CANADA EMISSIONS REDUCTION INNOVATION NETWORK (CERIN) PUBLIC REPORT

1. PROJECT INFORMATION:

Project Title:	EMISSIONS WEB PORTAL / APP FOR TANK VENTING INVESTIGATIONS & MITIGATION PRACTICES
Emissions Reduction Scope/Description:	The main goal of this project is to greatly recue methane gas leaks especially from storage tanks and well locations in the oil, gas and energy industries, by using this web portal/app designed for both estimating and providing emission mitigation solutions: www.carbonemissionscanada.com (iOS app is under review by apple by their respective software engineers and Android APP is currently available for download).
Applicant (Organization):	Breakwater Vantage Inc.
Project Completion Date:	March 31st 2023

2. EXECUTIVE SUMMARY:

This submission is presented to NRCan for consideration and evaluation. Breakwater Vantage undertook the development of a digital tool to support a better understanding of the issues related to gas escaping from storage tanks. The goal was to create a web portal/app that provides users with the ability to monitor and understand these gas emissions and offers tools for mitigation opportunities. The "Emissions Web Portal / APP for Tank Venting Investigations & Mitigation Practices" (the Project) incorporates algorithms and technological solutions to seamlessly sift through and efficiently capture real-time raw data from tanks and to analyze solutions using a vendor company directory.

The portal features multiple tabs, each designed with a specific objective. Some tabs showcase technology solutions, highlighting the various technological measures available to reduce emissions and offering users insights into the best options for their operations. A company directory search was also incorporated, allowing users immediate access to a range of new technologies and solutions from different providers, thereby promoting, innovation, and collaboration. Furthermore, an emissions

calculations tab was integrated, enabling users to calculate emissions accurately, which assists in more informed decision-making.

The team ensured that the system could adjust seamlessly to any updates in hardware or software, thereby keeping it current at all times. Given the complex nature of the development, the aim was to design an interface that was user-friendly. Such an interface is vital for facilitating easy access to and understanding of information about gas emissions, which is critical for the oil, gas, and energy sectors. This new portal can be accessed at www.carbonemissionscanada.com, as well as through Android and iOS apps.

A foundational aspect of this project was the user experience in accessing, understanding, and managing tank venting emissions. This was addressed by allowing users to download a PDF summary report that encapsulates key insights and takeaways, empowering stakeholders to make informed decisions about reducing emissions.

The project faced several challenges, including ensuring data accuracy, promoting user adoption, and maintaining current technology. A comprehensive overview of the emissions reduction potential for the industry is provided, underscoring the significant progress that can be achieved through the deployment of the summarized solution and the contents of the Handbook.

3. KEY WORDS

1. Mitigation
2. Technologies
3. Tank Venting
4. Calculations
5. Methane Emissions

4. APPLICANT INFORMATION:

Applicant (Organization):	Breakwater Vantage Inc.
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5. LEAD CONTRIBUTING PARTNER INFORMATION:

Organization:	Breakwater Vantage Inc.
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Representative Name:	Ivan Morales/David Grygar
Title:	Director/COO

6. PROJECT PARTNERS

Breakwater Vantage would like to thank PTAC and New Paradigm Engineering Ltd. for access to key information detailed in the APP.

A. INTRODUCTION

The emissions portal is designed to be an all-in-one platform that supports individuals and organizations in the Oil, Gas, and Energy sectors in managing, monitoring, and analyzing tank venting emissions. Emphasizing user-friendliness, the platform provides tools for emissions calculations based on industry standards, insights into emission reduction strategies, and capabilities to generate emission reports, graphs, and summaries.

The development of this platform required understanding current regulatory emission standards, planning the use of appropriate equations, considering the final output and user requirements of stakeholders, and effectively managing the associated computations and logic.

Key features of the Emissions Web Portal/APP include:

- A resource hub that contains information about emission reduction technologies, innovative solutions, research documents, and a glossary of terms.
- Emission calculation tools using standard equations and methodologies.

- A library of case studies on emission reduction technologies.
- User registration, authentication, and profile management with robust data security and privacy measures.
- Compatibility with web browsers and mobile applications for iOS and Android platforms.

The platform caters to engineers, management teams, and industry professionals. Its aim is to facilitate reductions in tank venting emissions within the Oil, Gas, and Energy sectors by providing industry participants with deeper insights into their current emissions and by equipping them with effective strategies for reduction through the adoption of specific technologies and practices.

Furthermore, users can calculate their current emissions, implement suitable technologies, monitor the effectiveness of their strategies, and keep up with the latest advancements in emission reduction technologies.

The platform is specifically tailored to address the contemporary challenges of tank venting emissions within the Oil and Gas sector. Designed with precision and scalability in mind, it aligns seamlessly with the industry's ever-evolving needs, offering the agility and adaptability needed to keep pace with advancements and growth. The platform puts forth a streamlined approach to reducing emissions from tank venting, aiding users in making informed decisions that align with their objectives. At present, users can calculate tank venting emissions and incorporate additional emissions tied to tank operations, such as fluid loading emissions, flaring, and pneumatics. They can select from various types of emissions based on their site-specific needs. Technology recommendations are generated according to users' specific concerns (site characteristics, Operations, Support Equipment and Additional Technology and virtual pipelines) using a proprietary mathematical formula that operates behind the scenes based on their choices. Moreover, users have the ability to reference a chosen company directory to input information on potential equipment upgrades and site measurements, for example:

- Emissions calculations:
  - Based on AER Manual 15 under
  - Tanks
  - Pneumatic devices
  - Flares
  - Engine start-ups
  - Rail/truck transportation of fluids
- Technology solutions:
  - Converting pneumatics to electrical devices
  - Site Characteristics (casing gas management, compliance, recovering waste gas, reduction in the number of oil tanks, environmental footprint reduction etc.)
  - Operations (Oil Transportation, Compressor Emissions, Facility, Combustion Devices, Production Casing Vents etc.)

- Support Equipment and Additional Technology (Strategy Technologies, Digital Solutions, AI, Handle Equipment Failures, Combustion Technologies, Monitoring Storage Tanks Pressure and Temperature, Grid Electrification etc.)
- Virtual Pipeline (Virtual Pipeline and Aligned with the Overall Prevention Strategy)
- Case Studies (VRU's, Combustion, Chemical Pumps, Pneumatics Replacement, Instrument Air, Solar, Power Generation Retrofits, R&D and managing emissions)

For a deeper dive into added functionalities and the user interface, please refer to the appendix.

In summary, the approach addresses elements such as tank emissions, operational challenges, site attributes, and pipeline integration. It also assesses equipment specifics, costs associated with technology implementation, and projected emissions reductions for diverse setups. The platform also includes company directories and allows users to add inputs as needed for summary reports.

B. METHODOLOGY

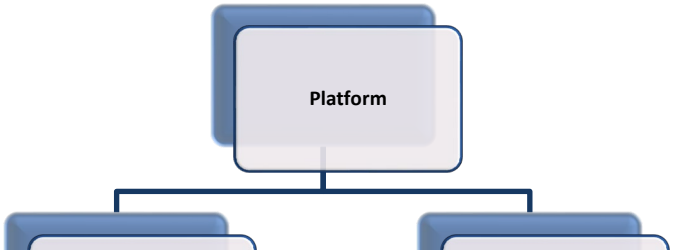
INTRODUCTION

The Emissions platform was constructed using a combination of technologies and tools including Adobe XD, MongoDB, React, NodeJS, Express, and Flutter, each offering unique benefits. Adobe XD played a role in UX/UI design, MongoDB handled various data types, React was used to develop responsive web applications, while Flutter facilitated cross-platform app development. NodeJS, as a runtime environment, was pivotal for specific aspects of the web and app development. When integrated with the Express framework, it allowed for the creation of efficient and scalable server-side applications with ease. To enhance the user experience, digital flipbooks were added to the platform, introducing an interactive dimension and analytics tracking; these features will be elaborated on in the following section.

To ensure the Emissions platform was a reliable tool for managing tank vent emissions calculations and practices, an extensive risk management strategy was implemented during its development. This strategy involved identifying and mitigating risks tied to factors such as technology choices, cross-platform compatibility, code integrity, regular testing, monitoring, optimization of performance, and adherence to security standards.

A vital aspect of the project management was selecting the right technologies and solutions, especially considering factors like cost, performance, scalability, and maintenance specific to tank vent emissions. Moreover, the team formulated an assessment logic to rigorously evaluate technologies, drawing on criteria such as user feedback, trackable performance, compatibility with various sources, and maintainability. The platform's design aims to provide users with a tailored selection of emissions reduction technologies and practices, enabling them to make well-informed decisions about deployment strategies to reduce emissions.

