

# CIM MAGAZINE

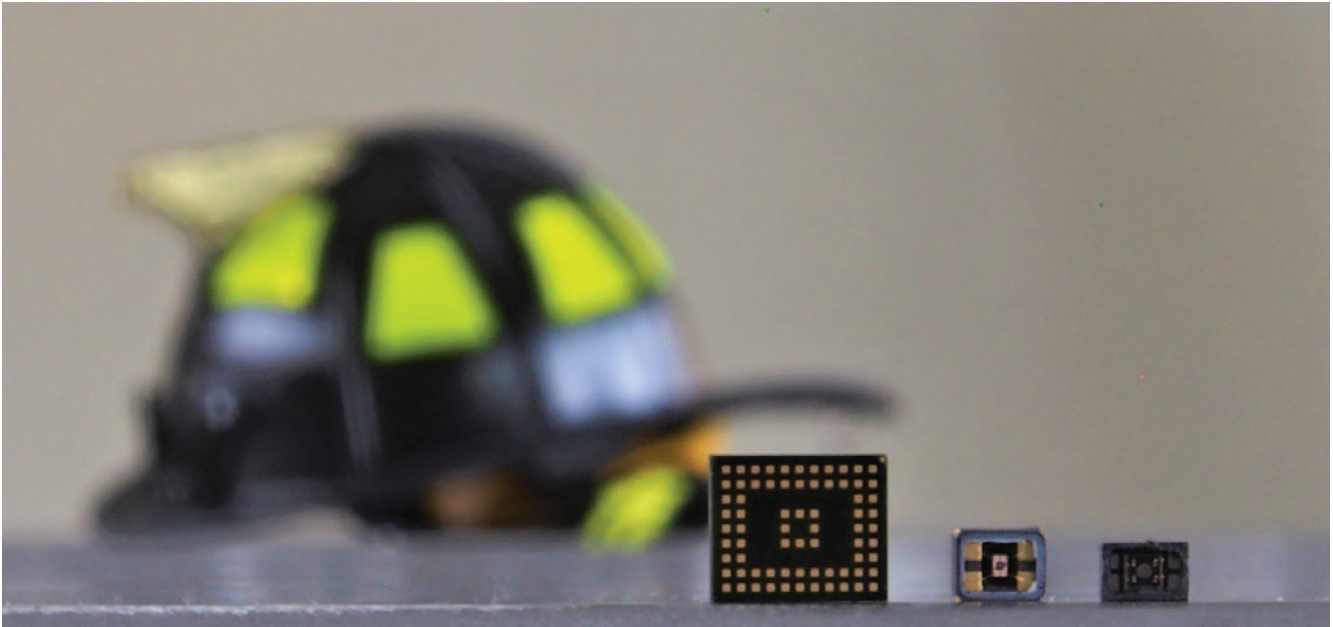
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## NEW FRONTIERS IN MINING

PROJECT PROFILE | PROFIL DE PROJET  
IAMGOLD CÔTÉ GOLD





GE equates its new portable gas sensor to a bloodhound with how it detects small traces of gases.

# Ready to wear

A new era of safety equipment comes in the form of unobtrusive wearable technologies that allow companies to reshape their health and safety protocols

By Sarah Treleven

Australia's Alex Moss – fashion model turned NASA-approved entrepreneur – wears a simple cuff tucked behind one ear. The medical-grade device resembles a slightly bulky hearing aid, but it does much more than simply amplify and concentrate sound. Moss's invention is a wearable predictive biometric system that combines vital signs and other data relevant to a user's body with artificial intelligence capable of predicting medical or safety-related incidents.

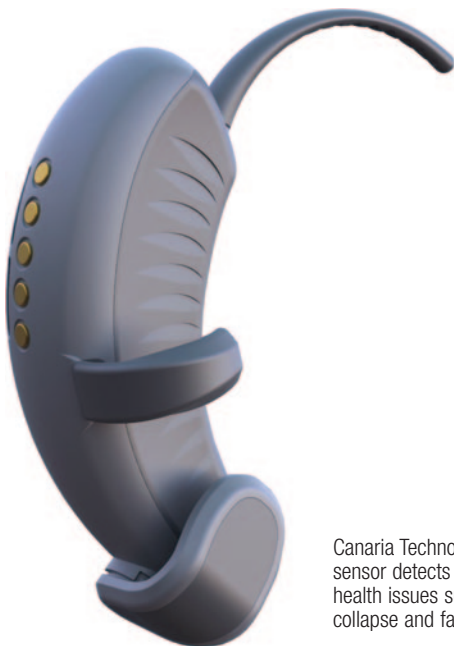
Moss is CEO of Brisbane-based Canaria Technologies, which she cofounded with Dr. Robert Finea, and her sensor has been adapted from a concept that won the NASA Space Apps Challenge in 2016. The device can detect heat exhaustion, cognitive fatigue, collapse and air quality. The technology uses pulse plethysmography (PPG) readings from the ear, combined with accelerometer and gyroscope readings, and temperature sensors. It can withstand extreme conditions – including Australia's increasingly hot summers.

