Question/ Answer Report - Tech Fair Day 1 - 6 October 2021

Question	Asker Name	Answer(s)
For Orongo: How much ore is processed per day and how much gold is daily produced? What is the gold recovery rate?	Marcello Veiga	Nansio as a company has 4 sites of which 3 sites are in Kenya and 1 in Buhemba Tanzania. From each site we processed approximately 1 ton of ore per day. From the one ton of ore, we get about 5 grams depending on the richness of ore being processed resulting to 5 to 15 gram per site. The recovery rate of gold is 75% to 90% depending of the effectiveness of the artisan recovering gold from the ore.
For Orongo: What happens to the ore after processing the gold because from experience using that method the ASM will further want to treat the ore for leaching? Or the process end there ?	Kudzai Henry	For us, after processing the ore using Mtambo technology, we store the (synate) remains for a long period in a protected site and later re-wash using the same Mitambo technology. Thus the process does not end with the 1st processing.
For Orongo: In what proportion approx the gold recovery got improved after the machine?	Gustavo Vargas	In terms of proportion to which the gold recovery got improved after discovery and making use of Mitambo technology is 15% to 30% above mercury depending on the patience, effectiveness and efficiency of the artisan recovering the gold from the ore.
For Winfrida: how much roughly the cost of gas and chemicals is compared to the cost of mercury (half, same, double)?	Gustavo Vargas	
For Kevin: Thanks Kevin...it seems interesting the session but very focused on microminers producing small grams of gold per day. Would this reduce Hg pollution?	Marcello Veiga	Yup, scale matters. Pilot versus commercial is something missing here too. Many moving parts and careful operation might not hold up...
For Winifrida: Can you controle the input parameters for the Gold Katcha as suggested by Winifrida? So for example the water pressure and sludge ?	Carla Neefs	
For Winifrida: Processing is majorly done by women in Kenya. What gender dimensions need to be considered to ensure that this intervention does not promote exclusion of women? Keeping in mind majority of women lack the skills and expertise required.	Kathy Njuguna	
For Stephen Yeboah: How much difference between direct smelting and cupellation on gold purity?	Byambasuren Odgerel	Direct smelting and cuppellation follows a similar process. They can be done together. After direct smelting, you can use cuppellation if there is high lead content and to increase purity of the gold recovered.
For Orongo: good day, what is the useful life of the carpet and when the concentrate is obtained, how is the gold separated?	Alfaro Arias Sacramento	The useful life of the carpet is averagely 1-3 months of useful use and ability to retain gold effectively. The duration varies depending on the availability of the fine processed gold being recovery explaining in the frequency of usage thus when processed ore are more; carpet must be changed within 30 days but when is not very frequent it take up to 90 days then it must be changed. Gold separation from the carpet is well illustrated in our video available in the planet gold website. Nonetheless the entire process is by mere thorough washing of the carpet using water that get pour on the carpet as the washed concentrate get retained in another plastic basin till the desired volume of the concentrate containing gold is attained based on the personal judgment of the artisan recovering gold from the carpet.
For Stephen Yeboah: Have anybody test the tailings from the gravity concentrator? How much gold are their in the tailings as free gold is what is recovered in the gravity circuit	Henry Salvado	Yes, we have tested tailings in Ghana using the gravity concentrator and it recovered some amount of gold. This has been done in more than 5 mining regions. We found out that these tailings contained gold. Since most operations in Ghana take place using mercury, the concentrator recovers mercury too.
For Stephen Yeboah: Was the tailings analyzed by fire assay for gold?	Henry Salvado	We are yet to undertake an official tailings analysis with SGS. Various academic literature show that artisanal and small scale miners get just about 30-35% of their gold. The tailings are either liberated with improved milling or sent through a concentrator to recover free gold.