Web Portal and App Overview Terminology



The iOS and Android versions of the app, which mirror the web portal setup, have been submitted for evaluation to the software engineering teams at Apple and Google, respectively. Currently, Apple is facing a backlog, leading to a delay in their review process; however, we remain hopeful that the review will begin shortly.

Concurrently, the web portal has been designed to feature direct links for app downloads. These links will effectively guide users to the respective app stores - either the Apple App Store or the Google Play Store - depending on their device. This design ensures a streamlined and personalized experience, making the app's access and installation on a user's chosen device straightforward.

The following methodology overview will address a technology gap in the Oil and Gas & Energy sectors concerning the management, monitoring, and analysis of tank venting emissions:

APPLICATION OVERVIEW

The emissions platform is more than just a digital device for monitoring and analyzing tank venting emissions. It serves as a comprehensive resource hub, featuring valuable case studies on the current technologies being used in the industry. These case studies provide in-depth insights into various strategies and their effectiveness, allowing users to understand and evaluate different options. The platform also offers detailed practices on site layout, giving users a clear understanding of how to implement and manage these technologies in real-world settings.

One of the primary aims is to make complex concepts accessible to its users, thereby ensuring that they are better equipped to handle challenges related to emissions. To this end, the platform features an extensive glossary of terminology related to emissions. This glossary serves as a comprehensive resource, allowing users to familiarize themselves with key terms, concepts, and metrics – the glossary will evolve overtime to include additional information and examples as the standards and industry knowledge evolves.

The glossary covers a range of topics, including but not limited to, emission types such as Scope 1 and Scope 2. Scope 1 emissions are direct emissions from owned or controlled sources, while Scope 2

emissions are indirect emissions from the generation of purchased electricity. These terminologies form the basis of emissions tracking and management, making them fundamental to understanding the broader context of the industry's environmental impact.

The platform also provides additional background information to underscore the importance and relevance of its tools and resources. This information hopefully will help users understand the importance and necessity of monitoring and managing emissions, particularly of the growing global concerns around climate change and sustainability.

In addition to providing resources for understanding and managing emissions, the platform also includes detailed engineering information. This includes foundational engineering principles, technical specifications of different technologies, and guidelines on how to implement and maintain these technologies.

CALCULATION

The emissions platform integrates a calculation module that adheres to industry standards and assumptions from AER Manual 15. Users have the flexibility to modify these assumptions and can reset them to the default settings if necessary. The overview section allows users to input summary data relevant to tanks, transportation, wells or facility sites, encompassing operational parameters, equipment specifications, and environmental conditions. Although this isn't an exhaustive list, it provides a solid foundation. Moreover, users can add supplementary comments to offer context or emphasize specific facets vital for subsequent analysis. This information is then saved and incorporated into the final printable PDF for end-user reference.

A pivotal element in determining tank emissions is fluid composition. The application's calculation algorithms take into account the varied fluid compositions, ensuring they fall within the range for which the calculations are highly accurate. This precision is crucial to guarantee that the results produced are both trustworthy and indicative of real-world situations and considerations.

Output data from the application is available in multiple calendar formats, encompassing monthly and yearly evaluations, as well as projections spanning the asset's remaining lifespan. Such versatility enables a thorough analysis, crucial for understanding the long-term consequences of different emission management approaches.

Furthermore, the availability of long-term forecast data lets users delve deeply into tank solutions, especially concerning the economic repercussions of emissions reductions. By studying the cost implications across diverse time spans, users can judiciously decide on the feasibility and sustainability of specific emission-reducing technologies. Future versions of the Emissions Web Portal/APP platform are set to incorporate an economic analysis module on the calculation page. This enhancement will empower users to probe and evaluate the financial ramifications of deploying various tank emission technologies, making it an indispensable resource for informed decision-making, particularly in cost-benefit analysis.

Additionally, the calculation page now includes other types of emissions beyond just tank emissions, offering a wider scope. This addition allows users to obtain a wide understanding of the multiple emission sources related to their operations. By presenting a comprehensive emissions view, the platform ensures

that users are thoroughly prepared to devise and enact potent strategies for emission curtailment and management.

TANK EMISSIONS/DIRECTORY

The Tank Emission Solution Selection Form is a resource tailored to reveal emission management strategies in the oil and gas sector. Once completed, the system evaluates the provided details, taking into account the site's distinct characteristics, operational parameters, and the type of project (be it brownfield or greenfield). The form evaluates factors such as:

- Site Characteristics: (Including but not limited to casing gas management, gas production, centralized gas gathering line, multi-well & single well batteries, integration with existing infrastructure, Methane conversion to efficient power etc.)
- Well Site Operations: (Including but not limited Backup for enclosed combustors, Centralized Facility, Compression and Reinjection of Casing Gas. Compressor Emissions, Easy deployment and transport, Exceptional destruction efficiencies for various waste gases. High methane destruction efficiencies, Impact of combustion on fugitive emissions, Lower Pressure Venting, No Combustion devices, Oil Transportation/Low pressure, Operational Opportunities, Redundancy of Equipment, VRU Installation and integration)
- Support Equipment and Additional Technology: (Including but not limited Adoption of realtime autonomous optimizers, Anomaly detection capabilities, Application of artificial intelligence (AI) in control systems, Capability to handle venting due to equipment failures, Capability to treat venting from relief valves, Combustion technologies, Equipment Solutions, Grid electrification, Implementation of digital controllers, Integration of digital solutions, Monitoring storage tank pressures, Monitoring storage tank temperatures, Operational Issues, Pressurized Storage of Condensate, Tracking storage tank levels, Utilization of digital technology)
- Virtual Pipelines: (Including but not limited allowed Virtual Pipelines, Aligned with the overall prevention strategy)

This tool aims to address the multifaceted challenges of the industry, promoting environmentally conscious and data-informed emission reduction techniques. However, it's crucial to understand that all recommendations derived from this form should undergo thorough scrutiny and be cross-referenced with internal evaluation methodologies. Depending on this form solely should not sidestep a company's internal due diligence; for example:

- Site Characteristics: Out of a total of 48 characteristics, users can select up to 24, refining the options to 9 distinct solutions.
- Well Site Operations: From 22 potential characteristics, users can pick up to 11, narrowing the choices to 16 specific solutions.
- Support Equipment and Additional Technology: Of the 27 available characteristics, users can select up to 12, refining the options to 8 unique solutions.

- Virtual Pipeline: Two distinct characteristics lead to two specific solutions.

The Company/Vendor Directory requires users to select a primary search category. For a more encompassing search, it allows the incorporation of supplementary service categories. This form has been curated to present options for a range of tank emissions solution endeavors, such as combustion, methane compression, and electricity generation. Its objective is to simplify the task of identifying companies equipped with the vital expertise and assets to back user emission management projects. Importantly, the inclusion of companies in this form has been conducted impartially. As a best practice, users are advised to initiate dialogues with their current vendors about particular products and services to guarantee a comprehensive assessment.

C. PROJECT RESULTS AND KEY LEARNINGS

As an essential segment of the documentation, the Project Results and Key Learnings section delves into the critical outcomes and insights garnered during the development of the Emissions Web Portal/APP. The introduction established the foundation by presenting an overview of the project's key outcomes, technologies employed, resources utilized, and more. This section, however, places emphasis on the crucial lessons drawn from the project and the utilization of the platform.

Furthermore, as the project transitions into the commercialization phase, the team plans to assimilate these learnings to gauge their implications for the Oil and Gas and Energy sectors. This evaluation will likely influence future decision-making, aid in identifying areas for improvement, and help in understanding the broader impact of the project on industry practices; knowledge that can be leveraged to optimize performance, make informed decisions, and foster a more impactful and sustainable solution for the Oil and Gas and Energy sectors.

PROJECT OUTCOMES

The development phase was divided into two subsections in Appendix A, including the Platform and External Handbooks. The platform subsection examines the various screens of the portal and engages in a detailed discussion regarding how the platform can be effectively utilized to mitigate emissions. In addition, this subsection will also encompass an exploration of various technologies that are instrumental in emissions reduction. It is important to note that this exploration will not be exhaustive, but rather serve as a high-level outline to guide users through the potential options available for emissions reduction.

The External Handbooks subsection in Appendix A, examines supplementary resources that are pivotal for a comprehensive understanding of emissions and the methodologies for their management. These handbooks are meant to serve as repositories of knowledge and best practices, and they will be instrumental in informing and educating users on the various facets of emissions, their impact, and strategies for mitigation.

