Video Topics:

Start of video:

NARRATOR: HASAN

Scene 1: Evil Mine Owner in chair, Turns around and commits evil laugh - Hasan (5sec) (Optional)

CEO: *In an office, picks up cell phone and dials a number*
phone rings

Foremen: Hello?

CEO: Well Mr. Foreman, I have very sad news. Our mining operation is no longer turning a profit. I'm going to have to shut it down. Effective immediately.

Foremen: But sir, this is so sudden! What about all the rubble? There is no way we can restore this mine site to its natural conditions!

CEO: Pff… Natural Conditions? Hah! That mine is in the middle of nowhere, who's gonna notice? the fish??

Scene 2: Starts black screen with water sound, Contaminated water (yellow filter) scene slow zoom out (15sec)

Significance:

- "Thousands of liters of Acid Mine Drainage poisons our environment everyday, harming our aquatic ecosystems and leaching into water supplies.
- These contaminants make their way into the human food chain through affected crops and aquatic life, potentially causing serious health effects to people.
- A solution to Acid Mine Drainage would decrease the threat that heavy metals pose to human health, save millions in lost revenue and fines, and increase the quality of life for those who rely on the land."

Background:

- “Acid Mine Drainage is the primary water-based effluent emerging from mines—with about 90% of Acid Mine Drainage coming from abandoned operations.
- It is created when sulphur-based minerals are exposed to water and air, causing a drop in pH which gets heavy metals to leach into the water from surrounding rock.
- This creates an effluent that's rich in Sulphide and Heavy Metals.”

Scene 3 options during background/significance narration:

- Nature (wildlife ex. birds , fish) - stock vid
- Nature (trees & plants) - stock vid
- Small waterfall/ streams flow - Stock vid

Scene 4: Our group is shown transitioned in

- “We have the solution!” - All together
- Introduce ourselves (20sec)
- Someone states the need statement - Connor

Scene 5: We are huddled together working on prototypes

- Zach looks up (Menacingly) and provides a description of our selected solution.
- Axel explains solution testing

1 minute = 140 words

Intro/Skit - 1 Minute
Background/Need Statement - 1 Minute
Solution/Testing - 2 Minutes
    Solution Explanation
    Solution Testing

Solution Explanation - 1 Minute

Solution Explanation:

For those who don’t know, this is a mine adit. It’s a slanted passageway that connects underground mines to the outside world. They originally served as a way to drain water from mines, but the only thing that flows out of here now is AMD.

This bad boy is an SFP-2880 ultrafilter. It’s a membrane with super tiny 30 nanometer wide pores. For reference, the size of a water molecule is about 0.3 nanometers, which allows AMD water to pass without requiring an absurd amount of pressure. However, because heavy metals and sulphates are dissolved within AMD, implementing this membrane alone would be completely ineffective as they’d just flow through the pores.

Enter precipitation technologies. It turns out that each heavy metal has a pH for which it'll precipitate out of water and clump up to form a ball in which the pores of our filter can catch. We found that if we were able to decrease the acidity of AMD from a pH of 2 to 8, we could precipitate out all of the major heavy metals that the governing bodies of the pacific northwest mandate by law.

So how do we increase the pH? At the entrance of the adit will lie a container filled with cheap cheap limestone powder. All that's required is a sensor at the base of our solution to monitor the pH of incoming flow, and if the pH falls below 8, a hatch will release this powder, and vice versa.

Now, our membranes can only last so long before they begin to foul, so we've developed a rotating mechanism to allow membranes to swap in and out when a flow sensor notices that the flow of water has decreased.

What powers this motor? Well, we've designed our solution such that our effluent flow spins a mini water turbine, allowing our solution to be almost completely self-sufficient. Aside from the occasional replenishment of limestone and backwashing of membranes.

There are so many more details to it, like a prefilter to catch any incoming rocks or debris that may damage our membranes, but those are just tiny details.

CBA - 1 Minute

Need Statement Script: "We built our solution to deal with the need of purifying contaminated water runoff originating from abandoned mining operations located in the Pacific Northwest."

