Innovating Oil & Gas for a Safer Tomorrow using Mixed Reality

Authored By:
Gavin Brocklebank
Muskan Gupta
Lauren Mayes
Omar Ramadan
Anoushka Suri

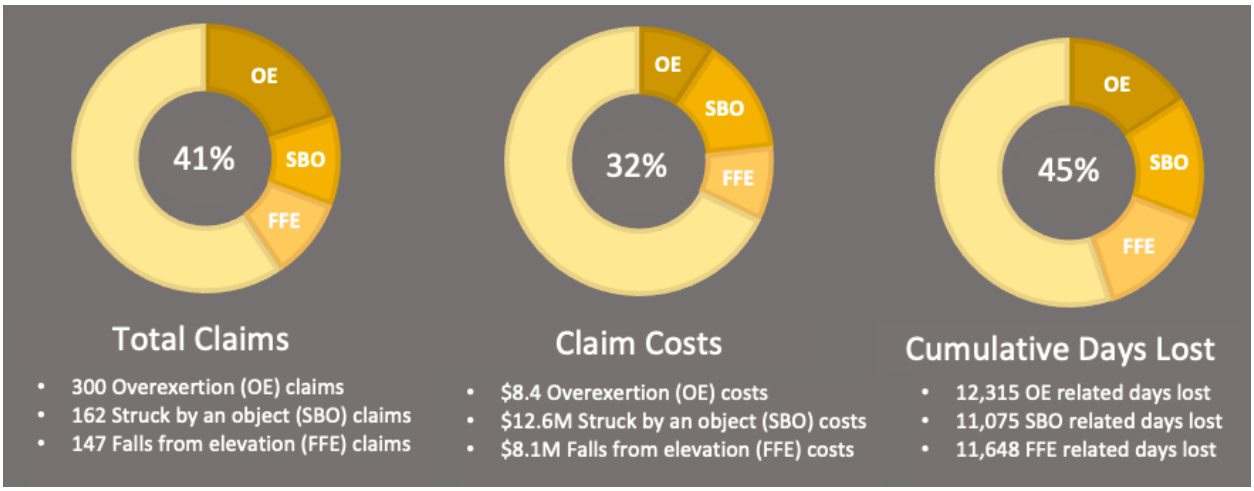
Executive Summary

The Oil, Gas & Mineral Resources industry experiences significant monetary and temporal losses due to reoccurring workplace incidents. To address this issue, global industry leaders have turned to technologies such as drones and extended reality (XR), enhancing safety training, conducting risk assessments, and emergency response plans.

This report establishes a business case demonstrating how Canadian oil, gas and mineral resource companies can benefit from implementing these technologies, specifically companies who strive to improve safety measures, reduce costs, and ultimately save lives.

The Safety Problem

Every five years, the Canadian Oil, Gas & Mineral Resources (OG&MR) industry loses approximately 80,000 working days due to employee workplace incidents. According to the Occupational Safety Group (OSG), the average direct cost of a worker's compensation claim after an on-site injury is between $39,000 and $78,000. Although this is a substantial sum, indirect costs such as lost wages due to injuries, OSHA fines, legal fees, and employee hiring/retraining costs can triple the total cost of a single incident, bringing the average cost closer to $196,000 per occurrence. Between 2017 and 2021, the Canadian OG&MR industry received 1,502 claims, half of these attributed from three classes of incidents: overexertion, struck by an object, and falling from an elevated surface.



The Three Primary Culprits

Incidents involving overexertion, struck by an object, and falling from an elevated surface account for 41% of the total number of claims, 32% or $29.1 million of the total direct costs, and 45% or 35,000 of the cumulative working days lost within the OG&MR industry. If safety initiatives were to reduce incident rates by 10% across these categories, an organization could save $2.9 million in direct costs and an additional $10.8 million in indirect costs.

The discussion above outlines a prominent opportunity to improve workplace safety.