By structuring the platform and External Handbook in this manner, users are provided with a clear and structured pathway to not only understand the features and functionalities of the platform but also gain access to information and resources that are essential for informed decision-making in emissions management. This structure thus enhances the utility of the platform by integrating it with knowledge

resources, thereby fostering an environment for continuous learning and improvement in emissions reduction strategies.

D. PROJECT AND TECHNOLOGY KEY PERFORMANCE INDICATORS

Organization:	Current Study	Commercial Deployment Projection
Project cash and in-kind cost ($)	229,825	Operational Maintenance
Technology Readiness Level (Start / End):	7/9	Deployed
GHG Emissions Reduction (kt CH4/yr):	n/a	n/a
Estimated GHG abatement cost ($/kt CH4)	n/a	n/a
Jobs created or maintained:	4	4

E. RECOMMENDATIONS AND NEXT STEPS

Lessons Learned & Future Considerations

During the development process, our Team gained valuable insights into various frontend, backend, database, and mobile app development technologies. In addition, our Team explored authentication, authorization, web server configurations, DevOps, deployment, and performance monitoring tools. The following is a summary of the key technologies that were evaluated.

Frontend:

The team worked with HTML5, the standard markup language for web pages and applications, alongside CSS3, a stylesheet language for styling HTML documents. JavaScript, a high-level programming language, was used to add interactivity and dynamic content. Our Team streamlined development by utilizing React for web development (with Render) and Flutter for cross-platform mobile app development.

Backend:

Various programming languages were considered, such as Node.js (JavaScript), Python, Ruby, PHP, and Java. Our Team also delved into web frameworks like Express.js (Node.js), Django or Flask (Python), Ruby on Rails (Ruby), Laravel (PHP), and Spring Boot (Java). For seamless communication between frontend and backend, we explored API development using RESTful APIs or GraphQL.

Database:

NoSQL databases like MongoDB, Cassandra, and Couchbase for managing unstructured or semi-structured data were investigated.

Mobile App Development:

For cross-platform development, our Team employed Flutter to create apps that run on both Android and iOS.

Authentication & Authorization:

OAuth 2.0, an open standard for access delegation, and JSON Web Token (JWT) for user authentication and authorization were incorporated into the final design.

Web Servers:

Web servers were examined and popular web servers such as Nginx and Apache for serving static assets, load balancing, and reverse proxying were considered.

DevOps and Deployment:

The toolkit included Git for version control, CI/CD tools like Jenkins, Travis CI, CircleCI, or GitHub Actions, and containerization solutions such as Docker. Our Team also explored orchestration options like Kubernetes or Docker Swarm and cloud providers like Amazon Web Services (AWS), Google Cloud Platform (GCP), and Microsoft Azure.

Performance and Monitoring

Performance and Monitoring tools were utilized to optimize application performance, our Team utilized caching technologies like Redis or Memcached. Our Team considered Elasticsearch, Logstash, and Kibana (ELK Stack) or Grafana and Prometheus for monitoring and logging.

Next Steps

As Breakwater Vantage, in cooperation with PTAC, contemplates the evolution of the Emissions Web Portal/APP Project, they understand the need for continuous development to ensure system reliability and efficacy. This development encompasses rigorous testing for handling extensive user traffic, ensuring data accuracy, and providing a consistent user experience across various devices. Breakwater Vantage, with additional funding and collaboration with PTAC, is also devoted to addressing questions about enhancing data security measures, refining load distribution, and advancing the adaptive UI/UX design.

Looking ahead to the next two years, Breakwater Vantage plans to leverage the learnings from this project to drive further innovation. The strategy includes regular updates to existing features, introducing new functionalities based on user feedback, and continuously optimizing system performance. With additional collaboration from industry partners like PTAC, there's a keen interest in exploring the integration of emerging technologies like Artificial Intelligence and public transaction ledger/credit generation based on established protocols. These technologies can considerably amplify the platform's capabilities.

Long-term, Breakwater Vantage, with support and additional funding from PTAC, aspires to turn this technology into a commercially viable product. This vision not only focuses on broadening the user base but also on potential technology licensing opportunities. Discussions are in place about introducing premium features or pivoting to a subscription-based revenue model.

Lastly, Breakwater Vantage, in collaboration with PTAC, is considering expanding the Glossary, introducing comprehensive definitions of technical terms and concepts, integrating an economic analysis tool for smart financial decision-making, adding a forecasting feature to anticipate emission trends, carbon credits generation, wellsite information, and offering an in-depth perspective on other emission sources from other PTAC funded projects from Q1 2023. With these additions, they aim to furnish users with a holistic, informed, and pragmatic experience, aiding them in honing their emission management goals with enhanced precision and foresight.

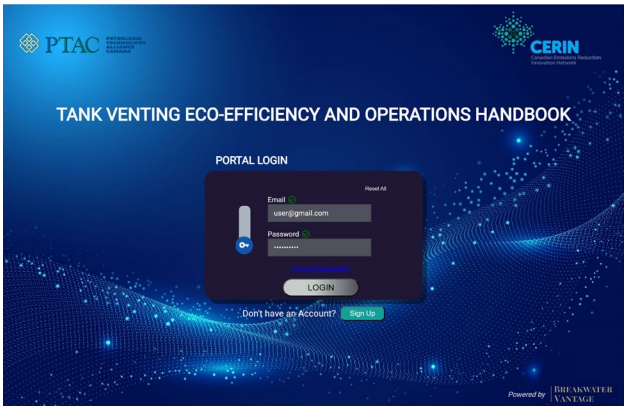
APPENDIX A

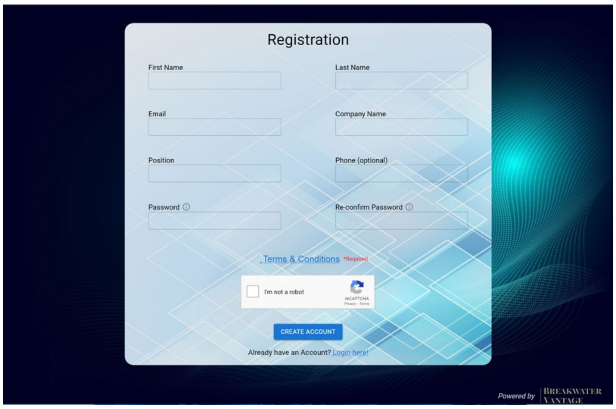
Below is an overview of the portal and app:

1. The Login Page offers a user-friendly gateway, ensuring data protection and an enhanced visual experience.
2. The Tank Venting Model Page provides users with a detailed understanding of the platform's functionalities and features, guiding them effectively.
3. The Resource Page is a repository of analytical content on Tank Venting Emissions, complemented by real-world case studies for meaningful insights.
4. The Calculation Page acts as the analytical heart of the project, simplifying emissions assessments and empowering stakeholders to make informed decisions.
5. Rounding out the suite is the Tank Venting Eco-Efficiency & Operations Handbook, which outlines a strategy that balances environmental responsibility with operational efficiency.

Login - Page

The Login Page requires that the user establish a user account if they have not previously done so. For individuals who have already created an account, they can proceed to log in by entering their credentials. The system has been designed to verify the credentials; upon successful authentication, the user is greeted with a visually engaging animation accompanied by a green arrow, when entering their email and password.





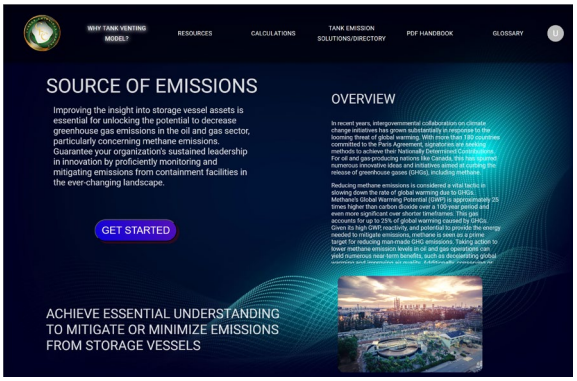
Registration allows users to access the features and resources available within the portal. The integrity and confidentiality of the user's input information are paramount; the data is securely stored in compliance with the prevailing data protection regulations. Furthermore, the Terms & Conditions of the platform explicitly stipulate that users retain the right to permanently delete their personal information from the platform. This ensures that the users exercise control over their data and can confidently use the platform, knowing that their privacy and data protection are held in high regard.

