NAEM

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# The EHS&S Tech Transformation

## A Guide to the Technology Tools Shaping the Future of EHS&S Management

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## Publisher


The National Association for Environmental, Health and Safety, and Sustainability Management (NAEM) empowers corporate leaders to advance environmental stewardship, create safe and healthy workplaces and promote global sustainability. As the leading business community for EHS&S decision-makers, we provide engaging forums, a curated network, peer benchmarking, research insights and tools for solving today's corporate EHS&S challenges. Visit NAEM online at naem.org.

# About this Report

At companies of all sizes, across every industry sector, the Internet of Things (IOT) is revolutionizing how the environment, health and safety, and sustainability (EHS&S) function collects data, designs programs and manages the impact of operations in real time.

Even as the future sits upon our doorstep, many companies are still working to identify the opportunities, and understand how to incorporate these new technologies into business operations. NAEM developed this guide to familiarize you with these new tools as you begin to explore what this future means to you.

The report synthesizes NAEM's deep industry knowledge, fresh insights from our 2018 trends survey and peer case studies into five sections, each profiling an emerging technology tool. Each section introduces the technology, explains what it means for the EHS&S function, how it is being applied by EHS&S functions and the key questions you can ask during your evaluation process.

# Research Overview

### *Background*

Technology today is the digital backbone for EHS&S management, integrating the company's data management system with IOT tools and business intelligence applications that are revealing new insights into a company's environmental, social and governance impacts.

To understand how EHS&S functions are responding to the wave of technological innovation, NAEM's 2018 trends survey included a set of questions about nine software and technology-related initiatives.

The survey itself was designed to reveal the EHS&S initiatives that will be on the corporate agenda for the 36 months to come. It was fielded among those who lead EHS&S programs within leadership companies; NAEM received 79 responses.

### *Notes on the analysis*

The data included in this report reflects those respondents who have either: formally implemented a software or technology tool, or are actively planning to do so. In certain charts the results have been combined to demonstrate scale; in others it has been separated to offer more nuance to the pace of adoption.

NAEM ranked the trends survey results based on the prevalence of the practice and segmented the data into four distinct categories, as follows:

**Emerging:** These practices are those where 20 percent or fewer of the respondent pool has either formally put these programs in place or is actively planning to do so. These EHS&S activities are primarily technology-related and are limited to industry leaders.

**Early adoption:** The phase during where the adoption rate ranges between 21 and 50 percent among respondents. These are activities that are rapidly gaining ground but are still not used by most companies. Examples include supply chain initiatives and integrated reporting.

**Integration:** EHS&S activities reach the integration phase when 51 to 80 percent of respondents have adopted the practice or are evaluating doing so. Examples of practices in the integration phase include a wide mix of goals and reporting, health and safety, data management and corporate responsibility activities.

**Business Norms:** This is the phase at which 81 percent of companies or more have already adopted or are evaluating adopting the practice. These include practices such as: operational footprint tracking for energy and water, as well as health and safety, and employee engagement activities.

# Emerging Technologies Present New Opportunities, New Challenges

The integration of new technology tools are the next step in the EHS&S technology adoption curve, which for most companies began with the implementation of their software system. Today these innovations are shedding new light on EHS&S operational risks in live time.

The EHS&S function is at the precipice of transformational change. What started with the adoption of software systems for routine data management has today expanded to include IOT, a web of technologies that together give business leaders a look at their business performance in exciting new ways.

NAEM's 2018 survey of the trends that are shaping the corporate EHS&S agenda over the next three years, found that 77 percent of respondents are using or testing mobile devices and apps to interface with EHS&S employees, conduct EHS audits, log incidents.

# Introduction

About a third of companies (31%) have introduced or are actively evaluating the use of internet of things (IOT) technologies such as smart sensors and wearable sensors. Twenty percent are using or evaluating artificial intelligence, 16 percent are integrating virtual reality and 14 percent are using drones.

