping from the second most important issue in 2015 (11.3%) to the [eighth in 2025](#) (4%).
- Innovation is now gaining momentum in the industry. There has been a shift in patent activity reflecting a growing focus on innovation, with companies exploring solutions to improve efficiency, environmental sustainability, and resource recovery.
- Imperial Oil was fined \$50,000 by the Alberta Energy Regulator (AER) after wastewater containing toxic tailings seeped outside the Kearl oil sands lease boundary in 2022. The incident has sparked calls for regulatory reform and national water guidelines to better protect communities impacted by industrial activities.

PESTLE Analysis - Political

Federal Legislation and Support Driving Water Quality and Clean Tech Innovation

- Key federal legislation includes the [Canada Water Act](#), which supports federal-provincial collaboration; [the International River Improvements Act](#), overseeing river flow modifications into the U.S.; and other laws like the [Fisheries Act](#) and [Canadian Environmental Protection Act](#) that regulate water use, pollution, and conservation. Annual reports under these laws track water quality and environmental impacts.
- The Government of Canada's **Bill S-5, Strengthening Environmental Protection for a Healthier Canada Act**, [received Royal Assent in June, 2023](#), marking the first comprehensive amendments to the Canadian Environmental Protection Act (CEPA) in over 20 years.
 - These updates enhance protections for vulnerable populations, integrate Indigenous rights and knowledge, improve chemical management, reduce reliance on animal testing, and formally recognize the right to a healthy environment, strengthening Canada's ability to address pollution and promote environmental health.
- **The Canada Water Act:** The Act allows for federal-provincial agreements on water resource management, which could support partnerships and funding opportunities for businesses working on water quality technologies that serve national interests.
- **Governmental Support for Clean Tech:** Many governments worldwide are enhancing clean technology support, especially in sectors with high pollution risks like oil sands. This trend creates potential for partnerships and funding for monitoring technologies (IEA - World Energy Outlook 2023).

PESTLE Analysis - Political

Alberta Government support for water management

- The Premier's mandate letters outline the objectives and priorities for each minister. The Minister of Environment and Protected Areas includes:
 - Working collaboratively with the federal government, First Nations and industry to develop and implement an accelerated strategy for oil sands mine water management and tailings pond reclamation
 - Reviewing Alberta's water management strategy to increase the availability of water and water licences to Alberta municipalities, businesses and agricultural producers while maintaining the highest standards of water conservation and treatment.

Government support for business opportunities

- **The Canada Water Act:** The Act allows for federal-provincial agreements on water resource management, which could support partnerships and funding opportunities for businesses working on water quality technologies that serve national interests.
- **Governmental Support for Clean Tech:** Many governments worldwide are enhancing clean technology support, especially in sectors with high pollution risks like oil sands. This trend creates potential for partnerships and funding for monitoring technologies (IEA - World Energy Outlook 2023).



Premier of Alberta

Office of the Premier, 307 Legislature Building, Edmonton, Alberta T5K 2B6 Canada

July 10, 2023

The Honourable Rebecca Schulz
Minister of Environment and Protected Areas

Dear Minister:

I want to thank you for your service to this government, and congratulate you on your new role as Minister of Environment and Protected Areas.

Our diverse Cabinet is made up of talented and experienced leaders and I am proud to share with you our responsibility to fulfill the mandate given to us by Albertans. We all love this beautiful province and want the best for our families and our future. Over the next four years we will take clear and decisive action to grow and diversify our economy while ensuring our health, education and other core social programs are world-class.

I have full confidence that our team will build on our solid foundation of stability, informed decision-making, and good governance to improve the lives of Albertans and help our province realize its potential.

Alberta is the most responsible energy producer and exporter on Earth. Our industry and government spend billions annually on pioneering and commercializing technologies that are turning our massive oil and gas reserves into a long-term, environmentally sustainable and responsible source of energy for the world.

We must accelerate these technological advances to significantly impact the direction the global community takes in pursuing emissions-reduction strategies. Alberta has the potential to provide the world with the technology and the energy-development policies necessary to make meaningful emissions reductions while maintaining global energy security, affordability and economic growth.

Under your leadership as Minister of Environment and Protected Areas, I expect you to work closely with your Cabinet and Caucus colleagues and the public service through the committee, Cabinet and legislative processes to deliver on several key priorities that will improve our environment, promote economic growth and ensure the protection of our land, air and water. These include:

- Working collaboratively with the federal government, First Nations and industry to develop and implement an accelerated strategy for oil sands mine water management

PESTLE Analysis - Political

Political climate

- The economic importance of the oil sands remains a central topic in public discourse, particularly in Alberta and Canada, amidst discussions on how Canada should respond to potential U.S. tariffs under incoming President Trump.
- Alberta Premier Danielle Smith, known for her pro-oil sands stance, opposes leveraging U.S. dependence on Canadian oil and gas in negotiations and has publicly challenged federal regulations aimed at reducing oil sands emissions, which account for 31% of Canada's GHG emissions.
- Premier Smith's position contrasts with federal environmental policies, many of which were implemented under Prime Minister Justin Trudeau, who resigned in January 2025. These policies, such as the Carbon Tax and the Emissions Reduction Plan, have been less popular in Alberta than in other provinces.
- With federal leadership set to shift, Conservative leader Pierre Poilievre, a frontrunner in the next election, has expressed intentions to expand pipelines and repeal environmental legislation, potentially reshaping Canada's approach to oil sands and emissions policies.
- The Government of Alberta has set an aspirational goal of achieving a net-zero economy by 2050, but without a formal plan or commitments. Their approach prioritizes hydrogen and LNG development as fuel alternatives and strongly supports carbon capture technology as the primary strategy for reducing emissions.

PESTLE Analysis - Political

Improving Oil Sands Wastewater Monitoring

- The Alberta Energy Regulator is the responsible provincial entity for oil sands wastewater monitoring. It collaborates and shares information with the federal government to monitor oil sands wastewater. According to the Federal minister of Environment, a better monitoring system is needed ([CBC](#), March 2023). (More on this covered in legal section.)
- In response to seemingly slow public notification of Imperial Oil oil sands spills in March 2023, Danielle Smith said the province was working with the Alberta Energy Regulator to develop more timely notifications ([CTV](#), March 2023).
- An [Oil Sands Mine Water Steering Committee](#) was launched in March 2024 to make recommendations throughout the year and into 2025 for addressing tailings ponds. No recommendations have yet been published. A peer reviewed research study critical of AER's record for monitoring oil spills was published in January 2025 and generated some limited media attention. The study found significant gaps and discrepancies ([CBC](#), January 2025).

There is a clear need for improved systems which present a strategic opportunity for Shawn to position his technology as a much-needed solution, however, will require navigating the political climate in Alberta and Canada.



Source: CBC, Nick Vardy for Athabasca
Chipewyan First Nation

PESTLE Analysis - Political

Assessing toxicity of Naphthenic Acids

- Beginning with the 2020 reporting year, naphthenic acids and their salts, including those in oil sands process-affected water (OSPW), have been added to CEPA's National Pollutant Release Inventory. In addition, research, monitoring, and surveillance work is currently being led or funded by the Government on OSPW NAs ([Letter from Minister of Environment and Climate Change](#)).
- The letter states: OSPW NAs will be added as a priority for assessment to the proposed Plan of Priorities being developed under section 73 of CEPA. This plan will be published for consultation in summer 2024 and finalized by June 2025 as provided for in subsection 73(1) of the Act. However, with the current political climate these timelines could be impacted.
- In 2024, the federal ministers of environment and health agreed to assess the toxicity of naphthenic acids under the Canadian Environmental Protection Act (CEPA), following a formal request by environmental groups and the Athabasca Chipewyan First Nation ([Environmental Defence](#), May 2024).
- The decision came after environmental groups and a First Nation officially asked earlier this year to look into the damage caused by oil sands NAs, since they are known to have health and environmental effects.
- The request was submitted in March by Ecojustice, on behalf of the Athabasca Chipewyan First Nation, Environmental Defence and Keepers of the Water.