The solutions are geared towards free milling gold at quite a small-scale, any considerations for scalability and the treatment of other ore types?	Thandazile Moyo	
For Jason Gaber/ Daniel Stapper: For Cupellation, what would be the fate of the lead that is used?	Anil Sookdeo	Hi Anil. Thanks for question. Lead vapors are toxic and must be treated with respect. I meant to highlight this in my remarks. Care must be taken to protect workers from toxic fumes, and smelting should never be done in close proximity to living or eating quarters. In the cupellation furnace, most of the lead is absorbed into the cupel (as litharge), but some can be released from the furnace as (toxic) lead vapors.
Daniel Stapper: the metallurgical term is Quartering, not Cupelation...adding a metal to collect gold when it is melted. In this case silver would be the best choice instead lead...which produces toxic vapors. Have you tried to use silver?	Marcello Veiga	Hi Marcello. My understanding is that quartering is different. I am familiar with the use of silver in quartering, which is a more expensive process due to the need for clean silver, for the process. Further, (from my experience) the quartering method with silver typically gets finished with acid digest of the silver-gold alloy, which is also expensive and time consuming. Cupellation is different in the sense that the bismuth or lead used is absorbed into the cupel, leaving a clean gold button behind. Will be happy to discuss this cupelling process further - drawing from Jason's extensive practical expertise.
For Jason Gaber/ Daniel Stapper: Cupelation is the step of evaporating the lead of bismuth (by the way vapors are carcinogenic). Most gold from the Pacific region has silver and miners use to refine it with HNO3	Marcello Veiga	Actually it is not really about evaporating Marcello. Actually, in cupellation (generally) 98-99% of the lead or bismuth is absorbed into the cupel. Jason has in fact done test work to confirm this. (weighing the cupels after, to see how much lead they absorbed). But YES, lead fumes are dangerous and must ABSOLUTELY be treated with a high level or respect (i.e. similar to mercury fumes). Miners that I've worked with in Indonesia use the quartering method to refine gold. This "quartering process" is also described in detail in the UNEP practical guide on reducing mercury use, available here: https://wedocs.unep.org/handle/20.500.11822/11524
This is an elutriator that John is showing. This is known and used for centuries. What is novel point thing here? I could not see.	Marcello Veiga	
For John Richmond: what is the procesing capacity of sluices (kg/hr)? -in case I did not catch that from the presentation.	Gustavo Vargas	Approximately 100 kg/hr. depending on the density of the pay dirt being processed.
For John Richmond: is it golddrop more or less efficient in clays or white sands than in black sands?	Gustavo Vargas	The efficiency is the same as long as the clay soil is liquified and the sand is wet prior to scooping into the feed funnel.
For Daniel/ Jason: Bismuth vapor is carcinogenic	Marcello Veiga	
For Kristina Shafer: Magnetic separation is very efficient with black sands rich in magnetite and pyrrhotite. But with other types of sands with sulfides and oxides of other non-magnetic metals, how can you do this separation?	German Marquinez	We have yet to find a site so devoid of magnetite that it could not be gathered and reused. Also, mercury is imported so why not magnetite? It's worth it for the recovery and can be reused. Hg cannot recover gold particles smaller than 70 microns. Cleangold recovers gold as small as 5 microns. We've also recovered fine gold coated in oxides and sulphides which resisted amalgamation and cyanidation.
For all: All these technologies include technical assistance and training for a period of time. This assistance is either virtual or on-site or has another cost.	Dallas Noelia Gonzales Malca	From Orongo with NANSIO: The technical assistance and training required is for efficiency and effectiveness in gold recovery by use of Mitambo technology should be on construction of Mitambo machine, carpet laying and the general fine power washing on a Mitambo through recovery from the carpet to actual gold separation from the mixture of concentrate, separation of fine gold from other residues to heating of the gold into fine pure gold free from mercury. Onsite training would be most preferred for quick attainment of the practical aspect of the process.