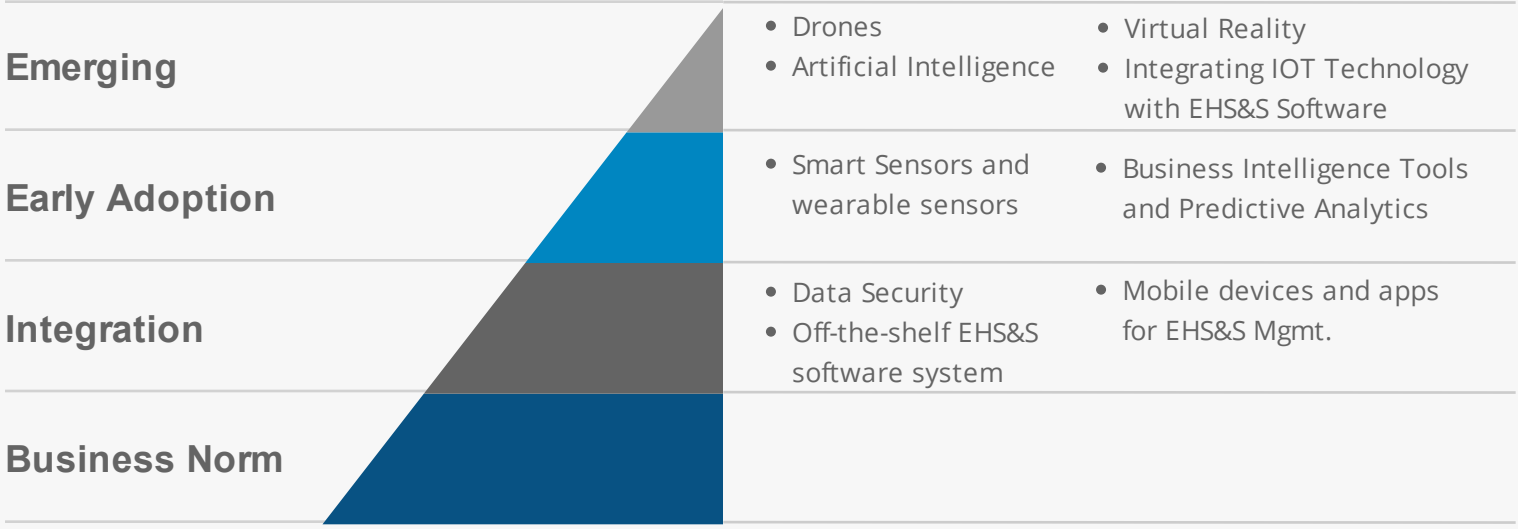
To leverage the 'big data' these devices create, 38 percent of companies are using business intelligence tools and predictive analytics in their program management. These are remarkable signs of change, especially with respect to machine learning and artificial intelligence.

The following analysis reveals the adoption rate of new technology tools among the 79 leadership companies who responded to NAEM's 2018 trends survey. The activities are organized by those that are least common ('emerging practices') to those that have started to become commonplace.

Among NAEM respondents, none of the technologies included in the survey had reached the level of 'business norm'.

## EHS&S Adoption of Emerging Technology

The following represents the adoption rate among NAEM survey respondents who have either implemented EHS&S initiatives or are actively planning to do so. These technologies remain on the leading edge.




Source: NAEM's 2018 trends survey

# Introduction

For the internal EHS&S leader, this presents both new opportunities as well as new management challenges.

The automation of routine tasks offers companies the chance to do more with less, but also introduces new questions about the optimal level of EHS&S resources required to manage risks. And while companies now have a more detailed look at their performance, it also challenges leaders to establish the right parameters to protect employee privacy, establish appropriate algorithms and set the right leading indicators.

These new tools are also likely to change the software options available to EHS&S leaders as well. New questions about IOT integration, the use of blockchain and how to mine existing data will certainly rise to the top  of demands for those seeking a new data management solution.

While the ideas on the horizon are quickly taking shape, the journey for most companies has just begun. This is the time for those leading EHS&S functions to develop their knowledge of the landscape and to guide their organizations through the changes underway.