While Moss's sensor might seem like a leap into the future, it is very much in demand for tracking and preventing longstanding safety issues in the mining industry. In September, Canaria inked an agreement with TSX-V-listed Macarthur Minerals Limited to test the biometrics safety system in Macarthur's flagship Lake Giles Iron Project in Western Australia.

The partnership between Canaria and Macarthur is just one example of a wave of high-tech, highly portable wearable safety devices with clear application for the mining industry. And even more extraordinarily, the next generation of wearable safety devices is not just focused on preventing discrete incidents. It also offers the mining industry the opportunity to collect valuable data that can help shape systemic protocols to create healthier workplaces for all.

## Feeling the heat

Canaria's sensor has been designed to guard against heat exhaustion, but to also gather data that could potentially allow mining companies to implement controls that prevent heat exhaustion and other events on a more systemic level. For example, during a deployment in Northern Australia last year, the sensor was used to confirm a theory that workers in close prox-



Canaria Technologies' sensor detects multiple health issues such as stroke, collapse and fatigue.

imity to hot equipment were experiencing more incidents of heat exhaustion. “We don’t just look at one metric,” said Moss, “we look at over 64 vital signs and then cross reference that with the ambient data that we also have coming in.” The devices are also designed to work with pre-existing safety equipment, including glasses and helmets.

Under the agreement with Macarthur, Canaria will supply a small number of devices for a four-week testing period during the current 2020/2021 summer season. Macarthur is hoping that a successful partnership will boost both employee wellness and the bottom line. “Building this sort of technology from the start presents a pretty unique opportunity,” said Andrew Bruton, executive general manager, corporate, for Macarthur. “The device can log medical data without impeding movement in operations, which is extremely important in the mining sector... We have the opportunity to put this front and centre in what we do.”

### Planning for particles

This past summer’s fire season – which for many created barely breathable air – served as a grim reminder that physical health has an intimate connection to environmental factors. This reality has long been a concern in the mining industry, where personnel have been compromised by the particulate matter released through a wide variety of activities.

Vancouver-based Nanozen Industries, a company that produces personal air-quality monitoring equipment for industrial workers, has new particle monitors – also known as DustCount – that stand guard against the smallest particles, which are also the most dangerous to inhale. “As particles get smaller and smaller, they go deeper and deeper into your respiratory track,” said Nanozen CEO Peter Briscoe. “When they go down to 10 microns in diameter, your body can purge them by sneezing or coughing. But under 10 microns, they can get right into and coat your lungs.” Any smaller than that, the particles can also end up in the bloodstream, liver, pancreas and brain.

The body can withstand short-term exposure, but damage is cumulative and regular exposure is a big concern. So Nanozen’s wearable IoT monitors, which first hit the market in 2016, pull particles in using an inlet that mimics the human body’s respiratory tract and alerts workers to dangerous conditions. “The whole purpose is preventive medicine,” said Briscoe. “By having a device that takes air from what we call the ‘breathing zone,’ we can alert you so you can do something about it. You can put a mask on, which takes two seconds and costs five bucks and will remove about 95 per cent of dangerous particles from the area.”

Nanozen’s IoT device also collects data and alarms constantly, sending them over Bluetooth or WiFi to a PC and to a big data storage facility. This provides a comprehensive history for an individual worker’s exposure, which can be useful for informing medical care. Industrial hygienists and ventilation experts who ensure that adequate mitigation measures are in place to protect a broad swath of workers can also use that data to target necessary solutions.

In 2019, Vancouver-based Teck employed Nanozen’s devices to determine crystalline silica dust exposure during a typical haul-truck driver shift at its Greenhills operation in Elkford, British Columbia. The dust monitors helped Teck to identify the riskiest activities and reduce exposures through a number of upgrades, including the introduction of HEPA vacuums, an enhanced cleaning schedule and a trial involving an air recirculation system. “Nanozen technology represents a paradigm shift in occupational hygiene because we receive exposure results

and their fluctuations in real-time,” said Chris Stannell, public relations manager for Teck. In addition to the Greenhills pilot, Nanozen’s monitors are now being employed at two additional sites: Fording River and Highland Valley Copper.