For all: It has been seen to see assistance in coordination with other projects so that the miner is not disincentivized, because most of them argue that they are good technologies, but when there is no assistance they abandon the project.	Dallas Noelia Gonzales Malca	From Orongo with NANSIO: It has been seen to see assistance in coordination with other projects kind of attitude among most miners so that the miners are disincentivized, because most of miners argue that they have good technology, but when there is no assistance they abandon the project i.e the technology promotion. The scenario with Nansio is the that we trust our technology and we as quickly building the confidence of the small scale miners who are increasing yeaning for the technology having seen its effectiveness as the only best option available in the region. Nansio shall therefore continue with the promotion of the technology unless a superior and environmental friendly technology is found to rid the planet earth of the mercury peril in the mining industry. The way forward is to continued research on viable and environmental friendly gold extract methods as we too work to improve on the Mitambo technology for the future good of the people and general environment. Mercury usage must be spurn on earth hence research and improvement on some likely viable technology to be promoted.
For John Richmond:...how much is the cost?	Sixto Agüero	Due to limited production and demand the cost of a GOLDROP is $1750.00. With the economy of scale, we look forward to reducing its cost to process greater quantities of pay dirt.
For all: Very exciting to see successful pilot operations. Pilot vs commercial operation considerations are next perhaps?	Kevin Telmer	
For Dayshawn: The use of "polishing tables" is prominent. It would be helpful for participants to comment on how a polishing table compares to mercury? The Guyanese presentation reported 99% recovery for the Gemini (polishing table). Yes but probably mercury would be the same at that stage.	Kevin Telmer	The polish table does have higher yeild percentage because of the particle size and structure of the fine gold present in Guyana. Because of its shape and structure it might be difficult for the mercury to bond to the surface area of the gold, thus avoiding the capture of the gold.
For all: The technology must be adapted to the type of mineral	Janeth Lazarte	
For all: From what is shared, I see at least something that can work for every miner from the smallest artisanal miner to larger ones. What I see missing is more learning and getting these technologies to where they are needed.	Ken Anjejo	
For all: Are there any data available on upscaling these technology to commercial sizes, since the feed rates will be much higher in a commercial operations, and as we know recovery tends to decrease with grade of the ore.	Anthony Druiventak	Cleangold sluices can be arranged to handle larger amounts of ore; just increase the amount of sluices in an array to handle the throughput.
For Jason/Daniel: Tip: Mass is the big factor in direct smelting. It is the same as cooking a turkey at thanksgiving (which is coming up soon in Canada!). The bigger the bird, the more time required to cook the centre.	Kevin Telmer	
For Sixto Aguera: I used many vibration mills here in a small operation in Canada. The main problem is that lots of gold stay inside of the mill full of small balls. We use to spend hours cleaning the mills to recover the fine particles of gold. How to avoid this?	Marcello Veiga	{Response from Kevin Telmer} Hi Marcello. A good question. It is a good question for other types of mills too. A simple answer is that it doesn't matter much if it is a flow through system. But if you are processing batches for different mining groups this becomes more important. We are working on a flushing system for this purpose. Stay tuned!
For all: Greetings from Nigeria. Availability, Affordability, Efficiency and Sustainability of technologies is very crucial	Ahmed Ibrahim Bah	
For Sixto: I operated with water in the vibration mill... probably this helps but not too much	Marcello M. Veiga	{Response from Sixto:} Hi Marcello...thanks for the question...you can reduce the gold adhesion to the mill by: having manganese liners/media, adjusting mass flow, using a wet process and verify the liberation size to stop at D80 your liberation size.
For John Richmond: The gold particle size does matter - a lot! Stokes Law... Elutriation is not good for fine gold.	Kevin Telmer	On the contrary we have recovered fine flour “float” gold beyond the reach of mercury as well as fine gold ore with ease using the GOLDROP and the Magnet Sluice as evidenced in this video. https://youtu.be/UlAoBoLDCZk The fine gold ore recovered was assayed by Chris Christopherson in Smelterville, Idaho to contain 270 oz. of gold per ton of ore.
For John Richmond: How much? Goldrop?	Tsogtsaikhan Delgerbuyan	Due to limited production and demand the cost of a GOLDROP is $1750.00. With the economy of scale, we look forward to reducing its cost to process greater quantities of pay dirt.