It's an exciting time.

## What is 'Big Data?'

'Big data' is a term used to describe data sets that are too large or complex for traditional data-processing software to manage. Big data is created by the web of sensors and devices that together comprise the 'Internet of Things'. Unlike 'dark data', which is stored in spreadsheets (or similarly inaccessible formats), 'big data' is stored and managed via the internet, where it is merged with other data for analysis using business intelligence tools.

# Smart Sensors and Wearables

What would you do if you could prevent a flood before it starts? How would you restructure the work environment if you knew the moment a worker became fatigued? With tools such as smart sensors and wearable sensors EHS&S leaders now have the opportunity to go beyond just monitoring compliance to truly anticipating risks before they happen.

## Q What are smart sensors?

A smart sensor is a device that is used to monitor a specific media or condition, such as air quality, water quality, temperature or pH. The data from the sensors are processed and analyzed, then transmitted wirelessly to a notification node, which uses an algorithm to alert the user as to whether the parameter is normal or abnormal. It may also be programmed to take a pre-defined action when it senses that an abnormal threshold has been surpassed [1]. Examples of smart

sensors include airflow sensors, pressure sensors, aquatic sensors and infrared sensors. One such tool, for example, offers continuous air quality monitoring. Another tool uses weather forecasts to actuate drainage valves to minimize flooding and runoff.

## Q What are wearable sensors?

A wearable sensor is designed to monitor a person's physical condition in real time. From step-tracking wristbands to portable heart monitoring devices to glasses that provide displays of information directly in the user's field of vision, wearables have quickly become mainstream.

### Advice for Introducing Wearable Sensors [2].

- Choose the right wearable for the problem
- Provide employees with details on how the data will and will not be used
- Do not use the wearable sensors for productivity monitoring
- Provide employees with the option to opt-out of a monitoring program
- Train users on proper wear and maintenance

To learn more: Advancing Safety Surveillance Using Individualized Sensor Technology [2].

## Q What do smart sensors mean for EHS & Sustainability management?

According to the Institute of Industrial & System Engineers report that there are more 8.5 million work-related injuries in the United States each year, which together represent $192 billion in lost revenue [3].

Wearable technologies offer a breakthrough opportunity to uncover the signs of worker fatigue that can lead to injury in the workplace [4], and to prevent injuries by giving workers increased strength and endurance. Examples of wearables include: smart helmets that enable situational awareness; chest and torso wearables that measure heart rate and breathing rates; and even ergonomics wearables.

**31%**

of those surveyed by NAEM are already using smart sensors to generate EHS&S data (20%) or are evaluating their use (11%).

Source: NAEM's 2018 trends survey

## Tech Tool #1

### Case Study: Ford Motor Co.

In 2019, Ford Motor Co. introduced the use of exoskeleton vests in all of its North American plants and in plants in Asia Pacific, Europe and South America. Suitable for workers of varying heights, the vests by Ekso Bionics use spring assistance to provide between 5 and 15 lb (2.2 and 6.8 kg) of lift assistance per arm. The goal is reduce the accumulated impact of routine wear and tear to reduce injury and accidents [5].

## Questions you should ask as you explore smart sensors and wearables:

- How will we monitor the data produced by these sensors? Who will be assigned this role?
- How will these sensors affect our existing workflows?
- Can our existing software platform integrate with these technologies?
- What are the human resources impacts of asking workers to use wearable sensors? How will we maintain their privacy?
- Do we have the tools we'll need to analyze the data generated by these sensors?

# Blockchain

For anyone who manages EHS&S data, validation, integration and migration between systems are key challenges. Emerging 'blockchain' technology offers a permanent solution to these concerns, in addition to its potential to provide security to the big data generated by the new networks of sensors and devices.