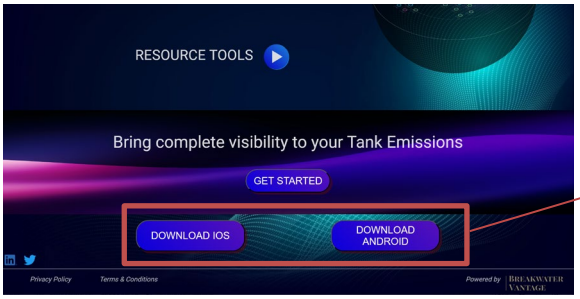
Why Tank Venting Model - Page

The Tank Venting Page serves as an introductory overview of the Tank Venting Model. It has been designed to provide in-depth insights and essential information regarding the utilization and underlying rationale of the Tank Venting Emission platform. Users are given an overview that explains the various features and functionalities embedded within the platform.

In addition, the page offers guidance on the systematic steps and procedures, thereby empowering users to navigate the platform with assurance. A comprehension of the underlying principles and algorithms that govern the model's calculations is also conveyed to the user to ensure that they can make informed decisions based on the outputs generated, and it permits the user to modify inputs as required.

Furthermore, this page sheds light on the significance of the Tank Venting Emission platform within the broader context of environmental sustainability and compliance in the oil and gas sector. By outlining the importance of monitoring and managing tank venting emissions, the platform is established as a tool for organizations striving to reduce their environmental footprint and adhere to possible regulatory requirements.





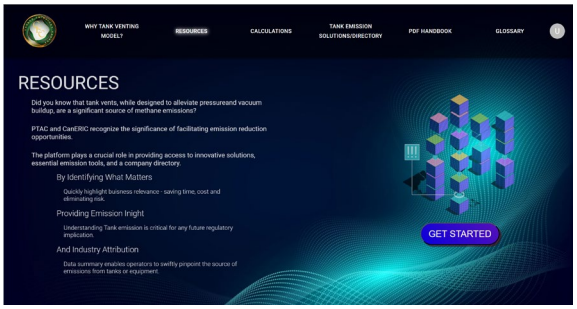
Download Buttons for the APP onto your phone.

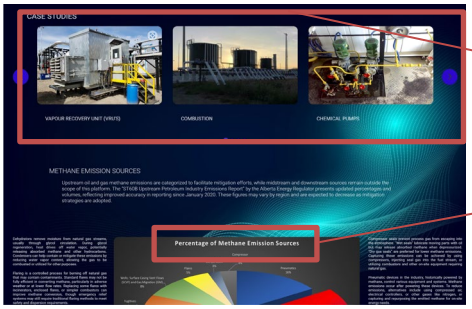
Resources - Page

The Resource Page examines in detail the significance of Tank Venting Emissions, offering an analytical exploration of the subject. It is an essential repository for stakeholders in the industry who seek an in-depth understanding of Tank Venting Emissions and their implications to other sources of emissions.

In this section, case studies are featured. These case studies provide real-world examples and detailed analyses of various scenarios, offering practical insights into how Tank Venting emissions can be managed and mitigated. When a user clicks on any one of the 10 Case Studies, they are forwarded to a page that examines the outcomes and strategies employed for that case study on emissions; therefore, allowing the user to glean valuable information that can be applied to their own contexts and operations.

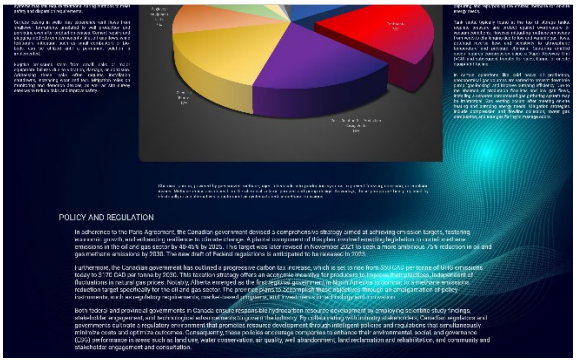
This compilation of resources is designed to equip users with the knowledge and tools needed to make informed decisions and adopt best practices in managing tank venting emissions, ultimately supporting emission reductions in the oil and gas sector.

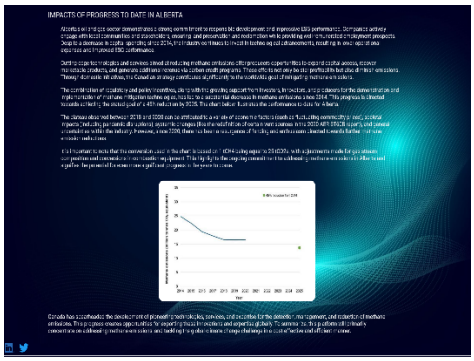




Case Study

Emission Summary



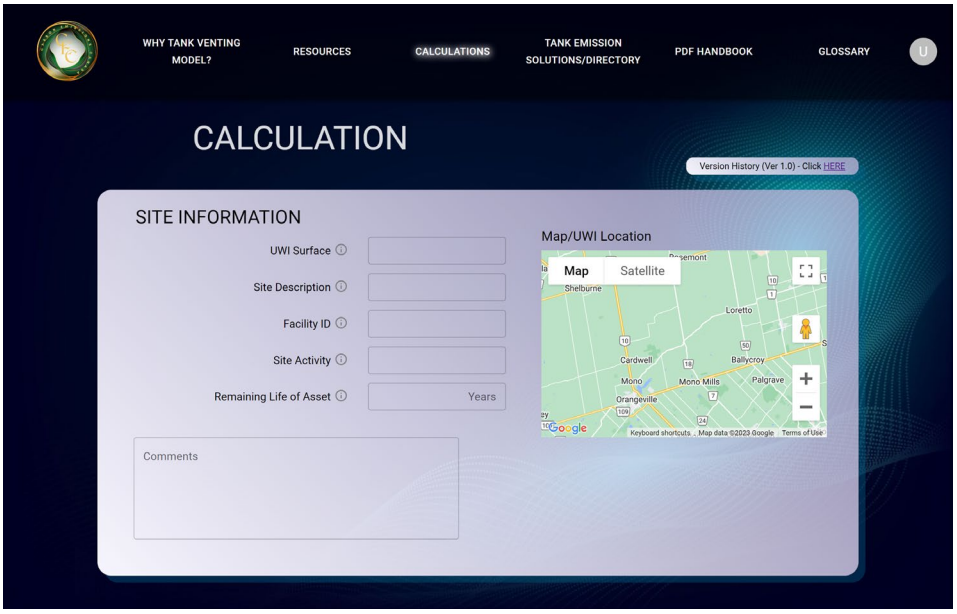


Case Study Example:

Calculation - Page

The Calculation Page constitutes the core and analytical crux of the project, embodying a multifaceted computational framework. It encompasses an amalgamation of distinct sections that pertain to various components within a facility or site. Each section within this page demands its own specific inputs and, in turn, generates specialized outputs through intricate algorithms.

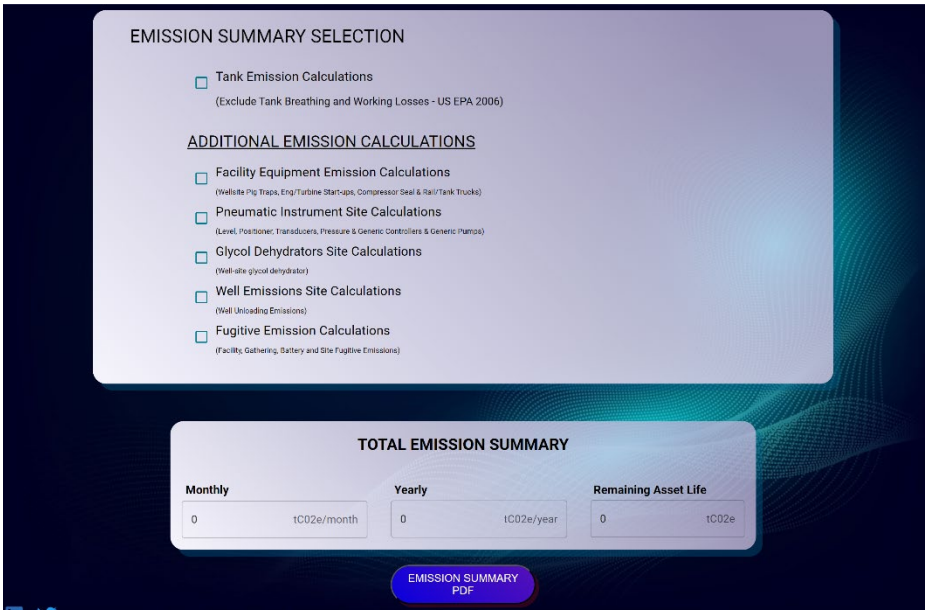
This phase includes site information from the user through input fields for an overview, including UWI (Unique Well Identifier), Site Description, Facility ID, Site Activity, Remaining Life of Asset, and map output options.