CBA: The data shows our solution is economically and environmentally beneficial and greatly outweighs the costs. Our research was limited by both time and data constraints and reliant on statistics provided by the Government of Canada. However, they still provide a solid basis for our Cost Benefit Analysis. Through our research we determined that we can save more than 18.9 liters per year, which has the potential of increasing the Canadian GDP by $5.7 million! This greatly outweighs the costs before even looking at the positive impacts on local ecosystems. Looking at our costs, our initial construction costs are about $49.5K factoring in social costs created by CO_2 production. Over the course of 5 years, about $17K dollars are incurred due to maintenance and social costs; coming to a total cost of $66.5K dollars. While there are limitations to this analysis, based on what we can perceive, our solution generates $5.6 million in profit in Canada alone! We implore the provincial, state and federal governments of the PNW to invest in our solution with aid from their region's mine reclamation budget. The cost is worth it.

References (In Order of Appearance)

(0:26) Tlingit & Haida. (2023). ICYMI: Tlingit & Haida President Richard Chalyee Éesh Peterson and Rep. Dan Ortiz discussed the cleanup of the Tulsequah Chief Mine in a press conference regarding issues with the mining industry in British Columbia. Full press release: www.ccthita-nsn.gov/info/press/index.html. Facebook. https://www.facebook.com/tlingitandhaida.gov/videos/bc-mining-press-conference-highlights/1328822804626671/

(0:53) Environment Matters. (2017). New Facility to Treat Acid Mine Drainage in the Cheat River Watershed (2017) [Video]. YouTube. https://www.youtube.com/watch?v=WD3fUaBbOxU&t=61s

(1:24) Methods of Mining and Formation of Minerals | High School Geography (n.d.). Esoma-KE. https://esomake.co.ke/secondary/geography/mining-form-1-geography/

(1:33) DuPont Ultrafiltration SFP 2880 XP IntegraFlux Ultrafiltration Module. (n.d.). Lenntech. https://www.lenntech.nl/producten/DuPont-Ultrafiltration/SFP-2880XP/SFP-2880-XP-IntegraFlux-Ultrafiltration-Module/index.html

(1:59) Mark Rober. (2019). Drinking Nasty Swamp Water (to save the world) [Video]. YouTube. https://www.youtube.com/watch?v=6qZWMNW7GmE

(2:25) Pratt, S.E.. (2016). Bringing geoscience to bear on the problem of abandoned mines. Earth Magazine. https://www.earthmagazine.org/article/bringing-geoscience-bear-problem-abandoned-mines

(2:52) 300w Pico Turbine. (n.d.). Suneko - Hydro Turbines.

https://www.micro-hydro-power.com/Micro-Hydro-Power-Propeller-Turbine-Arial-ZD1.8-0.3DCT4-Z.htm

(3:28) Kapepula, V. L., & Luis, P. (2024). Removal of heavy metals from wastewater using reverse osmosis. Frontiers in Chemical Engineering, 6.

https://www.frontiersin.org/journals/chemical-engineering/articles/10.3389/fceng.2024.1334816/full

(4:07) Kalin, M., & Chaves, W. C. (2003). Acid reduction using microbiology: treating AMD effluent emerging from an abandoned mine portal. Hydrometallurgy, 71(1–2), 217–225. https://doi.org/10.1016/s0304-386x(03)00159-2

(4:11) Government of Canada. (2019). Canadian System of Environmental–Economic Accounts: Water use, 2019. Statistics Canada.
https://www150.statcan.gc.ca/n1/daily-quotidien/221219/dq221219d-eng.htm

YouTube Link https://www.youtube.com/watch?v=zAza8bbq6t4

Title: APSC-O 169 (L2L); Squad 3 - Remedy to Acid Mine Drainage (Automatic Solution)

YouTube Video Description:

9 views Nov 25, 2024
Squad 3 is Axel Bendl, Zachary Boos, Connor Jones, Hasan Mohammad & Jacky Zhou.

References: (In Order of Appearance)

(0:26) Tlingit & Haida. (2023). ICYMI: Tlingit & Haida President Richard Chalyee Éesh Peterson and Rep. Dan Ortiz discussed the cleanup of the Tulsequah Chief Mine in a press conference regarding issues with the mining industry in British Columbia. Full press release: www.ccthita-nsn.gov/info/press/index.html. Facebook. www.facebook.com/tlingitandhaida.gov/videos/bc-mining-press-conference-highlights/1328822804626671/.