PESTLE Analysis - Economic

Alberta's Oil and Gas Sees Steady Investment

- According to the Alberta Energy Regulator, (Alberta Energy Outlook, 2024) Oil and Gas Production in Canada Alberta remains the largest natural gas and oil producer in Canada. In 2023, Alberta produced 61% of Canada's natural gas, although British Columbia's share of marketable gas production has trended up from 27% in 2013 to 37% in 2023.
- Alberta accounted for 84% of Canada's oil and equivalent, and 66% was marketable bitumen in 2023. In 2023, raw crude bitumen production in Alberta was close to 3.4 million barrels per day (106 bbl/d), a 3% increase from 2022.
- Estimated crude oil and natural gas capital expenditures fell to Cdn\$15.6 billion in 2023, a 6% decrease from 2022, driven by lower prices and less drilling activity.
- With the expected improvement of market access, estimated oil sands capital expenditures increased from Cdn\$11.9 billion in 2022 to Cdn\$13.2 billion in 2023, an 11% increase from 2022. Debottlenecking and efficiency enhancements on various projects contributed to the increased expenditure.
- Total oil sands, crude oil, and natural gas capital expenditures are estimated to be Cdn\$28.8 billion in 2023. Investment is projected to grow steadily over the forecast period. By the end of the forecast period, the total capital expenditures are expected to remain relatively low compared with the 2014 peak level.

PESTLE Analysis - Economic

Waste Treatment & Disposal Services in Canada

- The Waste Treatment and Disposal Services industry in Canada owns and operates waste treatment or disposal facilities, including hazardous waste treatment and disposal, and solid waste treatment and disposal
- Waste treatment and disposal services in Canada continue to benefit from consistent consumer and industrial demand for their services. While demand for recycling has been a long-term trend, waste production has continued to grow.
- The industry has been hampered by volatile crude oil prices, which, along with the pandemic, has hindered investment in the energy sector and cut demand from related activities.
- Waste treatment and disposal services revenue has grown at a CAGR of 3.6% to an estimated \$5.4 billion over the past five years, including an estimated 0.5% boost in 2024.
- Profit is expected to rebound amid stabilizing operational costs and growing adoption of automated equipment.



PESTLE Analysis - Economic

Steady Growth in U.S. Environmental Testing

- According to [IBIS World](#), the environmental testing industry in the U.S. (NAICS 541380) has experienced steady growth, with a compound annual growth rate (CAGR) of 1.8% over the past five years, reaching an estimated \$2.5 billion in revenue in 2024.
- The industry employs approximately 13,687 workers across 1,880 businesses.
- Broader environmental services, including waste management and remediation, have also grown significantly, with the sector's value added increasing from \$47.8 billion in 2010 to \$65.5 billion in 2021, according to the U.S. Department of Commerce. This growth highlights opportunities for innovative water monitoring technologies, such as those using engineered microbes, to address increasing demand for sustainable and effective environmental solutions.



The environmental testing industry's steady expansion makes it a promising market for new technologies.

PESTLE Analysis - Social

Understanding Toxicity and Health Impacts of Naphthenic Acids

- Based on the evidence reviewed and reported by Environment and Climate Change Canada and Health Canada ([Assessment - Commercial Naphthenic Acids Group](#), January 2024), there is a low risk that naphthenic acids and calcium naphthenates will harm the environment. They are not being released in amounts or conditions that would cause immediate or long-term damage to the environment, its ecosystems, or the life that depends on it, according to Canadian environmental regulations (CEPA).
- Efforts to enhance understanding of naphthenic acids in oil sands process-affected water (OSPW) are underway through the Canada-Alberta Oil Sands Monitoring program, led by Environment and Climate Change Canada.
- These initiatives focus on examining the presence and effects of naphthenic acids in tailings pond seepage. Additionally, Environment and Climate Change Canada has included naphthenic acid fraction compounds (encompassing diverse polar organic compounds found in bitumen and OSPW) and their salts in the National Pollutant Release Inventory, starting with the 2020 reporting year.

Clearly, there is still more work to be done on assessing the risk of naphthenic acids and educating the public about its level of harm.

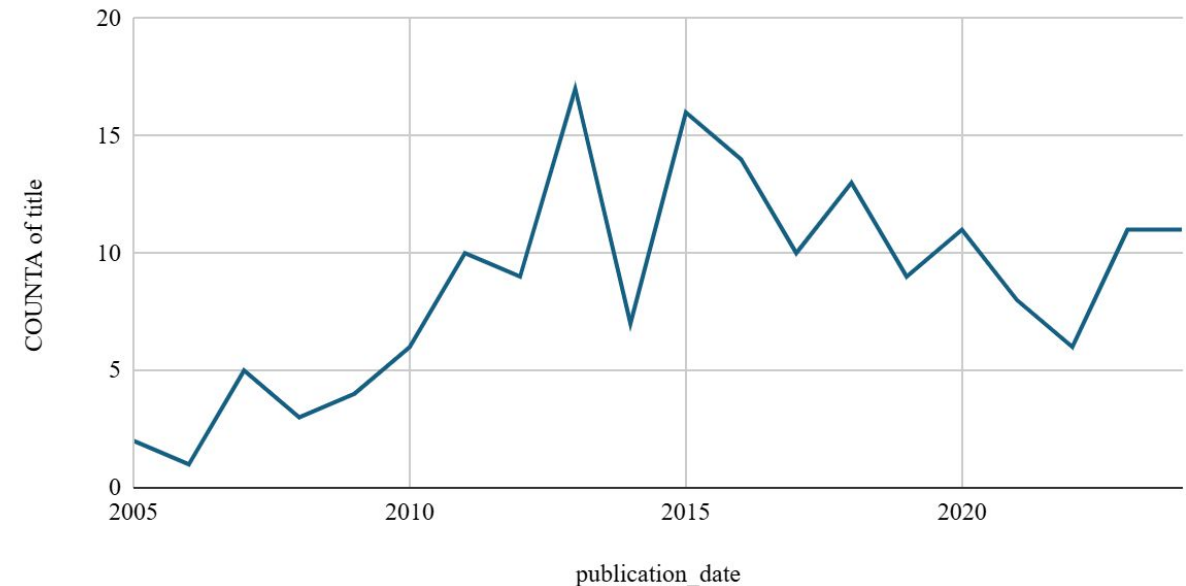


PESTLE Analysis - Social

Academic Interest in Naphthenic Acid Toxicity

- To date, there have been 190 peer reviewed papers on "Naphthenic Acid Toxicity".
- The academic interest in "Naphthenic Acid Toxicity" has followed a lifecycle of growth, peaking, and then stabilizing. The initial interest in the topic began in earnest in 2005, and the number of publications steadily increased from two to ten by 2011.
- Peak interest in 2013 was attributed to increased concern, breakthroughs in research methods, and substantial funding and regulatory interest.
- The post-peak decline from 2014 to 2024 was followed by a stabilization at 10-11 papers per year, indicating a plateau of research interest.
- The current levels point to ongoing monitoring and refinement rather than breakthrough discoveries.

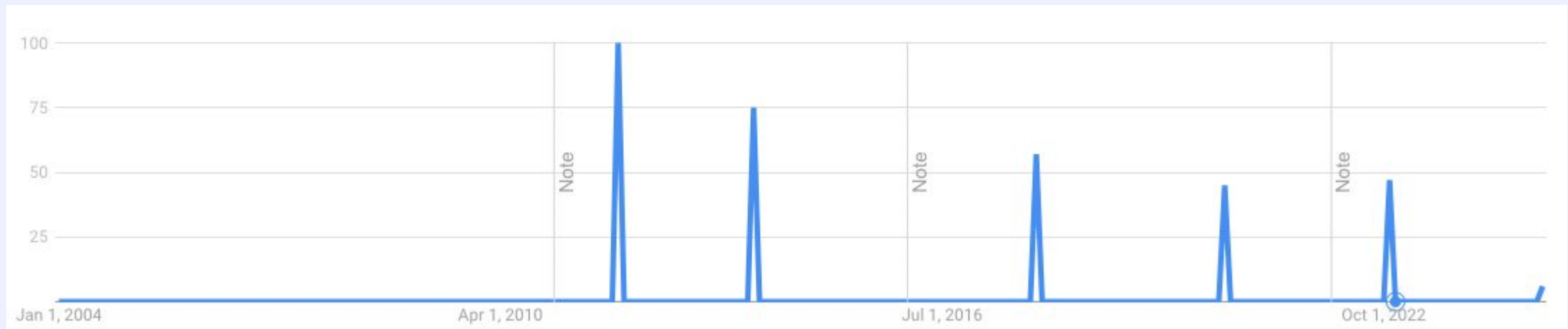
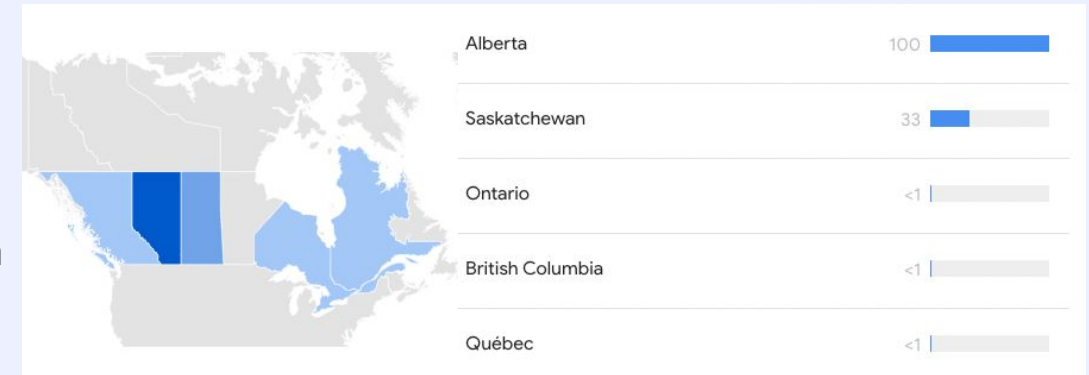
Number of Peer Reviewed Papers on "Naphthenic Acid Toxicity" per year