For John Richmond: Can this method be used in alluvial mining?	Maria Colmenares	The GOLDROP works with both alluvial and hard rock ore.
For all: Thank you very much for this kind of event, I suggest if it is possible to make a summary table of clean technologies, with processing volumes, costs and efficiency.	Dallas Noelia Gonzales Malca	

Question/Answer Report - Tech Fair Day 2 - 7 October 2021

Question	Asker Name	Answer(s)
For German Marquinez, thanks. What happens to the mercury collected by this mobile system?	Byambasuren Odgerel	The mercury collected is delivered to a colombian company that is in charge of handling hazardous waste.
For German: the material that you give to the National Service of learning, is it just for training? or miners can benefit from it (in gold processing)	Anna Bugmann	Equipment delivered to the national learning service can be used for: 1. Training; 2. Pilot test; 3. Small production.
For German: Hello from Bogota, Colombia. Thanks for sharing this informaction. Is this information available to share with artisanal small miners in other regions	Ana Sierra	Of course, this information is available to share with small numbers on other sites. Please contact me by email
For Francois Dumont: what is gold recovery rate with your technique?	Anna Bugmann	Anna, our Lab-Separator is equipped with various standard and custom-made equipment, all provide a recovery superior to 90%
For German: Curious to know approximate costs on Germán's mobile unit. Also for the GoldFINX plant.	Toby Pomeroy	This plant has a cost of 30,000 usd, however this model has a lot of electronics that for production can be eliminated and the cost can be lower.
For German/Francois/ JW: Thanks very much for the presentation. My name is Benjamin Mchwampaka from NEMC-Tanzania. Our main problem is that our miners are mostly involved in hard rock mining and not alluvial. They are many in number and it is not easy to organise them to have groups or cooperatives. What could be the alternative technology to mercury that can suit such huge number of miners who are scattered all over the country dealing with reef or hard rock gold mining? Thanks	Benjamin Mchwampaka	Benjamin Mchwampka. We have locally developed mobile plants for gold recovery from hard rock. We can contact us to show you more developed material- German Marquinez From GoldFinX: Benjamin, my company will be in Tanzania in mid-2022 most probably. Best is to interface with German. If you still have not resolved your situation next year, please contact me directly fd@GoldFinX.com
For Kristina Kazakoff: How does the cost of CML compare to cyanide?	Stephen Metcalf	Hi Stephen, The overall cost of our reagent is comparable if not cheaper than cyanide
For Kristina: What is the cost of the reagent Christina?	Anna Bugmann	Hi Anna, Cost of reagent is USD$3.80 per kg
To Kristina. Do you think Your method applicable in ASGM in the Amazon which takes place adjacent/in water bodies ? Any studies that you have made on impacts on biodiversity, others ? Many thanks	Beatriz Torres	Hi Beatriz, This answer needs a bit more info, what scale is planned, how much reagent will be released back to the enviroment, what local biodiversity is there around the surrounding areas. Happy to set up a techinical meething with you to disucss this. Feel free to email us at info@cleanmining.co
To Kristina, in which countries these CML reagent has been used for commercial purposes already?	Anonymous Attendee	Our CML reagent will be availible globally. We are currently working on our distribution logistics and blending in numerous parts of the world.
For Kristina: Composition of 'clean recover'; is it safe?	Anna Bugmann	All of our addatives are non-toxic. Our focus was always to provide non-toxic solutions.
For Kristina: Wow thats some great job Clean Earth Technologies are doing. So how much roughly does the reagent bag cost 25kg?	Kudzai Henry	Our reagent is $3.80 USD/kg.
