SOUTH DAKOTA MINES
SME Society for Mining, Metallurgy & Exploration
18TH NORTH AMERICAN
MINE VENTILATION SYMPOSIUM
June 12-17, 2021 // Virtual Event

Experiences in the Control of the Piston Effect in “El Porvenir” Mining Unit

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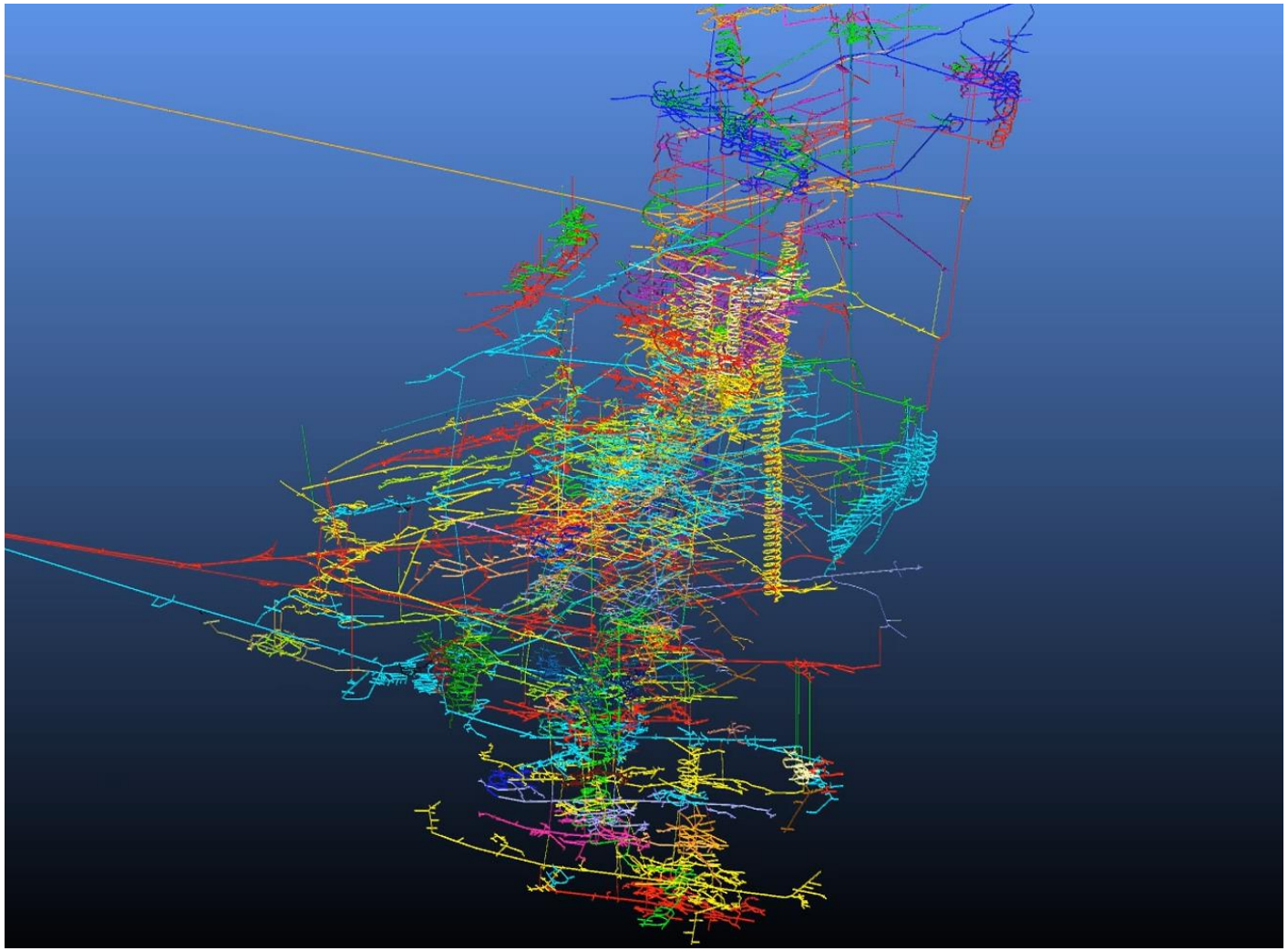
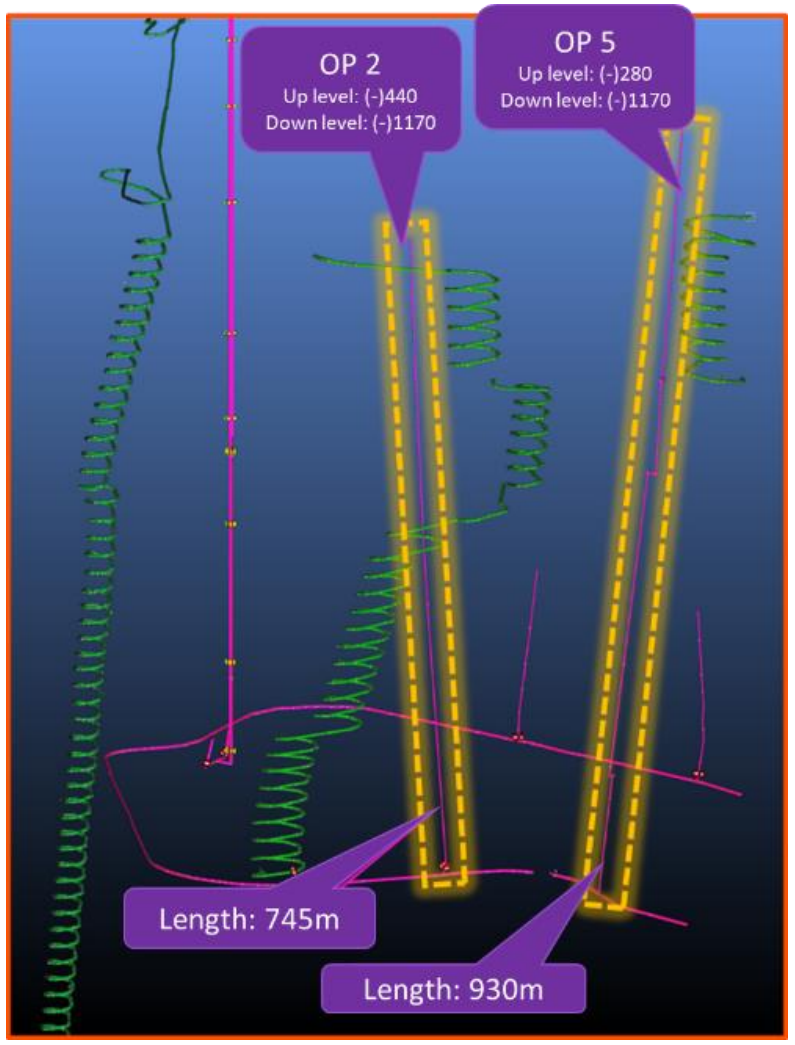
Jorge Godos – Nexa Resources