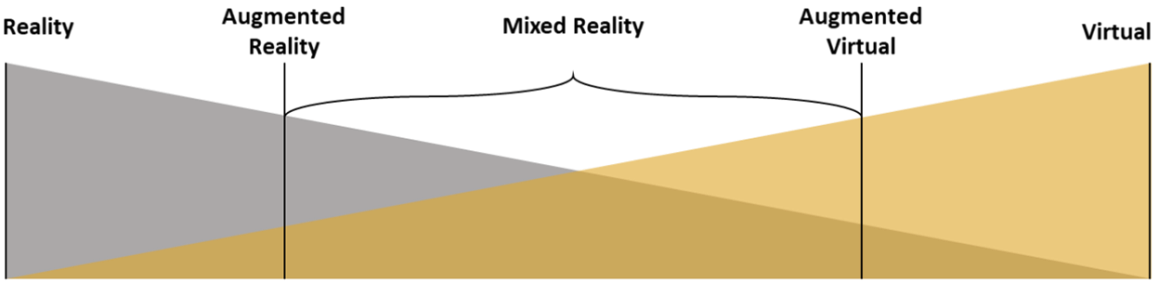
The Industry in a Pinch

A study conducted in Ontario by the Organizational Safety Group (OSG) found that for every dollar invested into health and safety, an average of $1.57 is returned in mitigated costs across all Canadian industries. Another study by the OSG evaluated that a firm's transition to a safety-based vision increases its sales by 400%, profitability by 14%, employee productivity by 45%, and decreases withheld periods due to injuries by 85%. These metrics outline lucrative incentives to improve safety within the OG&MR industry.

Companies within the OG&MR industry have implemented various measures to minimize on-site injuries, including enhanced training programs, risk assessment initiatives, and emergency response plans. In Canada, some companies have reduced their on-site workforce by 20% to improve safety and performance. They have also installed collision prevention technology on more than 1,000 pieces of equipment, and reassessed safety standards. More recently, companies have started to use VR to train employees and improve safety standards. The utilization of VR can benefit organizations in terms of cost savings, skill development, employee engagement, training effectiveness, and evaluations.

What is Extended Reality (XR)?

XR refers to immersive technologies that integrate the physical and virtual worlds, including augmented reality (AR), virtual reality (VR), and mixed reality (MR). Below is the XR spectrum:



XR offers several advantages, such as facilitating remote collaboration that makes teams feel like they are in the same room, and the transformation of traditional workplace training methods by simulating real-work environments. This allows trainees to actively participate and support maintenance and safety inspections by using AR for remote safety audits. Drones have the potential to greatly enhance safety in the industry by providing real-time monitoring and inspections of oil and gas infrastructure, reducing the need for manual inspections, and minimizing the risks associated with human intervention.

Augmented Reality in Oil & Gas

AR technologies augment the users' experience of reality often through wearable technology like glasses that project information onto the glass or plastic. These wearables often come with a camera that can see your environment and provide the user information through the glasses. While AR is most common with visual augmentation it can include augmenting all 5 senses. Using AR-controlled drones provides the ability to conduct inspections of elevated areas instead of the worker. Drones cover large areas quickly reducing the time and number of people on site, therefore, reducing the TRIR and LTIF by reducing the number of incidents from trips, slips, and falls. Costing around $59,000 in hardware and $25,000 in training these AR drone systems could potentially save $8 million in claim costs from elevation falls.

Augmented Virtuality in Oil & Gas

Augmented Virtuality Reality (AV) brings objects from reality into a virtual world such as creating photogrammetry environments. This is a new field of XR that is seeing more development in the cases of remote training, where the remote instructor can exist in a virtual environment while still being able to see students' work on-site. Digital twins are 3D virtual recreations of equipment and buildings in operation. They allow for remote monitoring of onsite equipment and can create predictive models for future maintenance. This reduces the number of people on site eliminating overexertion, being struck by an object, and slips from elevation. While digital twins have the potential to save over $20 million in claims they cost over $1 million to build and $0.5 million a year to run.