PESTLE Analysis - Social

General Interest in Naphthenic Acid

- Since 2004, there have been over 300 searches on Google across Canada.
- The interest has spiked in 2011, 2013, 2017, 2020 and 2022.
- Peak interest in 2013 corresponds with academic interest (on the previous slide).
- The vast majority of interest in Canada has been in Alberta with a third of interest in Saskatchewan. Negligible interest has come from British Columbia, Quebec and Ontario.



PESTLE Analysis - Social

Public Concern for the Environment

- Public concern for the environment in Canada has declined significantly [since 2015](#), dropping from the second most important issue in 2015 (11.3%) to the [eighth in 2025](#) (4%), as economic challenges like inflation, housing, and debt have taken priority. In Alberta, where energy and cost-of-living concerns are long standing, skepticism toward federal emissions policies has intensified amidst growing economic pressures.

Addressing Toxicity and Health Impacts of Naphthenic Acids in Oil Sands

- First Nations and environmental groups in Alberta urged Ottawa to classify naphthenic acids from oil sands tailings as toxic under the Canadian Environmental Protection Act (CEPA), ([Alberta Oil Sand Pollution Impacts on Local Indigenous Communities and Cooperation with Indigenous Peoples](#), 2024).
- Empowering First Nations with greater control over water resources is a fundamental step toward reconciliation, aligns with the UN Declaration on the Rights of Indigenous Peoples, and is essential for permanently resolving drinking water advisories in First Nations communities.

Some interest groups, especially Indigenous communities, are motivated to speak up and advocate for better water management in tailing ponds.



Source: National Observer,
Photo by Natasha Bulowski

PESTLE Analysis - Social

Addressing Toxicity and Health Impacts of Naphthenic Acids in Oil Sands

- Through a formal request, filed by Ecojustice on behalf of the Athabasca Chipewyan First Nation and others, aims to impose stricter regulations and monitoring, especially with plans to release treated tailings water into the Athabasca River ([National Observer](#), March 2024).
- While CEPA modernization enables such requests, experts caution that regulatory actions may only mandate self-monitoring rather than robust environmental safeguards.
- The agreement by the health and environmental ministers to assess the toxicity of naphthenic acids marks the second successful use of CEPA's 2023 amendment allowing public requests for prioritizing hazardous substances. This reflects growing attention to the environmental and health impacts of oil sands tailings ponds.
- In August 2024, the Minister of Environment and Climate Change Canada, Minister Guilbeault, announced that the Government of Canada is going to make available nearly \$12 million over 10 years for the Fort Chipewyan Health Study. The community-led health study, with the Athabasca Chipewyan First Nation, the Mikisew Cree First Nation and the Fort Chipewyan Métis Nation, will examine the impacts of the oil sands on community members' health.

PESTLE Analysis - Technology

Innovation in oil sands industry

- Oil sands companies have traditionally been criticized for relying on decades-old extraction methods, but innovation is now gaining momentum in the industry. Over the past decade, energy companies have increasingly sought patents for technological advancements.
- The report by Innovation, Science and Economic Development Canada, [Patent Landscape Report](#) (2017), highlights that patenting activity in the oil and gas sector grew by 188% between 2000 and 2012, with approximately 4,000 published patent families worldwide, including 100 from Canadian applicants. Leading Canadian patent filers, such as Trican Well Service, Envirollea, and GASFRAC, are based in Calgary, Alberta. It appears that patents related to environmental protection, including water monitoring, remain underdeveloped. Although the report offers valuable insights, it is dated, and finding more recent information has been challenging.
- Examples include:
 - Suncor: Patents for conveyor belts, hand railings, and solvents for extracting bitumen.
 - Imperial Oil: Patents for steel wire rope lubricants, heat and water recovery methods, and biological detoxification of oil sands effluent.
 - Cenovus Energy: Scientists are working on 50 projects but remain cautious about patenting due to its high costs and lengthy processes.



This shift in patent activity reflects a growing focus on innovation, with companies exploring solutions to improve efficiency, environmental sustainability, and resource recovery.

PESTLE Analysis - Technology

Biosensors

- The concept of biosensors was first introduced in the 1960s.
- The use of biosensors in water quality monitoring offers a promising solution for ensuring safe and clean water resources.
 - **Rapid and Accurate Detection:** Biosensors can quickly and accurately detect various pollutants in water, enabling real-time monitoring and faster response to contamination events.
 - **High Sensitivity and Specificity:** Biosensors offer high sensitivity and specificity, allowing for the detection of even trace amounts of specific pollutants.
 - **Cost-Effectiveness:** Compared to traditional physical instruments, biosensors can be more cost-effective in the long run due to their reusability and potential for miniaturization.
 - **Portability:** Biosensors can be made portable, enabling on-site and in-situ monitoring of water quality.
 - **Versatility:** Biosensors can be designed to detect a wide range of pollutants, including BOD, heavy metals, toxins, and microorganisms.
- Concerns over sustainability have been raised, since spreading biosensors in bodies of water could have unknown effects on ecosystems. To solve this, scientists propose a two-step approach. First, by using less precise methods to detect if the water shows signs of contamination, then, on an as-needed basis, deploy biosensors to more accurately pinpoint the type or source of contamination.
- Monitoring can influence decision-making based on real-time data so that producers can benefit from a more precise route to market. One of the challenges for commercial deployment of this technology is making it more robust, with affordable sensor technologies and understanding the effects of biosensors on ecosystems.

PESTLE Analysis - Environmental

Real-time Testing

- Laboratories Canada brought together the National Research Council of Canada's (NRC) Energy, Mining and Environment and Nanotechnology research centres, along with Environment and Climate Change Canada (ECCC) and Natural Resources Canada (NRCan) to try to find a better—and more efficient—solution to water monitoring.
- The NRC has created an IoT-enabled biosensor that continuously monitors water quality. Using a microbial fuel cell, it detects toxic compounds and organic materials in water. The IoT integration allows it to log data automatically and send real-time alerts, prompting further environmental testing when needed. This biosensor provides instant access to water quality information across Canada.



PESTLE Analysis - Legal

Legal: Imperial Oil Spill Highlights Regulatory Gaps and Calls for Reform

- Imperial Oil was fined \$50,000 by the Alberta Energy Regulator (AER) after wastewater containing toxic tailings seeped outside the Kearl oil sands lease boundary in 2022.
- It was revealed that tailings had been seeping for nine months before a 5.3 million-litre spill in February 2023 brought the issue to public attention.
- The fine, the maximum allowed under Alberta law, also required mitigation plans, lesson sharing, and research into environmental impacts. However, Athabasca Chipewyan First Nation (ACFN) Chief Allan Adam criticized the penalty as inadequate, calling it a "weak response" to significant environmental harm affecting downstream communities like Fort Chipewyan.
- The incident has sparked calls for regulatory reform and national water guidelines to better protect communities impacted by industrial activities. This case highlights broader frustrations with inadequate regulatory systems, insufficient penalties, and a lack of transparency and accountability from the Alberta government and AER.



Source: National Observer, Natasha Bulowski

Source: [National Observer](#), August 2024; [CTV](#), August 2024

PESTLE Analysis - Legal

Lawsuit claims Alberta Energy Regulator had duty to warn First Nations

- Northern Alberta's Athabasca Chipewyan First Nation (ACFN) has filed a lawsuit against the Alberta Energy Regulator (AER) that alleges negligence over a failure to communicate multiple tailings leaks at Imperial Oil's Kearl facility.
- The lawsuit's statement of claim notes that during the nine-month period from May 2022 to February 2023, the AER knew about ongoing significant and uncontrolled discharges of tailings at the Kearl Facility, "yet it failed to inform ACFN about them or their potential impact on the lands and waters where ACFN members exercise their Treaty rights."
- AER President and CEO, Laurie Pushor, apologized for the communication breakdown before a parliamentary committee in Ottawa on April 24, 2023.