- Introduction
  - General Information:
    - High above sea level
      - Main Entrance: 4170 masl
    - Deep
      - Lower level: 2420 masl
      - Max. Cover: 1942 m
    - Extension
      - Length: 4539 m
      - Width: 4373 m
  - Ventilation Circuit:
    - Inlet Air:
      - Main Entrances: 20
      - Capacity: 1’280 KCFM
    - Exhaust Air:
      - Main Exhaust: 17
      - Capacity: 1’387 KCFM
    - Main Fans:
      - Quantity: 8 units
      - Nominal Capacity 1’080 KCFM
  - Operative conditions:
    - Demand: 1’243 KCFM

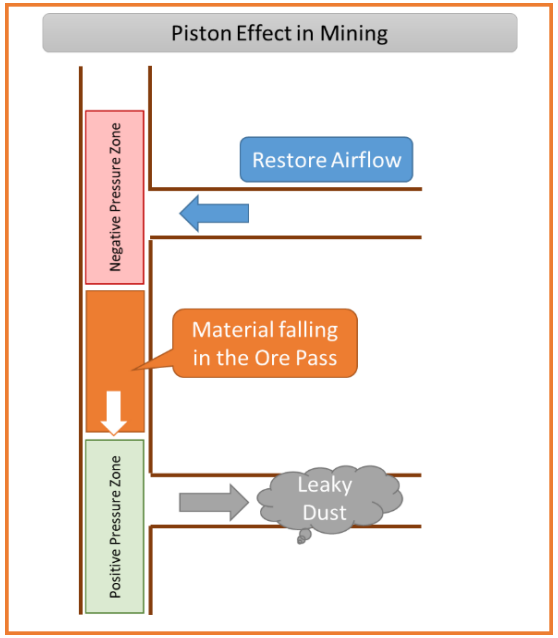


Background


OP 2
Up level: (-)440
Down level: (-)1170
OP 5
Up level: (-)280
Down level: (-)1170
Length: 745m
Length: 930m