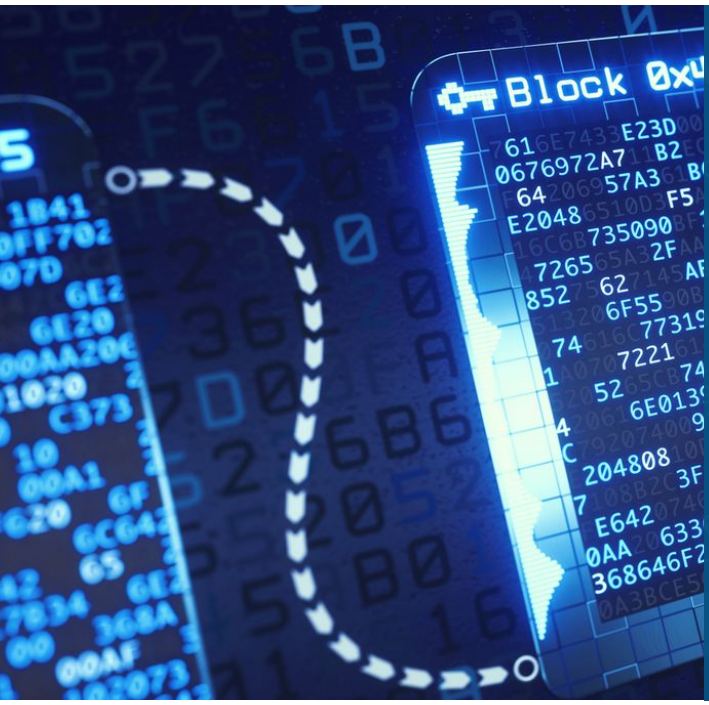
## Q What is 'blockchain'?

A blockchain is like a Wikipedia for data. Unlike our existing system, which relies on separate, centralized databases to store specific types of information, a blockchain is a digital collection of records that is maintained by a decentralized network of computers. Each transaction or

data entry is recorded, in detail, on a public ledger, or 'block'. The blocks are then linked together with cryptography to form a complete record, or 'chain'. Because no one person has control over the database, any changes to the data are duly recorded, making the information history tamper-proof and transparent [6].

## Q What does blockchain mean for EHS & Sustainability?

Since blockchain technology aggregates all known information about a topic, it could lead to dramatic breakthroughs in supply chain sustainability management. Blockchain could make it possible for a company to monitor the ingredients in its products and provide complete transparency to sustainability disclosures helping companies quickly identify potential partners who are not meeting their standards.




## Why Blockchain Could Revolutionize Data Management

**Blockchain makes data:**

- Immutable
- Consensus-driven
- Decentralized
- Easily verifiable
- Secured by cryptography
- Transparent

## Case Study: Locus Technologies

While many of the early use cases for blockchain are in transaction-driven industries such as banking, real estate or technology, blockchain is also being considered for use in greenhouse gas emissions tracking. Locus Technologies is exploring how they can use blockchain technology to resolve several key challenges that companies face when trying to quantify their emissions: namely, the lack of defensible data on emissions, the difficulty proportioning them to the facility, business unit, product line and region. Even though the long-term impact of these technologies is still yet to be determined, blockchain is expected to create new opportunities for EHS&S leaders [7].

## Questions you should ask as you explore blockchain:

- How quickly is blockchain expected to disrupt our industry? What are the EHS risks associated with that disruption?
- Are there EHS applications for blockchain?
- How could blockchain change how we manage and report our ESG data?
- What is our EHS&S software provider doing to prepare for blockchain?
- Will we need internal blockchain experts to support it?
- What are the practical limits of blockchain?

# Drones

Imagine being able to inspect hundreds of miles of pipeline without dispatching teams to a remote site. Consider how much safer it would be if you could spot signs of metal corrosion without asking employees to climb up a flare stack. These are just some of the reasons why companies across industries are using drones to lower safety risks, save money and improve EHS&S outcomes.

## Q What are drones?

Drones are unmanned aerial vehicles, which are operated by a licensed pilot on the ground. The Federal Aviation Administration (FAA) specifies approved uses based on factors such as purpose, geography and time of day [8]. In the future drones may also become semi-autonomous, which would allow them to 'think' and respond for themselves [9].