Source: [Environmental Science Engineering Magazine](#) March 2024; [MSN Video](#), March 2024



Source: *Environmental Science Engineering Magazine*,
photo credit: ACFN

PESTLE Analysis - Legal

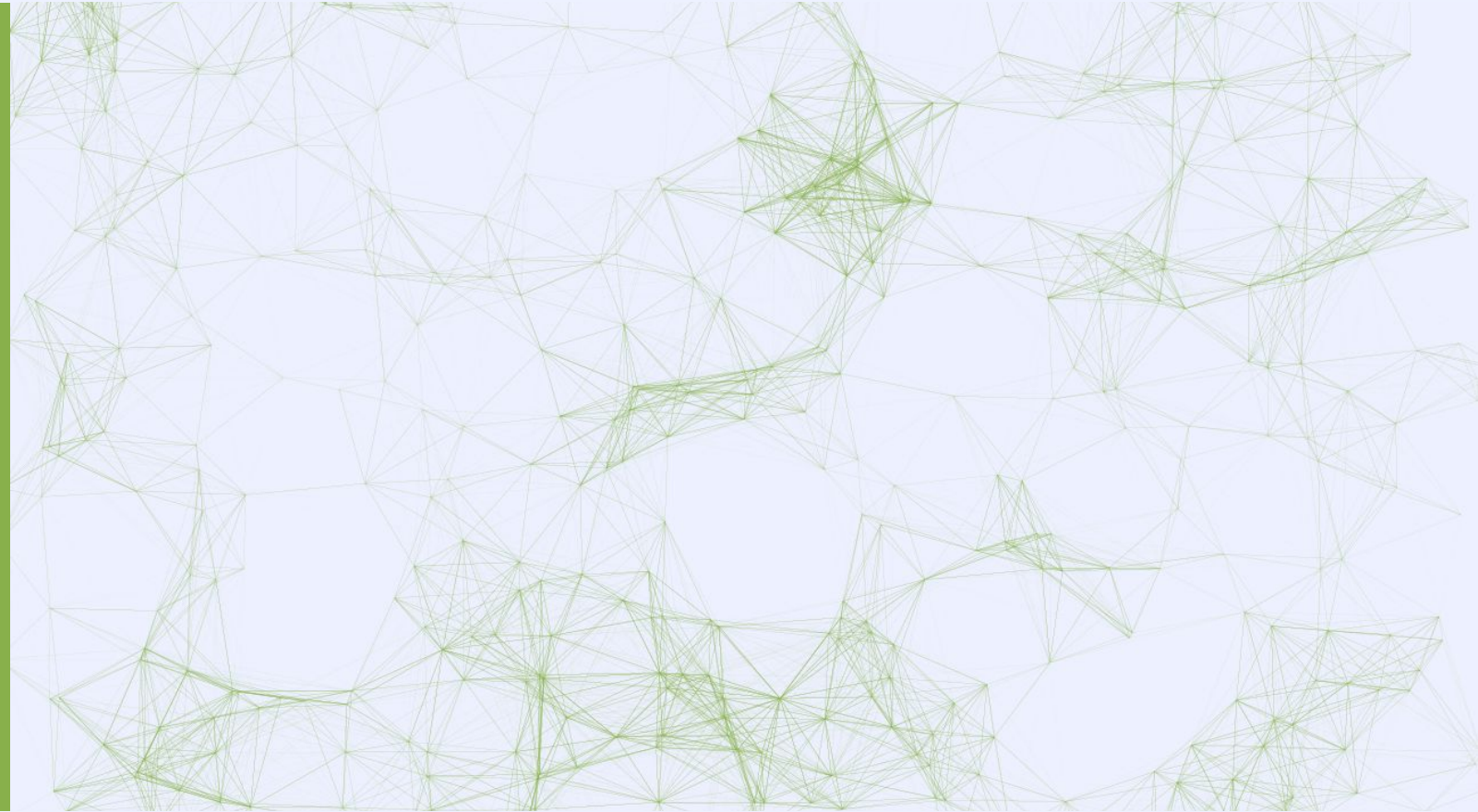
An example of fines for violating CEPA

- Groupe Marcelle Inc., a Quebec-based cosmetics company, was fined \$500,000 for violating the Canadian Environmental Protection Act, 1999 (CEPA). Environment and Climate Change Canada enforcement officers found that, between April 2021 and May 2022, the company marketed cosmetic products (Lise Watier, Marcelle, and Annabelle eye and lip pencils) containing Perfluorononyl Dimethicone, a substance regulated under CEPA.
- This fine demonstrates the enforcement of environmental laws in Canada and highlights the consequences of non-compliance with regulations aimed at protecting human health and the environment. Including this example in the report emphasizes the importance of adhering to CEPA guidelines and serves as a case study of disciplinary action taken against violators.



Source: [Government of Canada](#) (March 2024)

PRIMARY RESEARCH



Primary Research Analysis

OVERVIEW

- Through the course of this research, there were people identified by both Shawn Lewenza and CTRS who might be good candidates to interview.
- In total, **four people participated** in the in-depth interviews, as per the scope of the project. The participants were:
 - Dayue Shang, Ph.D., Head, Organic Chemistry Section, Pacific & Yukon Laboratory for Environmental Testing, Environment and Climate Change Canada
 - Fred Wrona, Professor, Svara Research Chair in Integrated Watershed Processes, University of Calgary
 - Ralph Hindle, Vogon Labs, private analytical testing lab in Alberta
 - Ty Veness, Director Environmental Monitoring with Pathways Alliance (formerly COSIA)
- The people chosen for an in-depth interview were individuals who were able to provide a variety of expertise and perspective on this market. Their responses have been aggregated for this report to maintain confidentiality.
- We made every effort to have a diverse group of people with different backgrounds who could help provide different points of view on the water monitoring industry today.
- All interviews were a minimum of **30 minutes** with some spending 10-15 minutes more on the call.
- The following are key topics we inquired about and collected information from all the interviews.

Naphthenic Acids Testing

Mass spectrometry, field test kits, and biosensors

- **Mass spectrometry** is considered the most precise method, but it is expensive, requires skilled personnel, and high-resolution equipment. The lab conducting this testing is unique in that they have the skilled personnel to operate the equipment.
- **Field test kits** offer a more convenient and cost-effective way to get quick estimates of naphthenic acid levels on-site.
- **Biosensors** are an emerging technology that uses microbes or enzymes to react with pollutants and produce a measurable signal. They are considered a promising technology but require further development and validation.
- The demand for testing is influenced by government regulations and industry practices.
- The cost of testing varies depending on the method used. FTIR (infrared) tests cost about \$20-\$40 per sample, while government labs charge \$120 for routine samples, and up to \$180 for legal samples in emergency situations. Private labs may charge around \$200 per sample.

Key takeaway: Biosensors have their advantages but mass spectrometry is considered the most precise, while it is the most expensive.

"People need to be skilled in mass spec. Most of the people are going to pharmaceutical because they pay more."

- Interviewee

Regulations

"This is a good long term project. It could be regulated in 15 years, maybe more. We will see downsizing [in the government] and scientists will lose their jobs so it could be hard to change regulations. But we need someone to lead and get indigenous on board."

- Interviewee

Regulations and industry practices

- Government regulations play a significant role in driving testing demand. However, there are currently no government regulations on NAs.
- There is a disconnect between research and industry regarding acceptable testing standards.
- Those people who were interviewed were not in the oil and gas industry, however, three out of the four people speculated that oil and gas companies would not be motivated to go beyond the minimum requirements if government regulations are not strict and with no current regulations, it is unlikely they would take the initiative to test for NAs.
- One person had a much more optimistic view sharing that there is a steering committee with representatives from the oil sands and government and Indigenous where they are looking for new technologies, even if they aren't regulated yet, as it can serve them well to be proactive before regulations are formed. This gives industry the opportunity to inform the regulations.

Key takeaway: Without government regulations, the oil and gas industry lacks motivation to prioritize NA testing, resulting in a significant gap between research advancements and industry adoption.

Barriers to Progress

Gaps in Resources, Regulations, and Transparency

- The lack of skilled personnel and resources is a challenge for research and development.
- It was suggested that there is a need for LC50 testing to determine the toxicity of tailings ponds but this has not been done, in part because research scientists do not agree with the methods of the lab. The challenge with not determining the toxicity of the tailing ponds is there is no baseline measurement of naphthenic acids or current level of toxicity.
- There is a pessimism about this business opportunity, for different reasons based on who was speaking. A few people believe was that without regulations around NAs, there is very limited opportunity.
- There is a concern that the oil sands area is a "wild expense" under joint jurisdiction of provincial, federal and municipal governments.
- The lack of NA regulations means that oil companies are not required to test, and even if they do, they are not obligated to report.