The following Calculation Sections includes:

1. Tank Emission Calculations:
   - This part is dedicated to the calculation of emissions emanating from storage tanks. Notably, it excludes Tank Breathing and Working Losses, but a comprehensive excel spreadsheet exists on the US Environmental Protection Agency's 2006 guidelines. This ensures a focused analysis of emission types for more accurate assessments for Alberta based assets.
2. Facility Equipment Emission Calculations:
   - This segment is concerned with emissions originating from an array of equipment in a facility. It covers aspects such as Pig Traps at well sites, Engine/Turbine Start-ups, Compressor Seals, and Rail/Tank Trucks. Each equipment type necessitates specific input data for precise calculation of emissions.
3. Pneumatic Instrument Site Calculations:
   - Focusing on pneumatic instruments, this section calculates emissions from various devices including Level Controllers, Positioners, Transducers, Pressure Controllers, and Generic Pumps. The section allows for in-depth evaluation of emissions arising from the usage of pneumatic instruments in operations.
4. Glycol Dehydrators Site Calculations:
   - Deals exclusively with emissions from glycol dehydrators at well sites/facility. Glycol dehydrators are critical in natural gas processing, and monitoring their emissions is essential for environmental compliance.
5. Well Emissions Site Calculations:
   - Calculates emissions associated with well unloading processes. This is vital for the accurate accounting of emissions during gas production activities.

6. Fugitive Emission Calculations:
    - Lastly, this portion evaluates fugitive emissions, which are inadvertent emissions that escape from various parts of a facility. It encompasses emissions from an array of settings including gathering systems, batteries, and sites.



The Calculation Page, in its entirety, functions as a central instrument for the analysis and assessment of emissions across an array of domains within the oil and gas sector. Its comprehensive approach enables stakeholders to make data-driven decisions, optimize operations, and ensure adherence to environmental standards and regulations.

The form accepts user inputs into the backend code to be processed in a large calculation that has been adapted from a mass balance.

The user can select between displaying the results of the calculation quickly on screen with the 'Calculate' button, or the user can generate a PDF of the Emission Summary which would include a breakdown of the emissions from the different sources.

In each of the section tabs, a subtotal estimate is displayed on screen as the user enters values into the input fields.

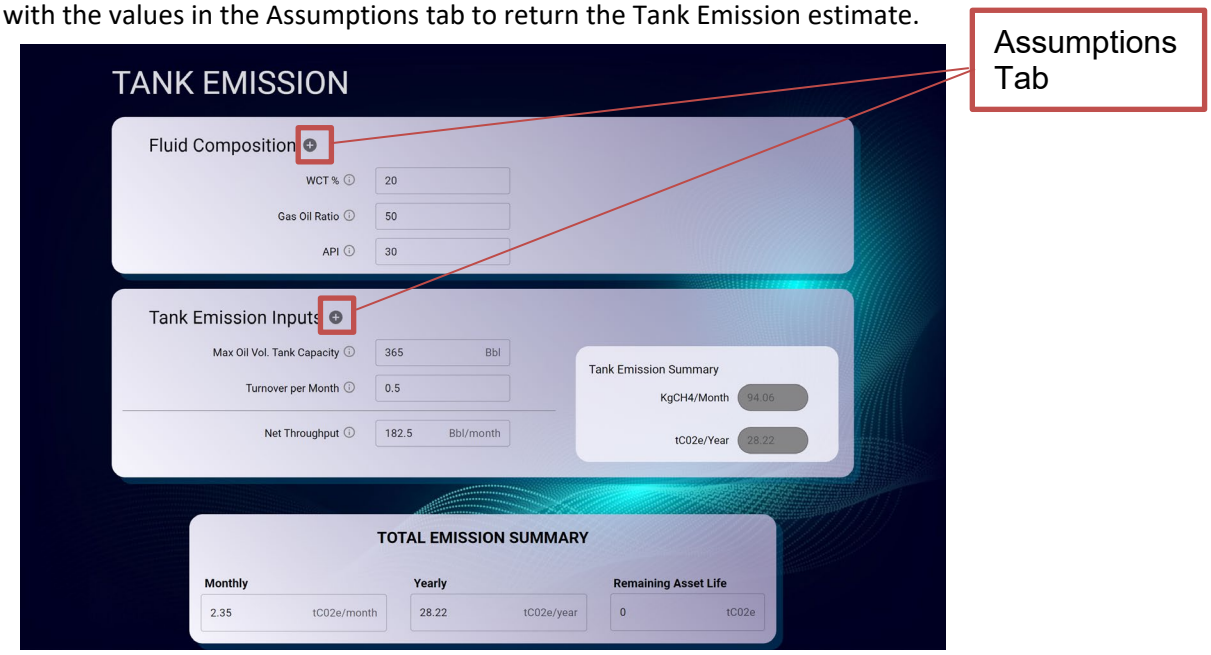
Example Calculation: Tank Emissions

The Tank Emission Calculation section is composed of 2 parts Fluid Composition and Tank Emission Inputs.

- **Fluid Components**
    - Fluid Composition user input fields:
    - The user inputs are WCT%, Gas Oil, Ratio API. These are checks to ensure that the conditions are correct for the calculation to be valid.

- **Fluid Composition Assumptions Tab:**
  - Methane Mol %
  - Set to a standard 93%

    Note**: This value will be used in the calculations of the rest of the following.
  - sections (except for Fugitive Emissions).
- **Tank Emission Inputs**
  - The user inputs Max Oil Volume Tank Capacity and Turnover per Month are multiplied to generate the Net Throughput.
  - The Net Throughput is then processed through a calculation in the backend in conjunction with the values in the Assumptions tab to return the Tank Emission estimate.

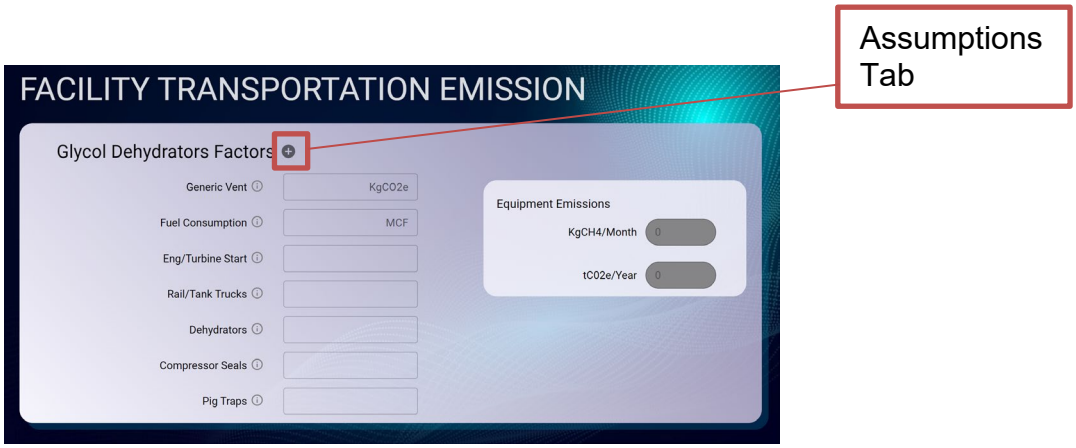


Additional Emission Calculations

Facility Transportation Emission

Contains input fields for Generic Vents, Fuel Consumption, Engine Turbine Starts, Rail/ Tank Trucks, Dehydrators, Compressor Seals, and Pig Traps.

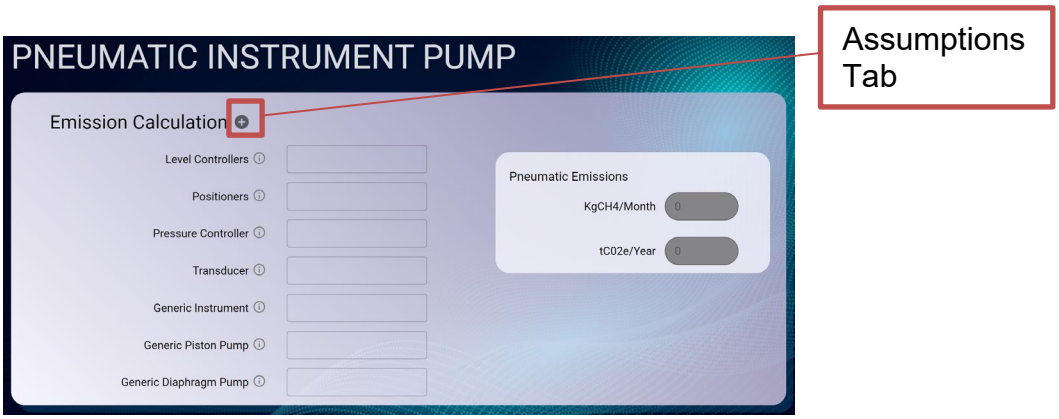
The Facility Transportation Emission input fields have their own calculations involving their respective assumption values already incorporated. The results are summed up and returned as the Equipment Emissions Estimate.



