

## JOINT VENTURE ARTICLE

## Mining Insights

## How Dundee Sustainable Technologies' eco-friendly advances boost ESG credentials



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BY NORTHERN MINER STAFF

**D**undee Sustainable Technologies (CSE: DST) has developed two innovative metallurgical processes that offer significant environmental benefits for the mining industry.

The recent tailings dam breach in the Yukon is a case in point where cyanide-laced material used to extract gold contaminated nearby waterways. But green technologies and sustainability-focused projects are helping the industry address risks earlier and build longer lasting community ties.

President and CEO Jean-Philippe Mai, who holds a B.Sc. in Geology from the University of Quebec in Montreal and has worked on projects spanning Canada, Australia and South America, has seen the industry realize that change benefitting the environment helps everyone. Mai, whose career spans years of innovation in metallurgical processes, highlighted the progress of Dundee's new methods.

Joining the company in 2013, he has played a key role in advancing its innovative solutions. These include the Chlorination Leach in a Vat Reactor (CLEVR) technology that extracts gold from ore without using cyanide and the GlassLock process that stabilizes arsenic.

In January, Mai sat down with MINING.com's Devan Murugan to discuss how the company's technology can provide miners with safer and more efficient alternatives to traditional mining practices. Please watch the attached video.

**Devan Murugan: It's been about 10 years since your first demonstration plant went up. That was back in 2014. What gap were you hoping to fill in the market back then? Take us through those beginnings.**

**Jean-Philippe Mai:** Bringing new metallurgical processes to commercialization within the mining industry is quite the journey. So, we've been actively focused on developing and now the commercialization of our process for numerous years. We started, of course, with the concept idea at the bench scale, then moved it to the pilot scale in 2009 through 2011.

We then proceeded to the construction of our first industrial demonstration plant in 2015. The objective was always to provide the industry with an alternative. We wanted to develop an efficient gold extraction and gold recovery processes which provided a save, efficient and a viable alternative to cyanidation.

So, the journey has been quite interesting, but I think that our main objective was really to provide an alternative which not only completely replaces cyanide, but also provides an added efficiency compared to the standard processes that we use today.

**DM: From an elementary perspective, what miners do is extract gold using cyanide, which comes with risks. How does Dundee's process provide an alternative?**

**JPM:** There's a lot of ways through which one can chemically solubilize gold for extraction and recovery. Our approach that we've taken was to use a chlorination-based approach. Although, historically, chlorine has been used before to put gold into solution, but chloride can be quite toxic as well when you're looking at handling elemental chlorine and its associated chlorine gas.

But we've gone a different route here. We really use sodium hypochlorite with a catalytic amount of sodium hypobromide. So essentially we're using the kinetics, the fast kinetics of bromide to rapidly put gold into solution using a catalytic amount of sodium hypobromide and sodium hypochlorite.

Essentially, we're using a diluted version of your household bleach solution, which operates at ambient temperature and ambient pressure. So, this novel chemical approach allows for a very efficient way of solubilizing the gold.

**DM: It's interesting because this method not only eliminates cyanide but also reduces leaching time and waste. That's a major benefit for mining companies, isn't it?**

**JPM:** Of course. And the approach, as I mentioned, was always to provide and to improve efficiency, process efficiency. Typical processes can take 24, 36, 48 hours to put the gold into solution. Our approach, using fast kinetics, achieves this within an hour to two hours of contact time.



Gold smelting at Dundee Sustainable Technologies' plant. DUNDEE SUSTAINABLE TECHNOLOGIES

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— JEAN-PHILIPPE MAI, PRESIDENT, CEO, DUNDEE SUSTAINABLE TECHNOLOGIES

That's a huge benefit just in terms of throughput and size of plant for equivalent capacity and throughput. But also, how you handle your contaminants. For us, being serious about sulphur handling is a major aspect of the process where if there's high amounts of sulphur within the ore, we would look at removing it for properly handling it and then transferring it to the CLEVR process for efficient gold recovery.

Same thing with associated contaminants such as arsenic. So that's another aspect which we've been very involved in. Just being able to properly and efficiently address contaminants such as sulphur and arsenic, and then allowing for the CLEVR process to efficiently solubilize the gold, provides a lot of benefits to mining operations.

You mentioned one, eliminating or reducing some of that waste component. One of the aspects of CLEVR was really to operate in a closed loop where we regenerate all of our effluents, which allows for dry stackable tailings to be generated. So, when you can eliminate ponds out of your overall project site, that's a huge benefit in terms of liability, but in terms of footprint as well.

**DM: And I suppose on the other side of the spectrum, the other process that you do, the GlassLock process, is aimed at similar efficiency, isn't it?**

**JPM:** We obviously started with our CLEVR process, but when you develop a new gold process, people send you their worst materials. So, we really worked with a lot of

refractory arsenopyrite gold ores. And when we were decomposing that arsenic, that sulphide compound, we were left with an arsenic product which needed to be stabilized.

So, this is really what forced us to develop our GlassLock process, which is essentially an arsenic stabilization using vitrification.

When we remove or have an arsenic product to permanently dispose of, we use vitrification, which essentially includes arsenic within a glass matrix and really provides a long-term stability. And again, increasing efficiency in terms of permanent and long-term stability, but also the associated cost of handling and properly stabilizing the arsenic.

**DM: Let's talk about investor appeal. You're in a space where environmental, social and governance (ESG) standards matter. What's your investor experience been on that front?**

**JPM:** I think we are offering the industry tools and options to address some of the project problematics differently. And I think that investors and the industry are looking for the right solutions, the right solution for a given project. And it's important for investors, for communities and for miners to know that they are doing the right thing for the project.

Having processes like ours, which at least give them an option to efficiently recover the gold and properly handle contaminants such as arsenic, I think that coupled with the vast experience that our industry has with incorporating novel processes and

the equipment that we use – all the equipment has already been used at the larger scale.

Our novelty really is on the chemistry. So, I think that properly understanding and learning about different processes like ours really provide an alternative route which can be welcomed favourably by investors and by miners and by communities.

**DM: From an investor point of view, at the end of the day, it's really about industry adoption, isn't it? Is there momentum there?**

**JPM:** I think our industry is very conservative. However, our industry is really keen and really willing to learn about processes like ours. So, in the recent years, we've seen a lot of interest and we're really asking for mining companies to be curious and to try us. We really believe that any adoption goes through proper understanding and we need to do the proper development.

We need to do the proper test work, the proper engineering designs to really provide and present data which allows for efficient and sound decision making. And I think that once you generate the technical data supporting your process, I think both operators and investors will be alongside as it is the right thing to do.

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