Key takeaway: The lack of skilled personnel, baseline toxicity data, and clear regulations creates significant barriers to advancing NA monitoring, with limited transparency from the oil and gas industry further compounding the challenge.

"I don't think we're there yet, even in terms of science on that side of it."

- Interviewee

"We don't have very good markers or capabilities to say this NA came from X or Y. It's because there are 1000s of complexes, they are trying to seeing what is toxic or not toxic."

- Interviewee

Opportunity

Other key topics for consideration

- There is an interest in developing sensor technologies that can provide more timely information, even if it's just presence/absence data. There is a strong community need for timely testing of water quality. Real-time data that is accessible to the community can be very impactful, eg. Indigenous communities. Real-time data from sensors could be a real advantage for monitoring programs.
- Biosensor technology can be taken into the field and used to conduct more tests at a lower cost. Smart monitoring networks with automated sensors could create efficiencies in cost and data return. Using biosensors for initial assessment can help identify "hot spots" where further testing with mass spectrometry is needed, saving time and money.
- Leverage the role that Pathways Alliance plays in water monitoring for the oil sands, especially through a platform called "ETAP" which is an intake process for evaluating new technologies within water monitoring.
- The market for sensor technologies is potentially broad, not just within Canada but globally.
- There is a need for monitoring in areas where there are spills and leaks.

"If you talk to the Indigenous communities in these areas, they want to know what's in the water. Whether there's regulations or not."

- Interviewee

Key takeaway: Real-time, cost-effective biosensor technologies present a significant opportunity to address the strong community need for timely water quality data, enabling targeted testing and improving monitoring efficiency on both local and global scales.

What is needed for this opportunity

The essentials for exploring this opportunity

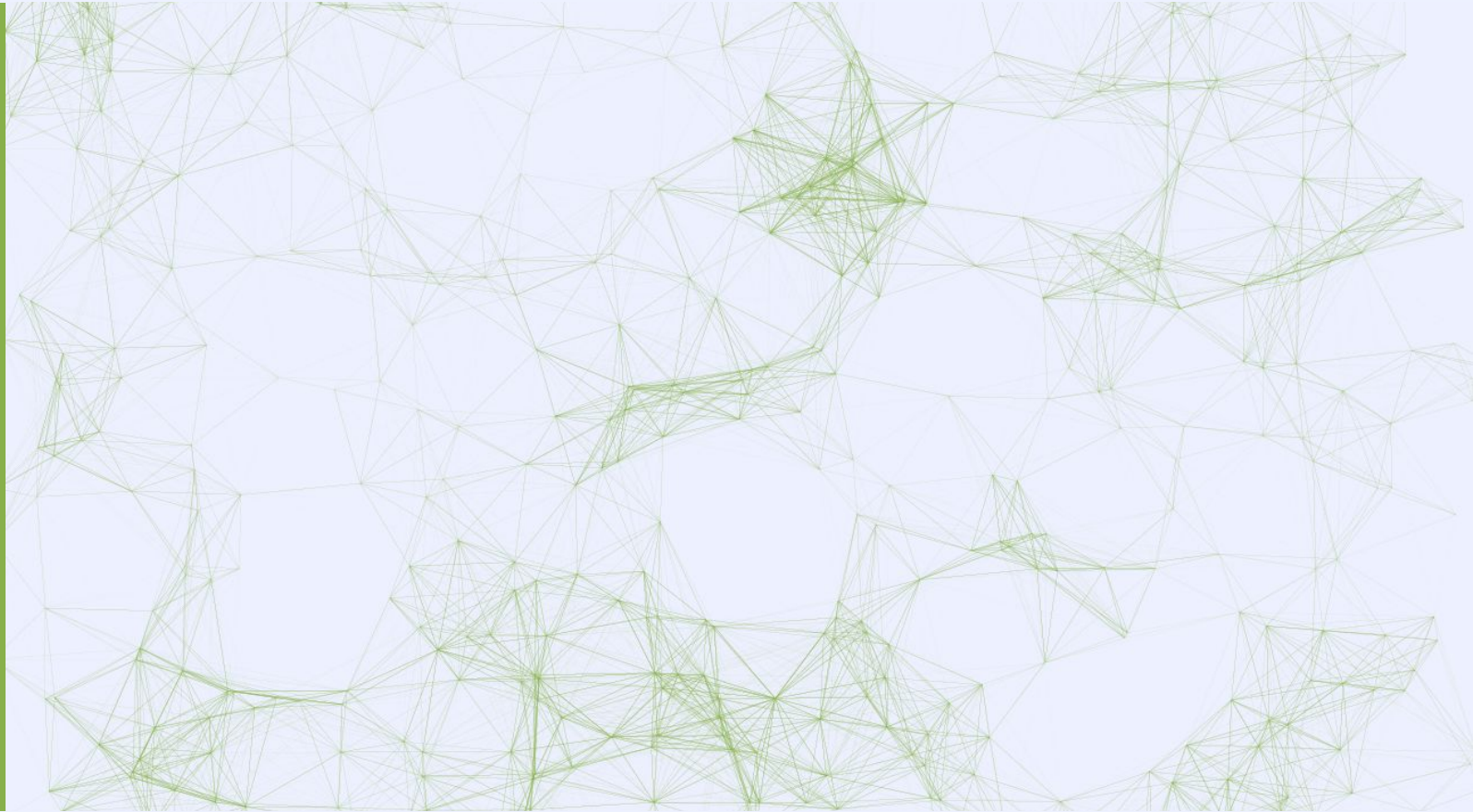
- Government funding and support are crucial for advancing research and innovation in this area.
- Government regulations will need to change in order to drive testing demand.
- Protests and public awareness might drive action and testing requirements around NA contamination
- The focus must be on identifying the customers who will pay for NA testing.

"This is the same idea as Erin Brockovich. We need protests to drive public awareness of the dangers [of NAs] in the water."

- Interviewee

Key takeaway: Advancing NA testing requires collaborative efforts across stakeholders to drive political will for emphasizing the importance of testing NAs, and a clear focus on identifying paying customers to drive innovation and adoption.

CHANNEL PARTNERS



What is a Channel Partner?

CHANNEL PARTNERS OVERVIEW



A channel partner is an organization or entity that collaborates with a business to help promote, sell, or distribute its products or services to end users.

Unlike direct sales, channel partners act as intermediaries, leveraging their established networks, expertise, or influence to connect a company with its target audience. They can provide credibility, increase market reach, and reduce the time and resources needed to engage potential customers.

For example, a channel partner in the environmental sector might introduce innovative technologies to their networks or integrate them into existing workflows, making it easier for businesses to gain traction.

Channel partnerships are particularly effective because they allow a company to tap into an established entity's reputation and relationships, facilitating market entry and adoption of the technology.

Channel Partners for Shawn Lewenza

SUMMARY OF POTENTIAL CHANNEL PARTNERS

Channel partners play a vital role in promoting and scaling Shawn's naphthenic acid monitoring technology by connecting him with key stakeholders in the oil sands industry.

We believe there are three key types of channel partners that could support Shawn Lewenza's market entry efforts:

- Water monitoring organizations
- Partnering with Indigenous communities
- Industry associations

Building relationships through pilot projects, case studies, and participation in key initiatives ensures Shawn's technology is positioned as a valuable solution for environmental monitoring.



Water Monitoring Channel Partners

Why the Alberta Energy Regulator (AER) Could Be a Strong Channel Partner

The AER is responsible for monitoring oil sands wastewater and works closely with both provincial and federal governments, giving it significant influence over industry practices. By partnering with the AER, Shawn could gain access to critical stakeholders in the oil sands industry and ensure his technology is considered as part of regulatory-driven monitoring enhancements.

To build a relationship with the AER, Shawn could approach the AER by demonstrating how his technology aligns with their mandate to ensure environmental safety and compliance.

Why the Oil Sands Mine Water Steering Committee Could Be a Strong Channel Partner

The Oil Sands Mine Water Steering Committee was launched to make recommendations on tailings pond management, making it a key influencer in shaping future water monitoring requirements. As the committee works on addressing gaps and forming recommendations, it creates a valuable opportunity for Shawn to position his technology as a solution to one of the industry's most pressing challenges.