Pneumatic Instrument Pump

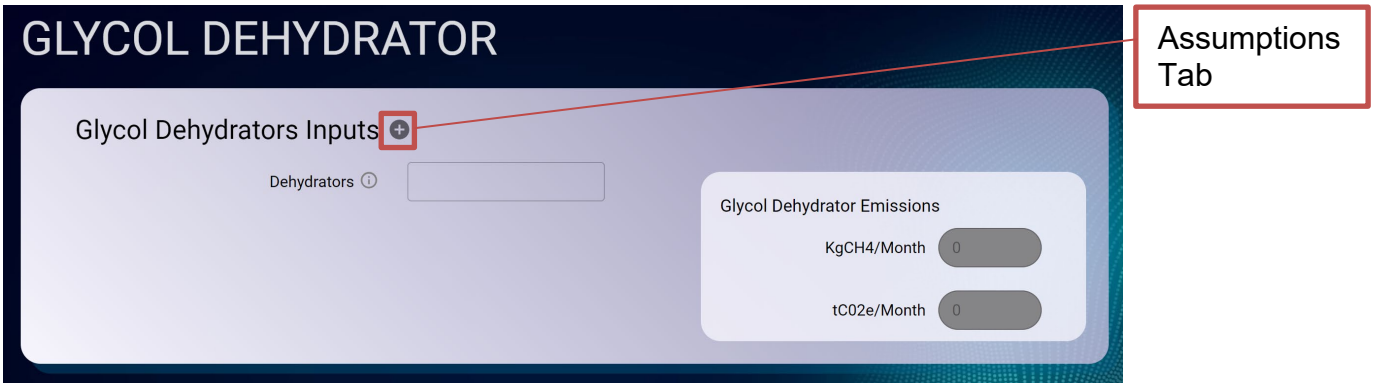
The Pneumatic Instrument Pump section contains input fields for the number of level controllers, positioners, pressure controllers, transducers, generic instruments, generic piston pumps, and generic diaphragm pumps.

The Pneumatic Instrument Pump input fields have their own calculations involving their respective assumption values already incorporated. The results are summed up and returned as the Pneumatic Emissions estimate.



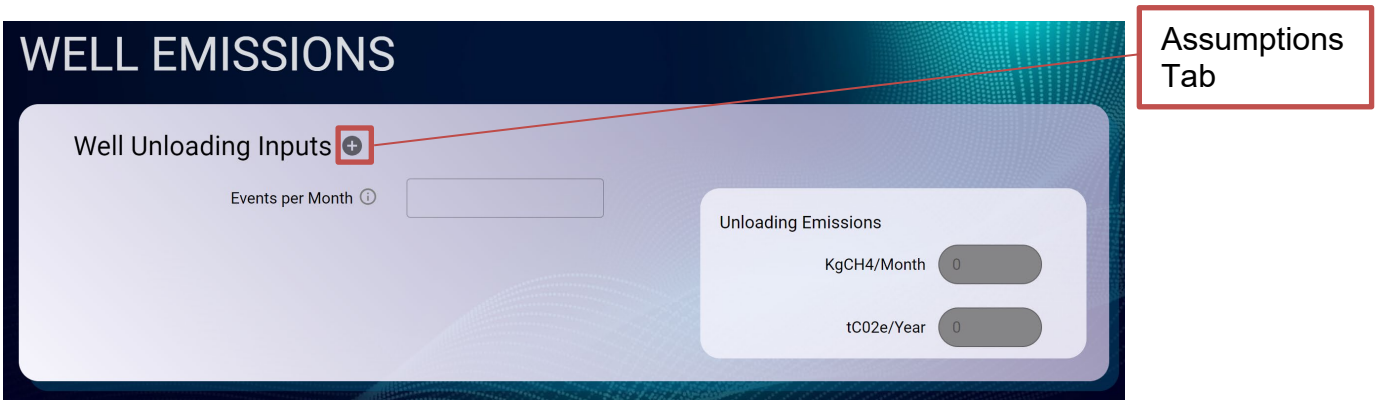
Glycol Dehydrator

The Glycol Dehydrator has a single input for the number of glycol dehydrators that are located on site. Well allocation and selection can be adjusted in the assumptions tab. The results are calculated and returned as Glycol Dehydrator Emissions Estimate.



Well Emissions

Well Emissions has a single input for the number of well unloading events per month to calculate the emissions associated with such events. Well specifications can be adjusted in the assumptions tab. The results are calculated and returned as an Unloading Emissions Estimate.

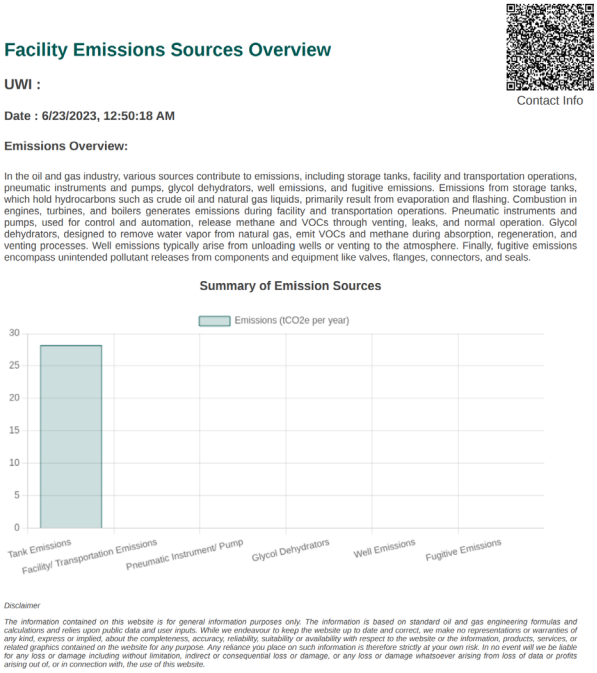


Fugitive Emissions

Fugitive emissions from valves, seals, and connection points are accounted for in this section. User inputs include the number of pieces of equipment, as well as the ppm concentration values categorized as “Low” (below 1,000 ppm), “Moderate” (between 1,000 and 10,000 ppm), and “High” (above 10,000 ppm). In the assumptions tab there are values for the type (sweet, sour, light, gas, vapor) of the product, as well as the annual number of hours that these connection points are being used. The results are calculated and returned as Fugitive Emissions Estimate.

Total Emission Summary PDF

The total emission summarizes the values of the sections identified above and are summed up and returned monthly, yearly, and remaining asset life values of tCO2e.



Facility Emissions Sources Overview

UWI :

Date : 6/23/2023, 12:50:18 AM

Emissions Overview:

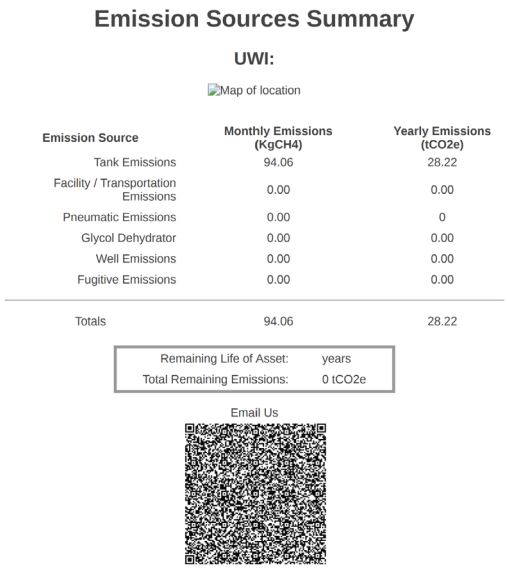
In the oil and gas industry, various sources contribute to emissions, including storage tanks, facility and transportation operations, pneumatic instruments and pumps, glycol dehydrators, well emissions, and fugitive emissions. Emissions from storage tanks, which hold hydrocarbons such as crude oil and natural gas liquids, primarily result from evaporation and flashing. Combustion in engines, turbines, and boilers generates emissions during facility and transportation operations. Pneumatic instruments and pumps, used for control and automation, release methane and VOCs through venting, leaks, and normal operation. Glycol dehydrators, designed to remove water vapor from natural gas, emit VOCs and methane during absorption, regeneration, and venting processes. Well emissions typically arise from unloading wells or venting to the atmosphere. Finally, fugitive emissions encompass unintended pollutant releases from components and equipment like valves, flanges, connectors, and seals.