Mixed Reality in Oil & Gas

The MR spectrum spans between augmenting your reality and augmenting a virtual reality. Since both blend virtual and reality there are varying degrees of how much technology is integrated. Where your technology lands along this spectrum will depend on the use case and technologies available. By combining physical and digital information, MR tools can enhance communication, visualization, and decision-making processes, allowing teams to work remotely, reduce downtime, and optimize operations, thus reducing costs. MR calling is becoming more popular through its offerings via Microsoft and Facebook. These calls allow users to connect from any point along the XR spectrum including through a normal phone call all the way to VR.

Virtual Reality in Oil & Gas

VR is where the user enters a completely virtual environment typically through a VR headset which fully blocks the users' view of their real environment. In these environments, the user will have to compete for freedom to interact with the world. Utilizing this technology, we can train workers for various emergency scenarios and common hazards in a safe environment. Workers gain hands-on experience; experience has been shown to increase the retention rate of training versus traditional learning. This would increase the Safety training completion rate by speeding up training time. AR training is contracted out to specialized AR training facilities that cost between $12,000 - $25,000 and would reduce the overexertion rate potentially saving $8.3 million.

Recommendations and Readiness

As discussed above there are many ways to integrate XR technologies into the Oil and Gas field to increase safety. Below are detailed examples of how 2 key technologies, training, and drones, can be used to in the manner.

Training

AR training allows trainees to gain hands-on experience in a virtual setting, reducing the exposure they have to unknown equipment. Overexertion is one of the largest incident types on site and can be mitigated through proper training. AR technologies can not only change how the user sees and interacts with the world but can also accurately track movements. For training purposes, this will ensure that the trainees get live feedback on proper technique. For example, 23.71% of overexertion comes from improper lifting; if they practice lifting pipes, ducts, and tubing and have poor lifting techniques they can be given feedback and shown the proper form.

There are 2 ways to set up AR training: contract out to a 3rd party training program or develop a training program in-house. When engaging a 3rd party, you must consider to what degree your training needs to be tailored to your company. There is a loss in customization and quality that can make training inconsistent. Internal tracking of training completeness is reduced. Contracting out acquires specialized experts that will provide insight into how to deliver the training effectively. If these experts are not present in the company contracting will save time and money.

AR Training reduces overexertion injuries on-site.

Drones

In the Canadian oil and gas business, drone technology has proven to be a viable answer to the issue of falls from elevation. Drones can inspect difficult-to-reach locations like drilling rigs, pipelines, and storage tanks without endangering the safety of workers through falls or other risks. It decreases the chance of falls and other safety risks, boosts production and efficiency, and lowers the costs connected with traditional inspection and monitoring techniques.

According to research by the Canadian Association of Petroleum Producers, several Canadian oil and gas businesses have already embraced drone technology, which has helped to increase safety and save

costs. Drones include cameras and sensors that can take in-depth pictures and data, which can subsequently be examined to spot any potential risks.

Drones can be used for monitoring and surveillance in addition to inspections. They can be programmed to patrol and watch over the perimeter of oil and gas facilities, look for possible security breaches, and immediately alert employees of any potential safety risks.