To connect with the committee, Shawn should monitor its progress and attend relevant meetings or workshops where members may be present. Establishing relationships with committee members early in their deliberations could ensure Shawn's technology is considered as part of any recommendations.

Indigenous Communities Channel Partners

Why Indigenous Communities Could Be a Good Channel Partner

Indigenous communities, particularly those downstream of oil sands operations, are deeply invested in ensuring water quality due to direct impacts on health and the environment. Many communities are actively advocating for stricter monitoring and better regulatory enforcement.

Shawn could partner with Indigenous leadership, such as the Athabasca Chipewyan First Nation or Mikisew Cree First Nation, to offer the technology as a tool for community-led monitoring. These partnerships could strengthen advocacy efforts and create demand from regulatory bodies and industry to adopt Shawn's technology.



Industry Association Channel Partners

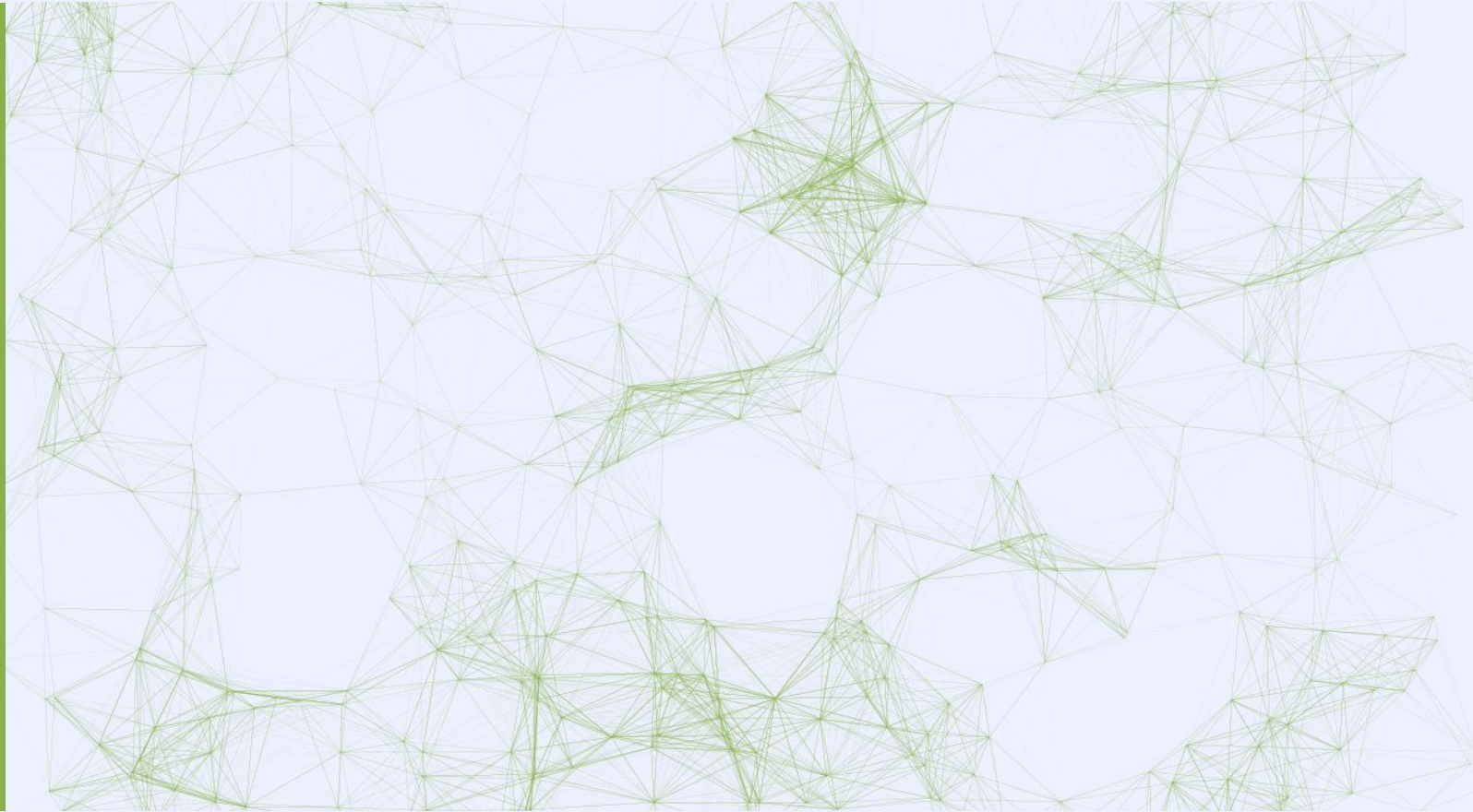
Why Industry Associations Could Be a Good Channel Partner

Canadian Association of Petroleum Producers (CAPP) and Pathways Alliance (formerly COSIA) are influential organizations that represent the oil and gas industry in Canada, focusing on environmental innovation and sustainability in oil sands operations.

The challenge with this audience is that the associations represent the interests of businesses and they may not be open to conversation until government changes regulations or guidelines about NA. The one warm opportunity that Shawn has here is to leverage the contact made by CTRS with Pathways Alliance who is open to talking with Shawn about his technology. There may be an opportunity to present Shawn's technology through the "ETAP" platform which is an evaluation process of new technologies that can help with water monitoring.

To build a relationship with CAPP or Pathways Alliance, Shawn should showcase how his biosensors align with their goals in reducing environmental risks associated with tailings ponds. Participating in initiatives, such as the oil sands monitoring program, of which Pathways Alliance is a key stakeholder, could help Shawn position himself in front of the right people.

MARKET FORECAST



What is the Market Potential?

\$73,920

per year

***with no regulation changes**

Let's dive into the calculations.

Total Available Market



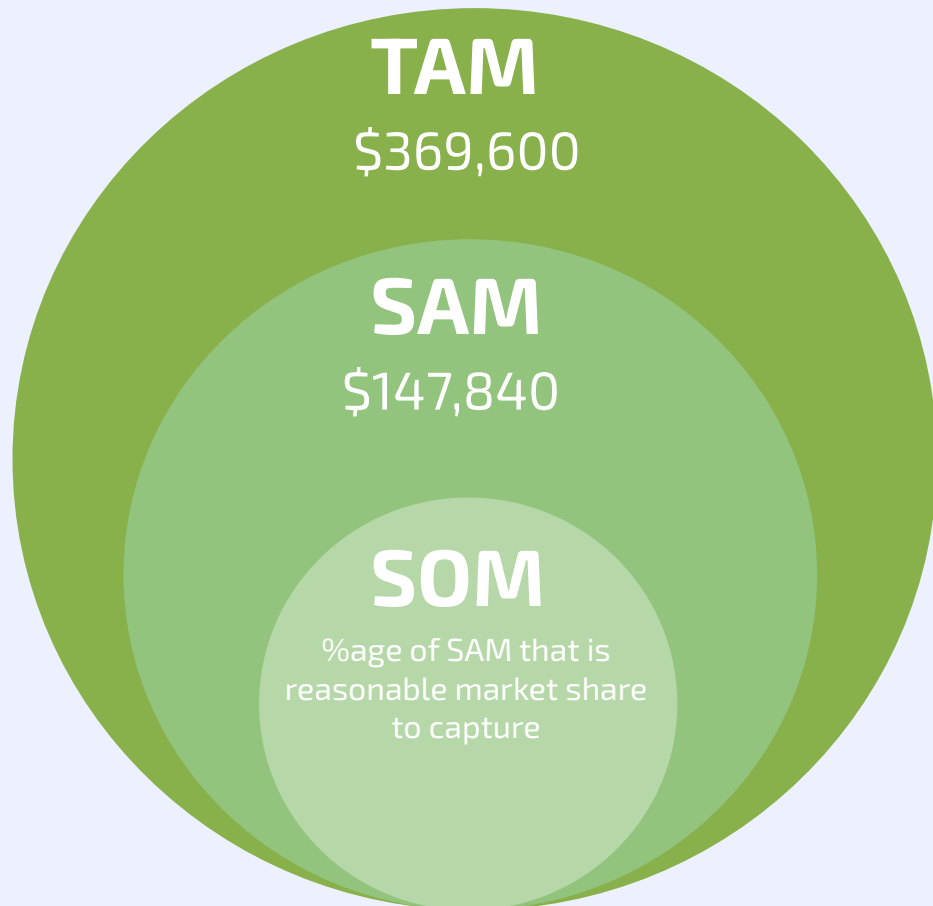
\$369,600

Total available market.