Summary of Emission Sources

Disclaimer

The information contained on this website is for general information purposes only. The information is based on standard oil and gas engineering formulas and calculations and relies upon public data and user inputs. While we endeavour to keep the website up to date and correct, we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the website or the information, products, services, or related graphics contained on the website for any purpose. Any reliance you place on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this website.

Contact Info



Emission Sources Summary

UWI:

Map of location

Emission Source	Monthly Emissions (KgCH4)	Yearly Emissions (tCO2e)
Tank Emissions	94.06	28.22
Facility / Transportation Emissions	0.00	0.00
Pneumatic Emissions	0.00	0
Glycol Dehydrator	0.00	0.00
Well Emissions	0.00	0.00
Fugitive Emissions	0.00	0.00
Totals	94.06	28.22

Remaining Life of Asset:	years
Total Remaining Emissions:	0 tCO2e

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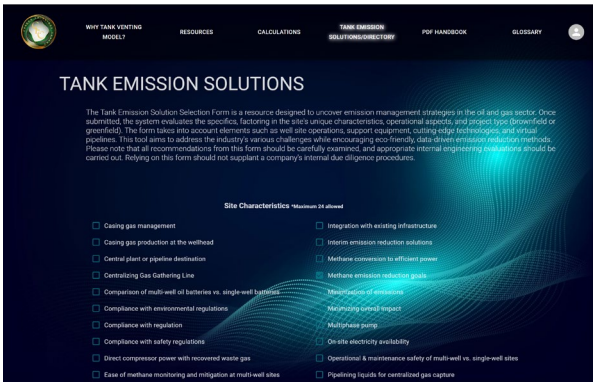
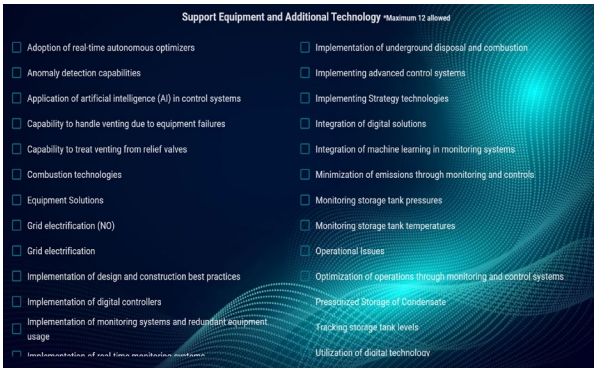
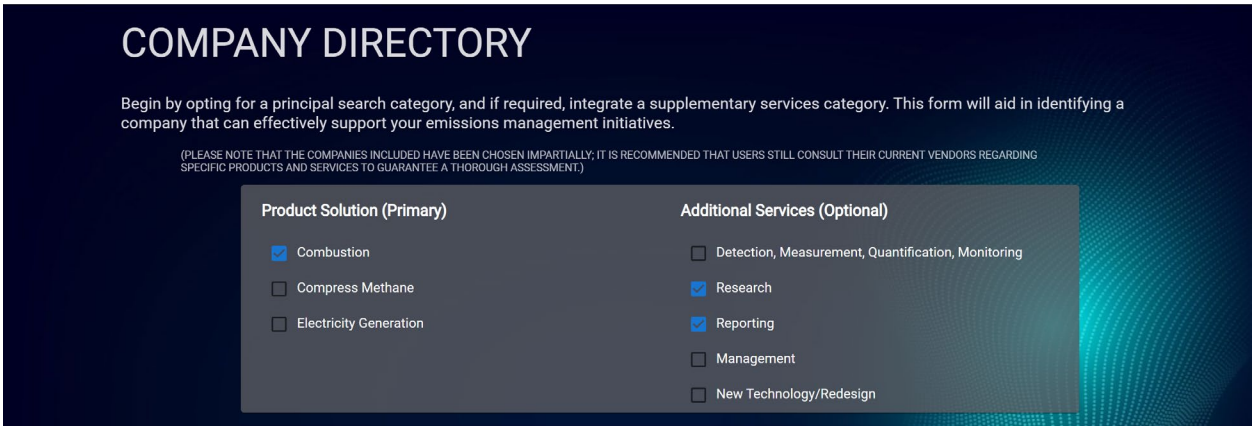
Tank Emission Solutions/Directory - Page

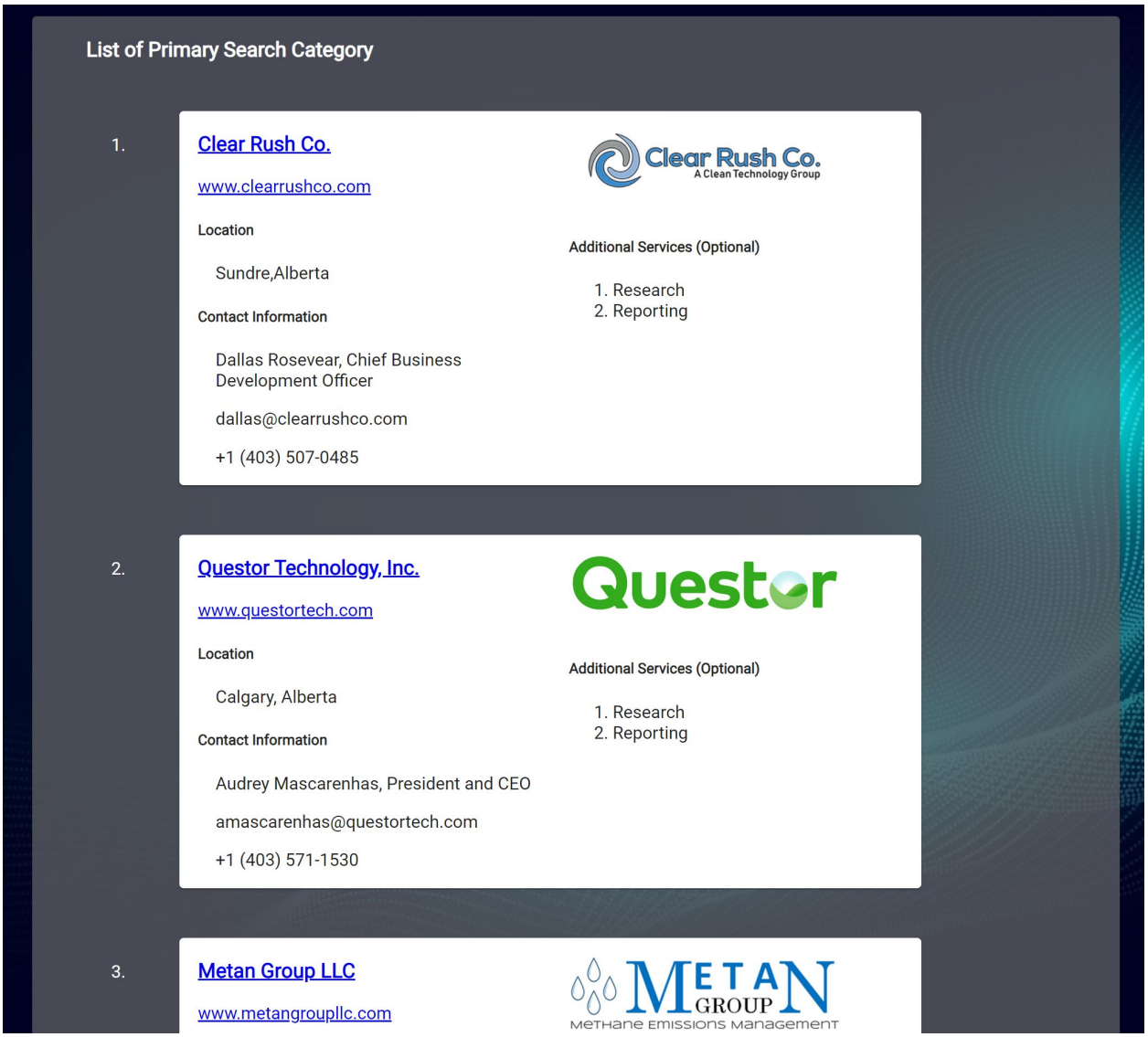
The Tank Emission Management Strategy Identifier is an instrument tailored to discern emission control tactics pertinent to the hydrocarbon exploration and production Site Characteristics, Well-Site Operations, Support Equipment and Additional Technology and Virtual Pipelines. Upon submission, the algorithm undertakes a comprehensive appraisal of the details, integrating the distinct attributes of the site, operational idiosyncrasies, and project requirements, whether it's a matured site (brownfield) or a nascent development (greenfield). The instrument considers an array of facets encompassing well site operational activities, ancillary apparatus, technological solutions, and virtual pipeline systems. The ideal objective of this instrument is to address the multifaceted hurdles confronted by the industry, while fostering environmentally responsible, analytics-driven emissions curtailment strategies. It is imperative to underscore that the recommendations generated by this instrument warrant thorough scrutiny and should be corroborated through rigorous internal engineering assessments. Utilization of this instrument should not obviate an organization's intrinsic responsibility to exercise due diligence.