(0:53) Environment Matters. (2017). New Facility to Treat Acid Mine Drainage in the Cheat River Watershed (2017) [Video]. YouTube. • New Facility to Treat Acid Mine Drain... .

(1:24) Methods of Mining and Formation of Minerals | High School Geography (n.d.). Esoma-KE. esomake.co.ke/secondary/geography/mining-form-1-geography/.

(1:33) DuPont Ultrafiltration SFP 2880 XP IntegraFlux Ultrafiltration Module. (n.d.). Lenntech. www.lenntech.nl/producten/DuPont-Ultrafiltration/SFP-2880XP/SFP-2880-XP-IntegraFlux-Ultrafiltration-Module/index.html.

(1:59) Mark Rober. (2019). Drinking Nasty Swamp Water (to save the world) [Video]. YouTube. • Drinking Nasty Swamp Water (to save t... .

(2:25) Pratt, S.E.. (2016). Bringing geoscience to bear on the problem of abandoned mines. Earth Magazine. www.earthmagazine.org/article/bringing-geoscience-bear-problem-abandoned-mines.

(2:52) 300w Pico Turbine. (n.d.). Suneko - Hydro Turbines. www.micro-hydro-power.com/Micro-Hydro-Power-Propeller-Turbine-Arial-ZD1.8-0.3DCT4-Z.htm.

(3:28) Kapepula, V. L., & Luis, P. (2024). Removal of heavy metals from wastewater using reverse osmosis. Frontiers in Chemical Engineering, 6. www.frontiersin.org/journals/chemical-engineering/articles/10.3389/fceng.2024.1334816/full.

(4:07) Kalin, M., & Chaves, W. C. (2003). Acid reduction using microbiology: treating AMD effluent emerging from an abandoned mine portal. Hydrometallurgy, 71(1–2), 217–225. doi.org/10.1016/s0304-386x(03)00159-2.

(4:11) Government of Canada. (2019). Canadian System of Environmental–Economic Accounts: Water use, 2019. Statistics Canada. www150.statcan.gc.ca/n1/daily-quotidien/221219/dq221219d-eng.htm.

For more information, read our extensive project reports documenting our journey that led the way to developing our current solution.

Report #1 - Background Research and Establishing Need Statement, Functions, Objectives and Constraints.

Bendl, A., Boos, Z., Jones, C., Mohammad, H., Zhou, J.. (2024). Project Report #1 - A2 [Unpublished assignment submitted for APSC169]. The University of British Columbia. docs.google.com/document/d/1CjBdQ0bzohkJqcKQADP1ZmjT58Tp7m_YRMm6QlqB-tI/edit?usp=sharing.

Report #2 - Exploring Existing Solutions

Bendl, A., Boos, Z., Jones, C., Mohammad, H., Zhou, J.. (2024). Project Report #2 - A2 [Unpublished assignment submitted for APSC169]. The University of British Columbia. docs.google.com/document/d/1kBi7Fi1OngpLpqckex08T_k8V3uh0ptRno-twvev6M8/edit?usp=sharing.

Report #3 - Phases of Initial Ideation for New Potential Solutions

Bendl, A., Boos, Z., Jones, C., Mohammad, H., Zhou, J.. (2024). Project Report #3 - A2 [Unpublished assignment submitted for APSC169]. The University of British Columbia. docs.google.com/document/d/1dPGLpDbUg7lb9PzsWTjx8lwBpjkBXDj5D3qQMFsN4XA/edit?usp=sharing.

Report #4 - Prototyping and Proposed Solution Write-Up

Bendl, A., Boos, Z., Jones, C., Mohammad, H., Zhou, J.. (2024). Project Report #4 - A2 [Unpublished assignment submitted for APSC169]. The University of British Columbia. docs.google.com/document/d/1DRrcW5UGN-REhkcs-BC26TB7pYRnATazTfukZ8LnyEc/edit?usp=sharing.