## Q What do drones mean for EHS & Sustainability?

Because they can be equipped with sensors, cameras, and even artificial intelligence, they can help access hazardous conditions, conduct inspections and even perform maintenance tasks. They also help companies do more with less, as Duke Energy recently proved in Puerto Rico. In this case, the North Carolina-based company is using drones to restore power on the island, searching for broken utility poles and downed power lines and to string new ones, and to even lift new power lines into place. This application not only reduces the workforce required, but eliminates safety risks associated with hazardous work conditions [10].

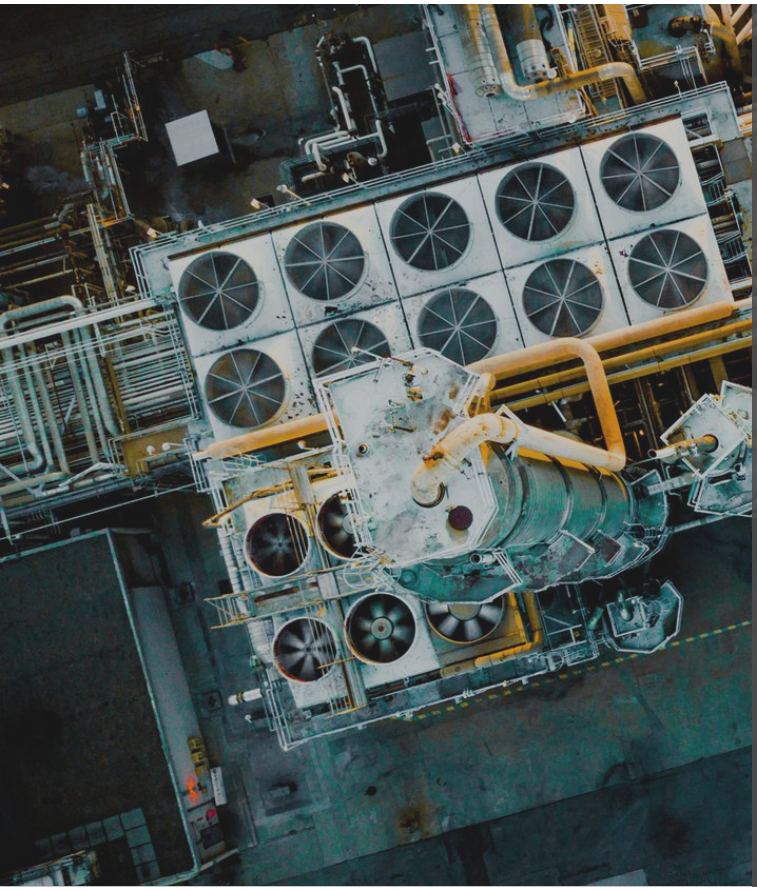
Not surprisingly, regulators are also finding new uses for the technology. Both the U.S. Environmental Protection Agency (EPA) and the U.S. Occupational Health and Safety Administration (OSHA) now use drones for monitoring and inspections. In OSHA's case, the drones are most often deployed following accidents when the work sites are considered too dangerous for inspectors to personally enter [11].

**14%**

of those surveyed by NAEM are already using drones to monitor EHS compliance (5%) or are evaluating their use (9%).

Source: NAEM's 2018 trends survey

## Tech Tool #3



### Case Study: ConocoPhillips

Since 2013, when ConocoPhillips complete the first commercial flight by an unmanned aerial system (UAS) in the U.S. the company has used drones across the globe to support their EHS programs. These uses include: conducting asset integrity inspections in hard-to-access places and monitoring methane emissions in hard-to-reach places. Not only have the drones help reduce risks to worker health and safety, but they have helped reduce the overall environmental impact of the company operations as well [12].