Baseline Approach

- Identified all oil sands facilities in Alberta (n=34), Rest of Canada (n=7), and the U.S. (n=15).
- **Assumed 12 tests per facility per year (monthly testing)**, based on:
 - Oil Sands Monitoring Program (OSM) guidelines.
 - Environmental regulations for pollutant monitoring (e.g., naphthenic acids).
- **Aggregated total tests/year across regions:**
 - Alberta: (408 tests/year); Rest of Canada: (84 tests/year); USA: (180 tests/year).
 - Total: 672 tests/year.
- **Pricing Assumption**
 - \$550/test for biosensor- based NA analysis, derived from:
 - Competitive methods (FTIR, mass spectrometry) costing \$400–\$1,000 per test.
 - Market feedback (some labs charge \$700+).
 - Positioned to be cost- competitive yet profitable.
- **Calculation**
 - TAM = (Total annual tests) x (Price per test).
 - 672 tests/year x \$550 = \$369,600.
- **Key References & Rationale**
 - Facility counts come from Canadian Energy Regulator (CER) statistics and project- specific data (e.g., Utah oil sands). For the Rest of Canada, we assumed 16% of total production outside Alberta, yielding 7 facilities.
 - Monthly testing frequency validated by OSM reports, lab feedback, and industry norms.

Serviceable Addressable Market



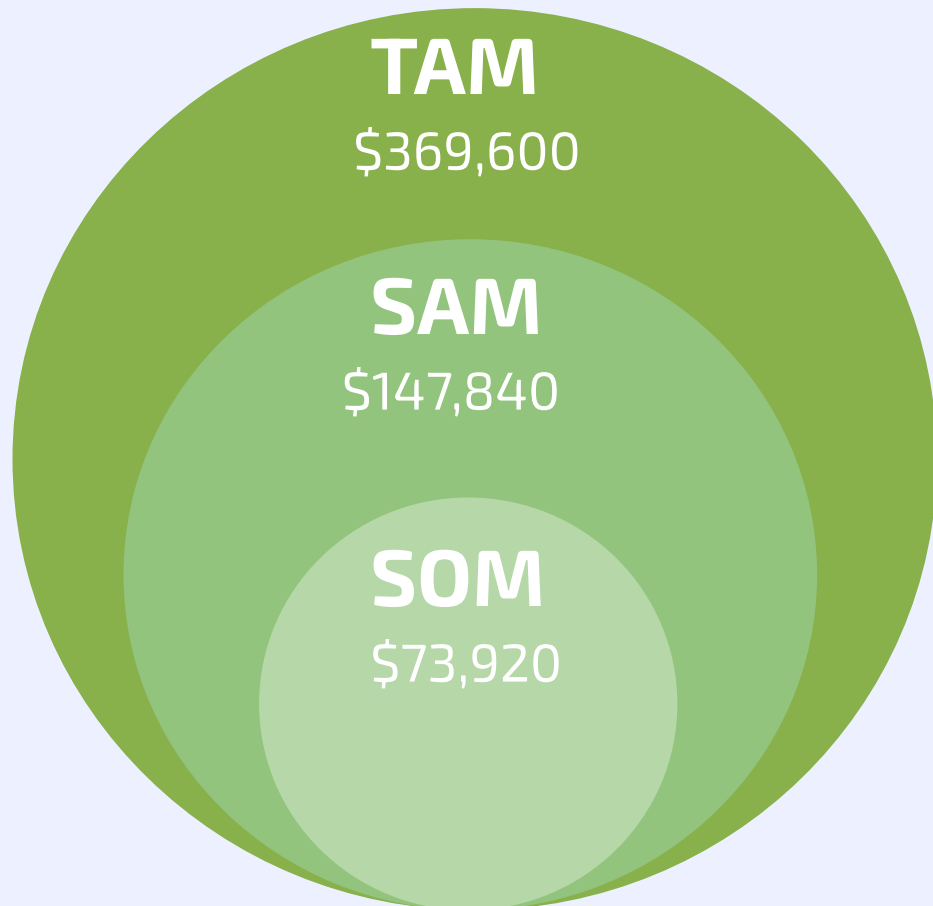
\$147,840

Serviceable available market.

Defining the Serviceable Segment

- **Hypothesis**
 - Not all facilities will immediately convert.
 - Based on market conditions (cost efficiency, initial regulatory pressures, trust in new technology) - **40% of the TAM is assumed to adopt the biosensor approach.**
- **Calculation**
 - $SAM = (TAM) \times (Adoption\ Rate)$.
 - $\$369,600 \times 40\% = \textbf{\$147,840}.$
- **Key References & Rationale**
 - Oil Sands Monitoring Program (OSM) and other environmental initiatives drive partial market uptake.
 - Reflects a conservative yet realistic portion of the total market that can be "serviced" now.
 - Early adopters will likely come from larger operators or those under tighter scrutiny.
 - Regulatory trends suggest momentum, but 100% adoption is not realistic in the near term.

Serviceable Obtainable Market



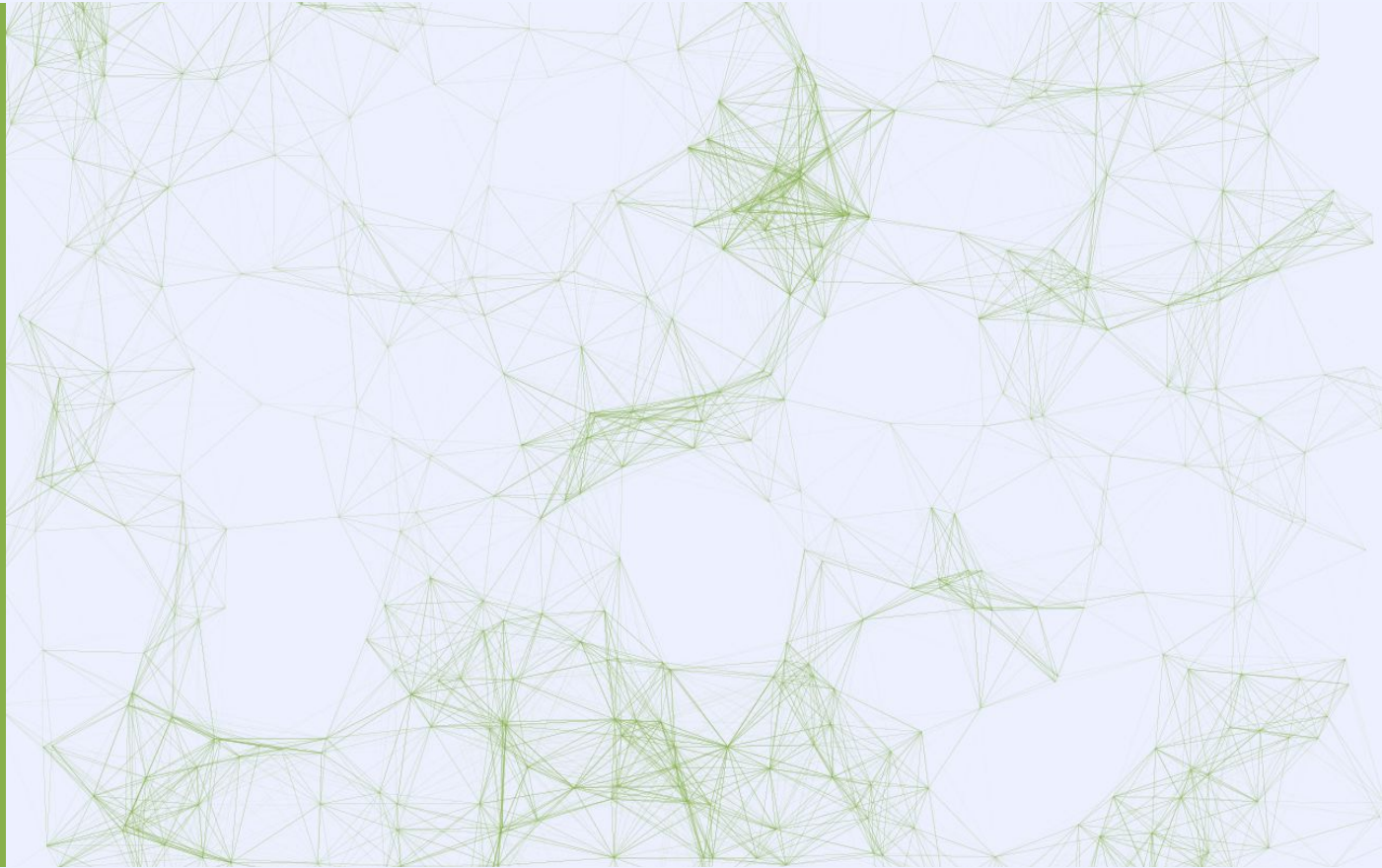
\$73,920

Serviceable obtainable market.