For Douglas Kao: are there any example of succeful use of amino acid acid assisted leaching	Anna Bugmann	Yes, we have 3 project sites in Indonesia that have successfully adopted this technique to some degree. We were also able to pilot a comparative trial directly in an ASGM's facility that produced better results than their traditional method using unoptimized cyanidation
For Tom Boston: What is the fate of mercury when processing mercury-contaminated tailings? Thank you!	Jane Dennison	Jane, the Cycladex process removes Mercury, as well as all toxic heavy metals selectively with proprietary resins, then the Mercury is stabilized and disposed of responsibly in an accepted way similar to radioactive materials
For Marcello Veiga: I suggest using inquartation and not quartering.	Anonymous Attendee	
For Kristina/ Tom: Does CML complex/disolve mercury and affect elution? Same question for Tom...	Stephen Metcalf	From Kristina: Our CML reagent does dissolve some mercury. However, the resin we use is very selective for gold so mercury should not report to the eluate. This is ore dependant though. From Tom: Our Cycladex leach does put Mercury into solution where it is then extracted on resins and disposed of properly and does not affect extraction.
Marcello: transportation of artisanal ore to processing centers is difficult to impossible in many regions	Stephen Metcalf	
Tom: you process is chemically complexe as you said; what happen if compounded(chemicals) with contaminated tailings. Did you do some tests about that? Could'nt it be harmful?	Anna Bugmann	Anna , the Cycladex process does not use any Hazardous chemicals in addition the tailings are left completely benign and used for building products
For Tom: I am in Zimbabwe how easily can I get it?	Kudzai Henry	Kudzai, you can email me and I can discuss with a local distributor
For Kristina: Is there a distributor nearby or we can link up with for the reagent?	Kudzai Henry	Hi Kudzai, This depends on where you are based, please send us an email on info@cleanmining.co and we can discuss further
For Marcello: in your estimation what would be the best solution for ASGM	Quinton Johnson	Miners sell the ore.
For Pariya: Can our cassava in the northern part of nigeria be used to get cyanide from it	Bello Yahaya Gezah	Hi Bello, If you have bitter cassava, you can. Because bitter cassava has high level of cyanogenic gylcosides so more free cyanide. You can follow the process of how to generate free cyanide from cassava in our published paper. We supposed to come to Nigeria, analyse cassava there and start a pilot plant, but Covid - situatoin did not let us to do that.
For Nicole: some time in June this year I did send an email enquiring about this technology after I participated on your webinar which was done some time in June or May. But the email upto date was not responded. I have been following your project for long.	Kudzai Henry	Hi Kudzai, My apologies for this, I will follow up on my end but in the mean time please send me an email on nicole.looney@cleanmining.co This way it will go personally to me and you will get a reply.
For German: What do you do with the recovered mercury amalgams? What is the final disposal?	Janeth Lazarte	The mercury collected is delivered to a colombian company that is in charge of handling hazardous waste.
For German: With the mobile plant, what is the recovery percentage?	Janeth Lazarte	We are conducting laboratory analysis to quantify gold recovery. By visual analysis it may be above 85%.
For all: It is not only a matter of changing technology, the states must change the electricity matrix so that it reaches the artisanal miner.	Andrea Ravines	Andrea , with our goals in mind of a centralized processing facility the miners will not have any changes to make
For Nellie Mutemeri: Is it possible to have the french version of the Gender in ASGM document? Thanks.	Anassi Etchri	Unfortunately it is not yet available in French.
For Douglas. Agree that understanding of process optimization is really so fundemental. Even simply testing for gold loss with ASMs is such a helpful and eye opening exercise	Daniel Stapper	I couldn't agree more! Thanks Daniel
For Kristina: I would like to know if the reagent you propose is suitable for any type of mining material, what happens with arsenic-rich gold materials. Is the reagent selective with gold?	German Marquinez	We have tested over 150 different ore types. Our reagent was made to be able to extract gold from varied ore sources including sulfide ore. The gold needs to be liberated for extraction to work, same as any other type of leaching process. If the gold is locked in an arsenopyrite structure then it is unlikley to be recovered without pre-treatment.
For all: A thought, has anyone perhaps done a lifecycle analysis (LCA) of some of the technologies proposed? Will we look back some years down the line an realise we traded one "bad" technology for another?	Daniel Stapper	