## Questions you should ask as you explore drones:

- How is drone use being regulated now, and what regulations are expected that could limit their use?
- What are the payload limits of the drones you are considering?
- Can the drone be retrofitted to incorporate new technology (e.g. AI as it becomes available)?
- How will the drone affect our EHS staffing levels?
- What kinds of new training will be required to introduce drones?

Tech Tool #4

# Augmented Reality and Virtual Reality

If you thought virtual reality was just a toy for computer gamers, think again. From safety training to facility design, virtual reality offers new tools to EHS&S leaders who are looking for more effective ways to reduce risks.

## Q What is augmented reality?

Augmented reality, or 'mixed reality,' is also introducing new applications in industrial settings. One example is a product by a company called DigiLens, whose lightweight AR smartglasses give maintenance, logistics or manufacturing users real-tie access to data while remaining hands-free. The technology can also be used to conduct situational training, where employees can learn interactively in an actual work environment [13].

# Tech Tool #4

## Q What is virtual reality?

Virtual reality is an immersive, interactive experience within a simulated environment. It incorporates computer-generated sensory feedback (auditory, visual, haptic) to create an experience that participants process as 'real world'. It is now finding applications in sports, entertainment and EHS&S management.

## Q What is the impact on EHS & Sustainability?

While it remains a leading-edge technology, virtual reality holds enormous promise for EHS&S management, particularly in the area of safety training. As one EHS&S professional explained, virtual reality "ensures that knowledge is captured in the different parts of the brain that are involved in uptake of the training. People learn more easily and remember content longer when they do things rather than when they are sitting on a chair and reading a procedure or when they are listing to a trainer [in a classroom]." Rather than simply describing safety risk, then, companies can use a simulated work environment to teach employees how to safely lift and load, work in confined spaces or for machine safety training. EHS&S professionals are also using it to conduct virtual 'walk throughs' of facilities before they are built to flag compliance issues and to advise on modifications that could be made while the project is still in the design stage.

**16%**

of those surveyed by NAEM are already using virtual reality for EHS (5%), or are evaluating its use (11%).

Source: NAEM's 2018 trends survey.