### Discrete detection

Teck is not the only player concerned about worker proximity to heavy machinery. Orange Business Services, a digital services company based in Paris, and De Beers Marine South Africa are working together to test a geofencing solution that will help maintain safe distances between the crew and the equipment required in marine diamond operations. This potential fix – which combines Bluetooth low-energy locators and wrist sensors, integrated with onboard antennas and Orange software – was recently piloted on the MV *Mafuta*, the world’s largest offshore diamond mining vessel stationed just off the coast of Namibia. In the event that a crewmember breached a predetermined geofenced area, the ship’s bridge was alerted immediately. Devices are attached to individual profiles – meaning an individual will wear the same device on a daily basis for years – which also leads to opportunities for learning and best practices.

In pursuit of a “zero harm” target, Orange is supporting De Beers in the next step of the solution: a device that will gauge the proximity of workers to machinery and, in the event of a breach alert, affect an automatic shutdown of that machinery. “The next step is how we can correlate these smart tracking systems with the actual heavy machinery,” said Emmanuel Routier, vice-president, Industry 4.0, Orange Business Services. The data generated from these events, he added, can be used to implement systemic changes to operations with an emphasis on safety protocols. “You can optimize the process to make it both less dangerous and more efficient.”

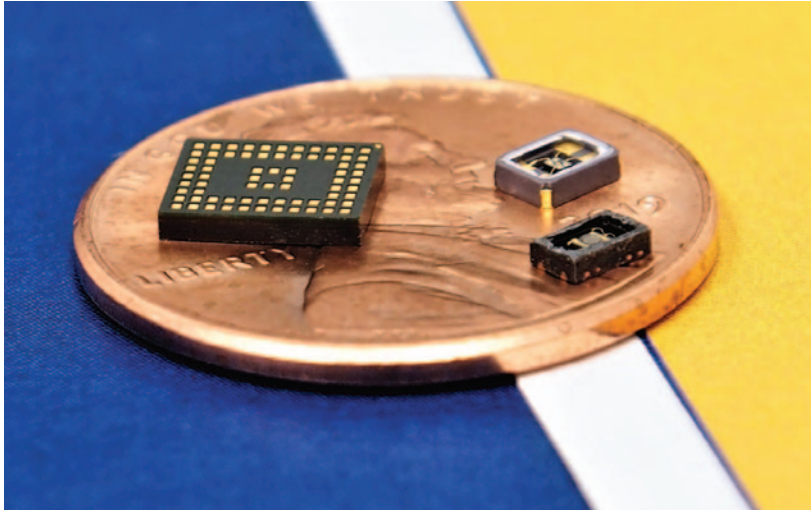
If Orange is essentially creating a new form of wearable high-tech safety gear to be mindfully integrated into an existing uniform, GE has created a new piece of equipment that is designed to be as unobtrusive as possible: a grain-sized, ultra-sensitive gas sensor with functions likened to the way bloodhounds isolate even the smallest traces of specific smells.

The primary goal is, of course, worker safety. But the size of this device also offers efficiencies, particularly when it comes to reducing power consumption and enhancing the range of applications. GE has noted that this particular design offers opportunities for 24/7 monitoring and the potential to deploy such sensors in wearable, drone-based and wireless formats – all alongside enhanced monitoring capabilities, including an ultra-broad range of detected gas concentrations, high-response lin-



Nanozen’s air quality monitors were piloted at Teck Resources’ Greenhills operation in British Columbia.

Courtesy of Nanozen Industries



The size of GE's gas sensor offers it distinct advantages, such as reducing its power consumption.

erarity, boosted sensor stability and eliminated interference of ambient temperature.

“You can buy classic gas sensors off the Internet, but they come with lots of limitations that hinder their application for the mining industry,” said Radislav Potyrailo, principal scientist at GE Global Research who is directing the gas-sensor’s development. “They have been designed to detect relatively large amounts of expected gases in the presence of relatively small

fluctuations of ambient conditions – anything like ambient relative humidity or temperature that might compete with that signal change.”

GE’s new device offers a more refined yet simple detection process – and that has implications beyond acute safety alerts, said Potyrailo. “The challenge that we’re addressing is that present sensors are not good enough to tell us about the presence of low-level gases of interest in complex backgrounds. So there is no way to collect information about the spatial distribution of those gases. But with our devices on drones or as sensor networks, we can see where those gases form, how they’re propagated in real time, and then make predictions. With these dynamic maps, we can proactively save lives.”

The prospect of saving lives – and limiting both the shorter- and longer-term health implications of some work in the mining industry – has

spurred an enormous wave of both innovation and cooperation. The next generation of wearable safety devices presents a huge opportunity for collaboration that many mining industry and technology leaders are grasping with both hands. “It’s really about proving that it works, and we can do that with a great industry partner who gives us super feedback,” said Moss, of her partnership with Macarthur. “There’s so much alignment in terms of the ethical use of new technologies in the mining sector.” **CIM**