The Company Directory is based on starting by opting for a principal search based on product solutions, which facilitates the filtration for companies specialized in the chosen solution. You can further refine the search by highlighting companies offering a plethora of services, amalgamating the primary product solution with additional services; this elevates companies to the forefront of the list that align with your specified criteria. This form is devised to aid in identifying a corporate entity adept at helping a user emissions management initiative.





The Corporate Profile Cards contain pertinent contact details and direct hyperlinks to respective company websites, designed to facilitate easy navigation for users. By clicking on the company name,

users can access comprehensive company profile information, offering deeper insights into their operations and solutions. This feature assists companies in their exploration through a multitude of potential partners, enabling them to identify the one that resonates best with their requirements to fulfill their emission management strategy. It simplifies the decision-making process, empowering companies to formulate informed choices in their quest for effective emission management collaboration, ultimately leading to better emission equipment and reduction in Tank Emission Sources.

External Handbook - Page

To facilitate the reduction of tank venting emissions, which encompass emissions emanating from the storage of oil and gas, it's imperative that a user follows a series of structured steps.

Firstly, a user can utilize the "Manual 015 – Estimating Methane Emissions" to gauge the magnitude of methane emissions from its tanks. This assessment is crucial in understanding the scope of the issue at hand.

Subsequently, the user can consult the "ST60B Upstream Petroleum Industry Emissions Report" to gain insights into the broader landscape of emissions within the industry. This resource enables the entity to learn from the experiences of others and discern trends or solutions that could be applicable to their own operations.

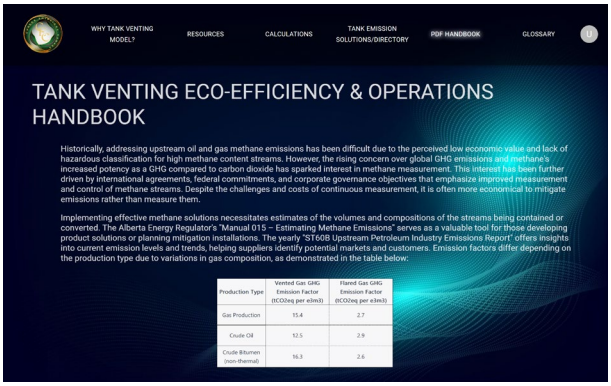
Also, it is important to take into consideration the specific type of production it is engaged in. As different productions have diverse gas compositions, they necessitate varying approaches for emission control.

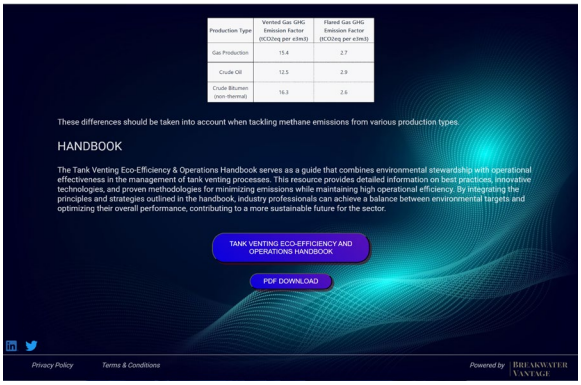
Following this, the user can make effective use of the Tank Venting Eco-Efficiency & Operations Handbook developed though PTAC networks https://www.ptac.org/wp-content/uploads/2019/06/Handbook-Final.pdf and Canadian Capabilities in Methane Emissions Reduction – PTAC. This guide imparts valuable knowledge on how to proficiently manage Tank Venting processes while concurrently minimizing emissions – this handbook has been summarized from several PTAC and associated consults with PTAC. It serves as a comprehensive manual for combining environmental stewardship with operational efficiency.

Incorporation of technological advancements is also pivotal. The employment of sensors and data analytics allows for real-time monitoring of emissions, enabling the entity to swiftly take corrective measures in case of discrepancies or malfunctions.

Lastly, it’s advantageous for the user to engage in dialogue with relevant stakeholders, including government authorities, environmental organizations, and neighboring communities. Such collaborations can lead to the exchange of best practices and resources, thus fortifying collective efforts.

In summary, the Tank Venting Eco-Efficiency & Operations Handbook capitalizes on industry-wide knowledge by tailoring methodologies to specific production types, adhering to an informative guide, leveraging technology, and fostering collaborations. Through these measures, the user can significantly reduce tank venting emissions. This not only improves the environmental footprint, but also enhances the efficacy and sustainability of operations.





The Tank Venting Eco-Efficiency & Operations Handbook serves as a comprehensive resource, detailing the strategies and techniques to effectively manage tank venting emissions. The handbook delivers an in-depth understanding of the complexities associated with tank venting operations and proposes solutions that can significantly reduce the environmental impact while maintaining operational efficiency.

This includes guidance on selecting and implementing technologies, best practices, and methods tailored to user specific operations. The handbook sheds light on understanding the unique composition of gases in each entity's tanks, focusing on how this impacts the emissions generated and, consequently, the best approaches for their reduction.

In addition, the handbook delves into the importance of real-time monitoring of emissions, showcasing how advanced sensor technology and data analytics can aid in immediately identifying and rectifying any operational issues leading to excessive venting.

Furthermore, the handbook encourages active engagement with all relevant stakeholders, be they governmental authorities, environmental bodies, or local communities. This facilitates a collaborative approach to managing emissions, where experiences and insights can be shared, thus fortifying the efforts to reduce tank venting emissions.

Lastly, the Handbook offers an extensive guide to navigate the complexities of managing and reducing tank venting emissions, underscoring the balance between environmental responsibility and operational effectiveness.

GENERAL LEARNINGS

The following is a concern regarding the development of the Emissions Web Portal/APP:

- **Issue:** The calculation when taking in all the inputs in a single object was straight forward, but when we were developing the emission summary subtotals to render to the page, we could not use the entire object because some of the values were out of scope for that specific tab.
- **Solution:** New objects were created for each individual tab, so that the values would be correctly tailored to the corresponding tab.

WEB APPLICATION

The Emissions Web Portal was constructed employing the MERN stack (MongoDB, Express.js, React, Node.js) due to its seamless integration and scalability through JavaScript. React was preferred over Angular in the MEAN stack for its performance and reusable components. Material UI was chosen as the CSS Framework for its compatibility with React and distinctiveness compared to the ubiquitous Bootstrap and Tailwind.css.

During the development, priority was given to user experience and security. The login and registration pages were developed with security measures such as input validation using Validator.js, password encryption using bcrypt, and authorization through JSON Web Tokens (JWT) which were stored in cookies. The application also took precautions against cross-site scripting and MongoDB injection attacks.

For the technical side, MongoDB was chosen for the database due to its flexible data model, scalability, cost-effectiveness, and support. The Emissions App leveraged Flutter for cross-platform development due to its efficiency and flexibility. Throughout the development process, the team utilized various libraries and followed documentation for technologies like Flutter, QR Codes, and third-party integrations to ensure a robust solution.

Table 1: KPIs and Targets

KPIs	Description	Target
Development Timeline	Timely completion of the project within the established timeframe	4 Months
Budget Adherence	Staying within the allocated budget for the project	
Quality Standards	Meeting or exceeding predefined quality benchmarks for performance, usability, and security	100%
Software Technologies	Effective utilization of innovative software technologies, such as	100%

	MongoDB, Flutter, and React	
Commissioning Process Completion	Seamless commissioning of the web portal and app, including testing and integration	100%
User Adoption Rate	Percentage of target users adopting the web portal and app within the first week of operation	75%
User Satisfaction Rate	Percentage of users satisfied with the web portal and app's performance, usability, and features	85%
Objective Fulfillment	Achievement of all predefined project objectives and deliverables	100%
Post-Launch Support & Updates	Ongoing support, maintenance, and updates provided to users, addressing their feedback and Oil and Gas & Energy sectors' needs	100%