## Tech Tool #4

### Case Study: Antea Group

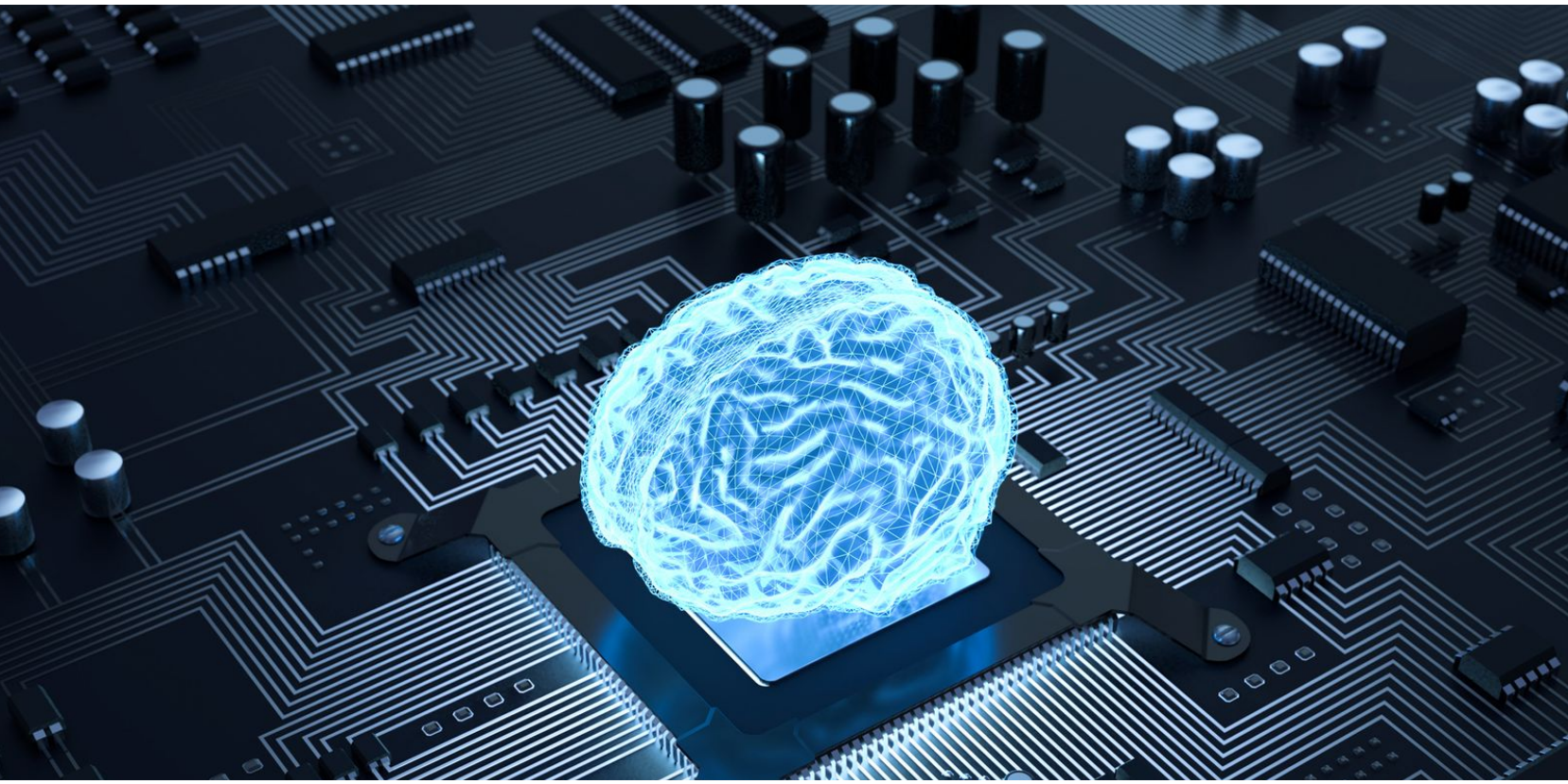
Antea Group, a global EHS&S consulting firm, has been using virtual reality in its work since 2014. Its primary uses include conducting hands-free field inspections and assisting inspectors in the field from a desktop location. For one European oil and gas client, the company, created 3D images of a refinery, then marked all of the fire equipment. The technology allowed EHS&S managers to do a virtual walk through of the site to determine the status and location of fire extinguishers and other equipment [14, 15].

## Questions you should ask as you explore Augmented Reality and Virtual Reality:

- What, if any, are the safety concerns associated with using this technology?
- Does your company have the required data connections to operate it?
- Are there specific contexts within your business or industry where it works better than others?
- What, if any, are the limitations of the hardware itself?

# Artificial Intelligence and Machine Learning

In an era when Siri and Alexa have become household names, artificial intelligence (AI) has already started to change how we live. While most companies already using AI in some form or another, EHS&S leaders are finding new uses for it as they mine big data to uncover hidden risks, develop predictive analytics and reveal new insights into their programs.



## Q What is Artificial Intelligence?

"Artificial intelligence (AI) makes it possible for machines to learn from experience, adjust to new inputs and perform human-like tasks...Using these technologies, computers can be trained to accomplish specific tasks by processing large amounts of data and recognizing patterns in the data" [16].

# Tech Tool #5

## Q What is machine learning?

Machine learning is a form of AI, whereby via an algorithm, and maybe business rules, directs computer to identify new patterns in data and solve problems. Once trained, the machine is able to handle unfamiliar tasks and quickly find solutions.

## Q How AI is changing EHS&S Management?

Data analytics is among the most immediate opportunities for those who seek to introduce AI tools to EHS&S management. The technology can be used to help customers mine their data for insights and to produce better metrics. It can interpret regulations for company-specific requirements. It can analyze industrial photos and videos to tag safety issues.

Many software providers have already developed tools for their customers to do just that: one company's application even helps safety managers prevent incidents before they occur. Taken together, these gains translate into tangible business benefits in terms of safety, productivity and profitability.