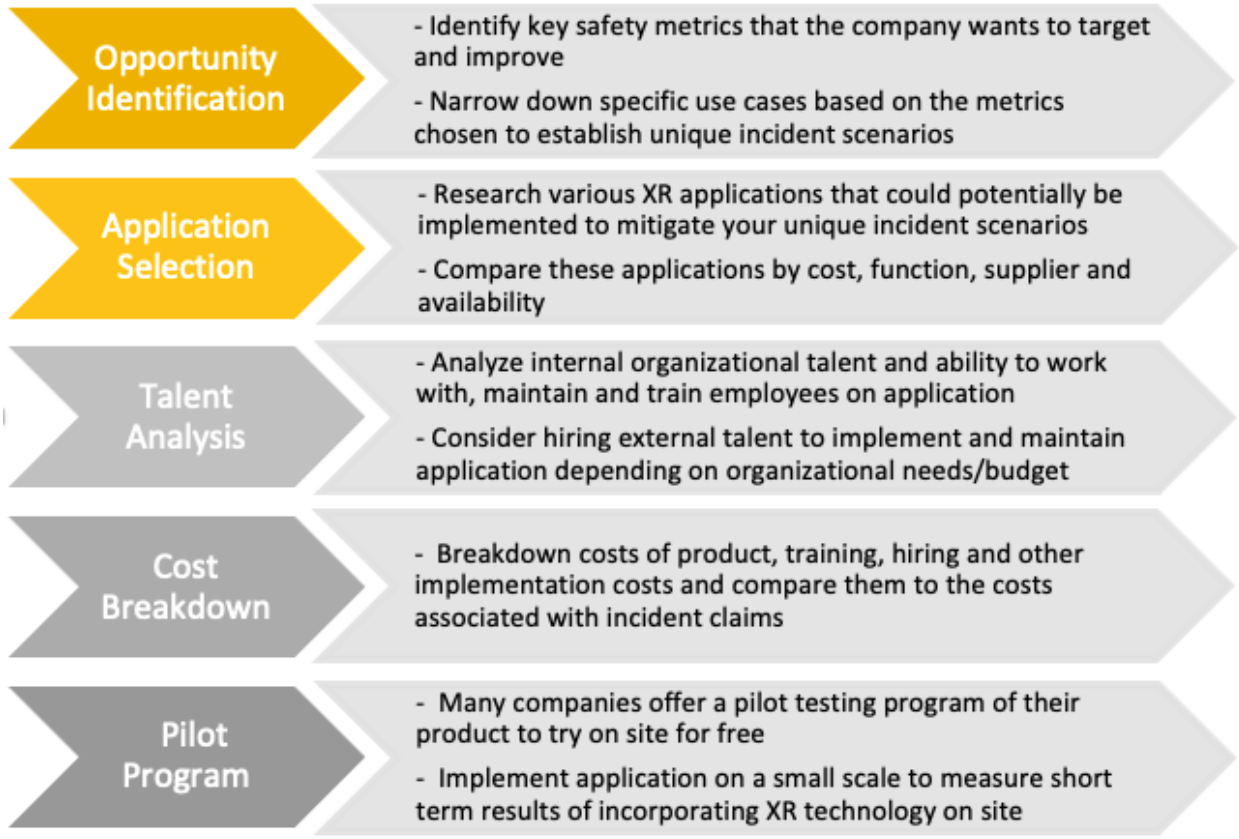
AR Drones mitigate falls from elevation.

Would XR Fit into Your Organization?

At Level 1, the company has basic safety protocols in place, but workplace incidents may not be adequately recorded, and employees may have safety concerns related to their duties. At Level 2, the company would have a more comprehensive safety program with designated safety personnel and protocols for measuring and reporting incidents. They would also have financial resources to invest in safety initiatives and may consider using XR technology to address safety concerns. At Level 3, the company would have an advanced safety program that incorporates XR technology with a team dedicated to implementing and managing it. They have also conducted a cost-benefit analysis to justify the investment in XR technology and have a clear strategy for integrating it into the organization. At Level 4, the company would have identified a specific XR solution to increase safety and pilot it to assess effectiveness. They also have a plan in place to monitor and evaluate the pilot program and may explore the possibility of scaling it up. At Level 5, XR technology would be successfully implemented company-wide, and safety is a key priority in all day-to-day operations. The company would have a robust safety

management program with a continuous improvement culture and a commitment to staying at the forefront of safety technology.

How Do You Get Started?



Conclusion

There exists a lucrative opportunity for members of the OGMR sector to reduce expenditure by approximately $59 million dollars per year. Leaders must identify the appropriate mixed reality solution required to generate an increase in employee productivity, sales, and a decrease in withheld unproductive periods. Moreover, leaders must be prepared to assess their organization's readiness level, and modernize their culture, people, and technology, to successfully implement the solution. In this digital era, organizational leaders must embrace technological change rather than resist it.

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