Market Share Assumption

- Of the 40% who adopt biosensor testing, capturing 50% is considered feasible based on:
 - Technical advantages (ease of use).
 - Price competitiveness.
 - Limited direct competition in the NA testing niche.
- **Calculation**
 - $SOM = (SAM) \times (\text{Market Share})$.
 - $\$147,840 \times 50\% = \$73,920$.
- **Key References & Rationale**
 - Even in competitive markets, biosensors offer a unique value proposition (cost, real-time analysis).
 - A 50% share of the addressable adopters is ambitious but grounded in price/performance advantages.
 - Based on competitor landscape (mass spectrometry, FTIR).
 - The 50% figure acknowledges possible resistance from operators already invested in alternative methods.

CONSIDERATIONS



Considerations

MARKET SIZING CONSIDERATIONS

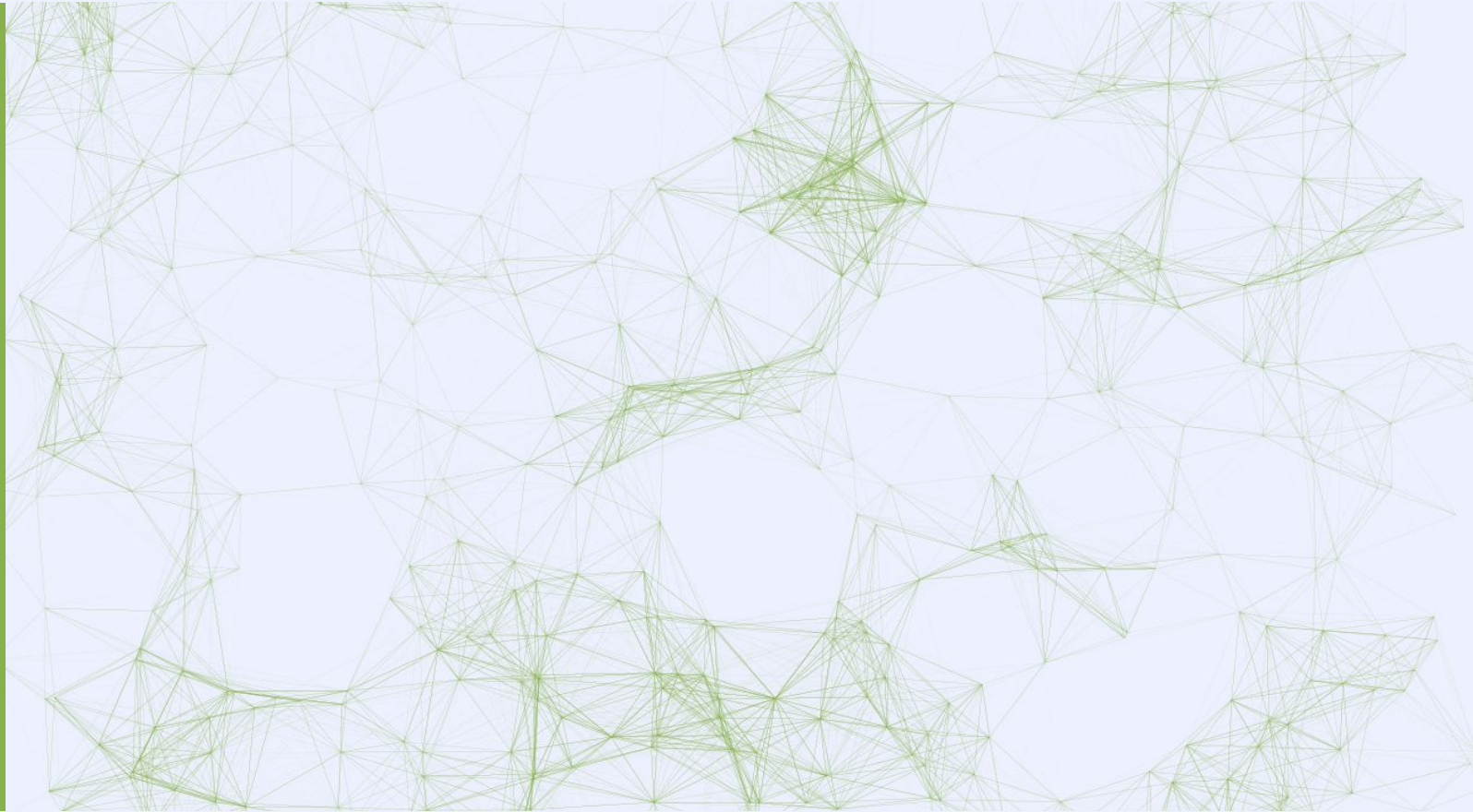
- The market sizing numbers provided in this report are based on the most reliable data and information available during the course of this project. While we considered doing additional data collection, Shawn decided to forego the survey, opting instead to conduct his own broader research at a later stage. As a result, our market sizing analysis remains conservative, reflecting only the evidence and insights gathered within the scope of this work.
- The spreadsheet we developed provides a flexible framework that Shawn and his team can use to adjust the numbers as they gather more data or refine their market understanding. While our numbers are accurate based on the current inputs, further research and validation could uncover additional opportunities or refine the market potential.
- We are confident that this report and accompanying tools will serve as a strong foundation for Shawn's ongoing research and business development efforts.

Considerations

FURTHER RESEARCH CONSIDERATIONS

- The insights and findings in this report are based on secondary research and four expert interviews conducted during the project. While additional engagement with industry stakeholders was considered to validate the data, this step was deferred in favor of broader research and outreach at a later stage. Similarly, a competitive analysis was planned in the initial scope but was reallocated to another consultant. As a result, our findings do not include a detailed evaluation of competitors. The recommendations in this report reflect the evidence collected within the project's scope.
- We recommend Shawn prioritize further research with key industry stakeholders and deeper competitive analysis. Collaborating with an external research partner could validate the assumptions and findings presented here and enhance market understanding.
- The tools and frameworks developed in this project are designed to be flexible and adaptable. Shawn can refine his understanding of the market and adjust his strategy as more data becomes available. Identifying key gaps in competitor strategies and validating industry needs will help position Shawn's technology effectively.
- This report provides a strong starting point for exploring the market opportunity. Continued engagement with industry stakeholders will be critical for refining the approach and achieving long-term success.

CONCLUSION



What is the market potential for a biosensor technology that detects naphthenic acids from oilsands?

There is limited potential for Shawn Lewenza to commercialize the naphthenic acid water monitoring technology with a tricky political landscape to navigate and a conservative estimate on the serviceable obtainable market, as outlined in this report.

Recommendations

- **Secure Patents for Your Technology:** Protecting your biosensor technology with patents will establish intellectual property rights and provide a competitive edge in the market. A strong patent portfolio can also attract investors and partners while safeguarding your innovation from competitors.
- **Leverage Relationships to Develop Channel Partners:** Utilize your existing network to build partnerships with organizations like the Alberta Energy Regulator, Indigenous communities, or industry associations such as the Pathways Alliance. Channel partners can amplify your reach, validate your technology, and connect you with key stakeholders who influence market adoption.
- **Conduct Research on Pricing and Market Volume:** Further investigate the pricing structure for traditional and emerging water testing methods, as well as the frequency and volume of testing in oil sands operations. Understanding these financial dynamics will help determine the size of your market and whether this is a viable business opportunity.
- **Develop a Comprehensive Competitive Analysis:** Conduct a deep dive into the competitive landscape to identify existing solutions and gaps in the market. Analyze your competitors' strengths and weaknesses to position your technology as a unique and necessary tool that fills unmet needs.

Recommendations

- **Interview Potential Customers to Understand Pain Points:** Engage directly with oil sands operators, regulatory bodies, and environmental service providers to uncover their biggest challenges related to water quality monitoring. Use these insights to tailor your technology and messaging to address their specific needs effectively. Building a relationship with Pathways Alliance could be a very important step to gain valuable insight on this topic.
- **Pilot and Demonstrate Your Technology:** Offer pilot projects or demonstrations to showcase the real-world value of your biosensors in addressing industry challenges, such as timely detection of naphthenic acids. Pilot programs can build credibility, generate data for further refinement, and encourage adoption by early adopters.
- **Determine a Clear Go/No-Go Decision Point:** Establish specific milestones or criteria, such as securing a certain number of partnerships, achieving pilot success, or validating market demand through research, to decide whether to continue pursuing this market or redirect your focus. This ensures you can evaluate progress objectively and avoid unnecessary resource investment if the opportunity doesn't meet your expectations.



THANK YOU

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