**20%**

of those surveyed by NAEM are already using artificial intelligence tools such as machine learning (5%) or are evaluating their use (15%) .

Source: NAEM's 2018 trends survey

## Tech Tool #5

### Case Study: Teck Resources Limited

Teck Resources Limited is a Canadian metals and mining company, and Canada's largest diversified resources company. At its Trail facility, the company is using artificial intelligence to help detect equipment failures and predict when maintenance should occur. The system takes a snapshot of process signal data in order to find out what is normal. This data is stored in the software and provides insights into the conditions that may indicate an equipment failure. If those conditions are met, a warning is triggered. This technology is now an important component of Teck's risk management strategy, improving both safety and environmental performance [17].

## Questions you should ask as you explore Artificial Intelligence:

- How can we use AI to make better use of our existing data set?
- How should we structure our data collection to optimize it for AI?
- How can we avoid unwittingly introducing a bias into our algorithm?
- How can we ensure data privacy?
- How does the EU's General Data Protection Regulation apply to our company and our proposed uses for AI?
- How could AI change our EHS staff levels? How could it be used to re-distribute responsibilities?

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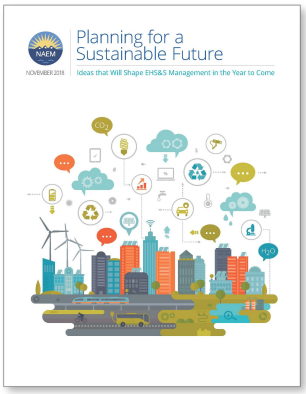
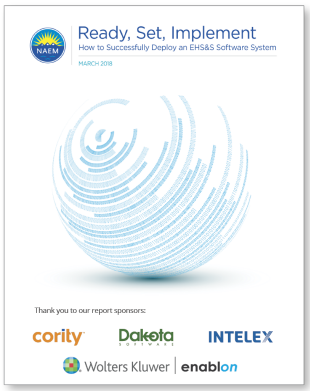


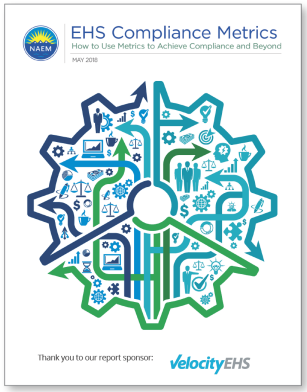

## Planning for a Sustainable Future

NAEM's 2018 trends report identifies the initiatives and emerging ideas that are shaping the environment, health, safety and sustainability agendas of companies today. The report provides a behind-the-scenes look at the latest ideas companies are putting into practice to advance their EHS and sustainability programs.



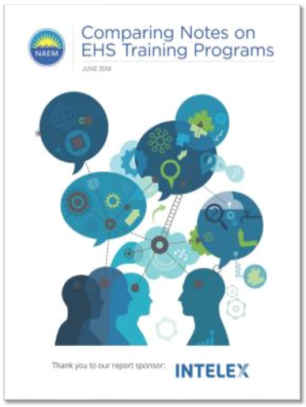

## Ready, Set, Implement: How to Successfully Deploy an EHS&S Software System

NAEM's Ready, Set, Implement - How to Successfully Deploy an EHS&S Software System report is based on in-depth interviews with corporate EHS&S professionals and implementation partners, who have decades of experience deploying software systems on a global scale.




## EHS Metrics: How to Use Metrics to Achieve Compliance and Beyond

What are the metrics your peer companies use to drive EHS performance? This report provides benchmarking data from companies who are leveraging metrics improve their compliance program. You'll get quantitative data as well as verbatim perspectives from peers so you can use to optimize your own EHS compliance metrics.




## Comparing Notes on EHS Training Programs

What are the strategies your peers are using to engage employees and build EHS culture? What training methods are the most effective? And how do you measure whether your training is working? Download the report today to find out how your programs stack up.