16-06-19 10-50-13 AM
dnaupari/3430 - (-)640/Alto


28-08-18 04-08-03 PM
D:\aupari/3530 - (-)540/Alto


Piston Effect in Mining
Negative Pressure Zone
Restore Airflow
Material falling in the Ore Pass
Positive Pressure Zone
Leaky Dust


07-12-18 10-33-33 a. m.
dnaupari/3630 - (-)440/Alto

Piston Effect

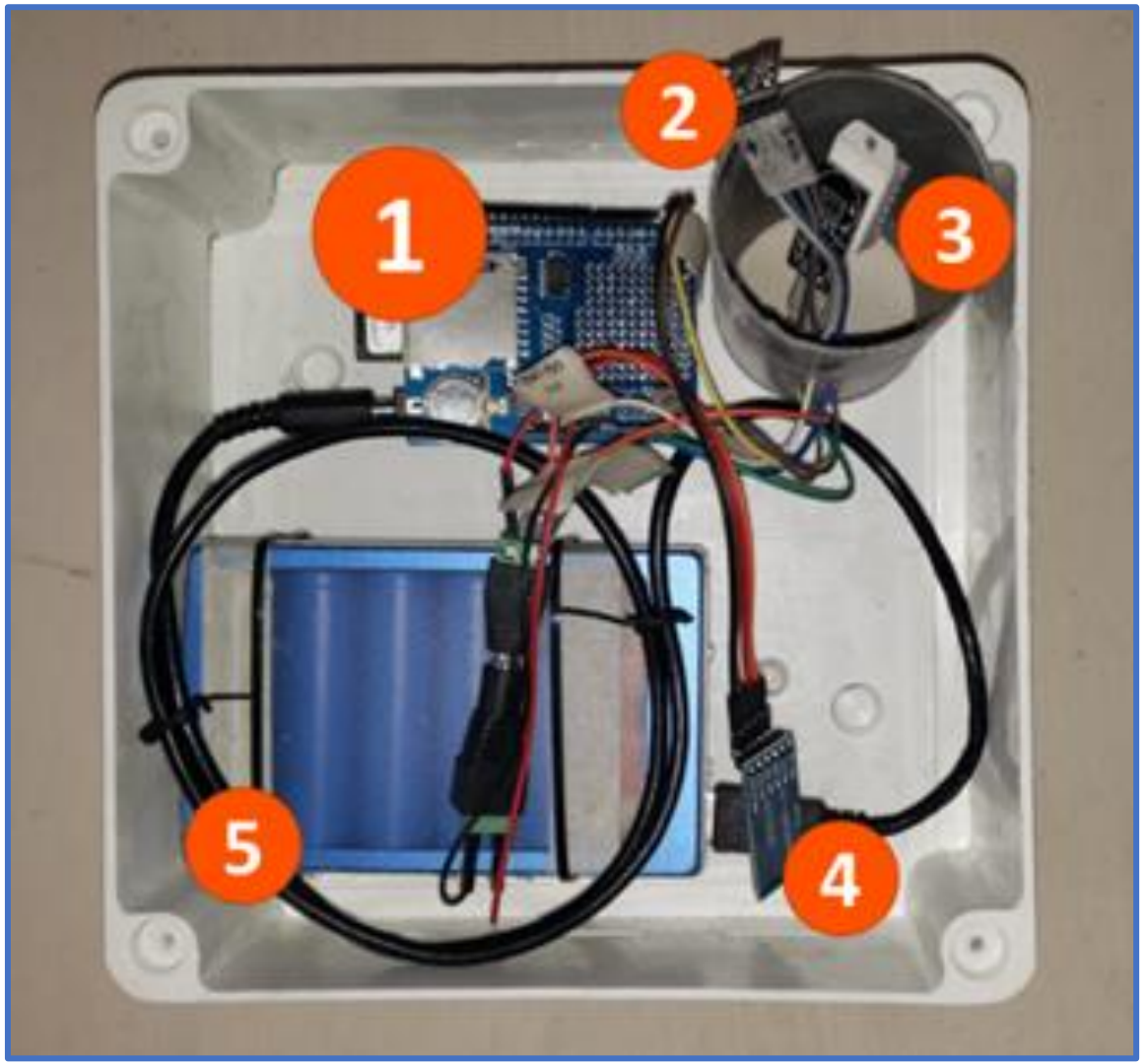
Low Intensity

High Intensity

Methodology

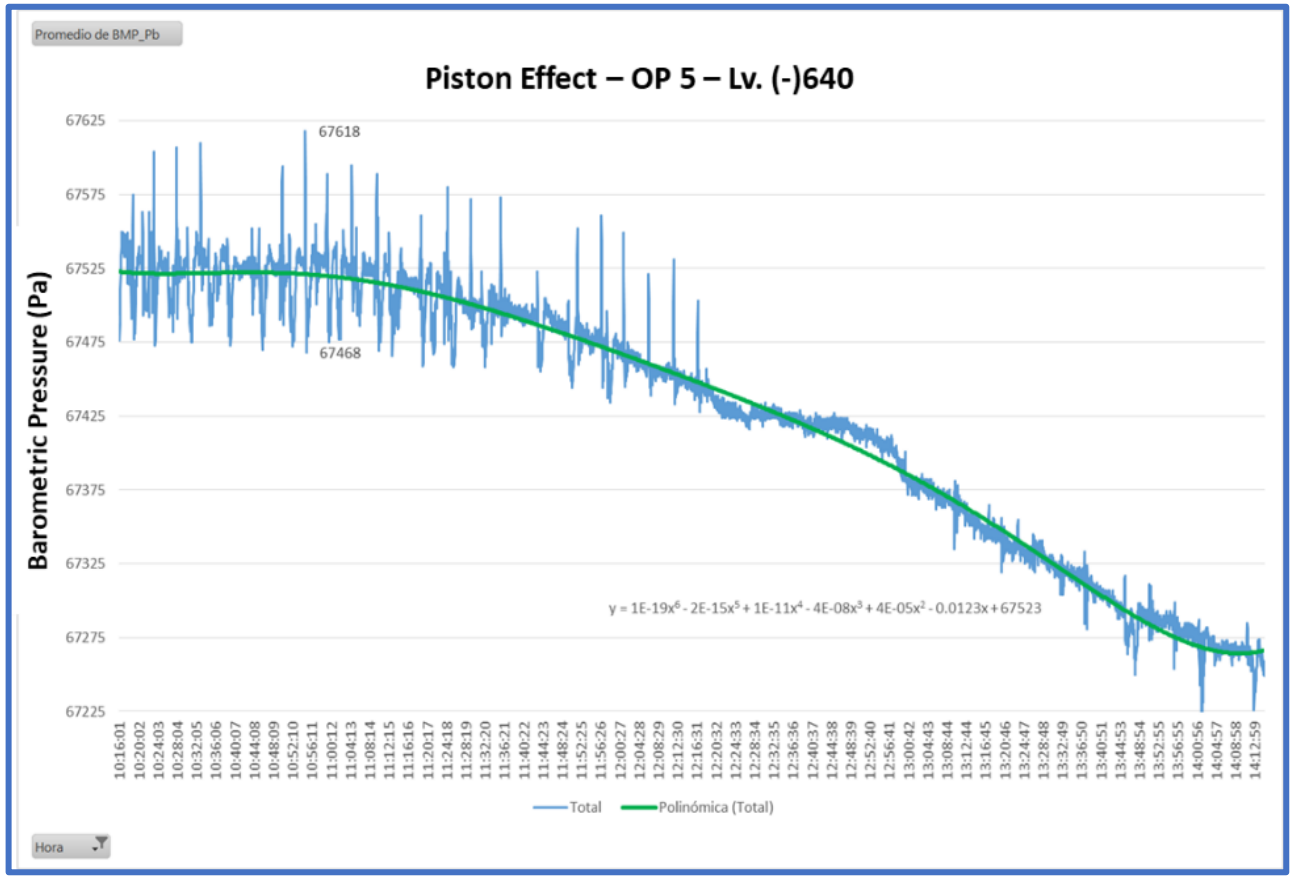
Measurement

1. Arduino with data logger
2. Barometric Pressure Sensor – BMP 180
3. Temperature Sensor – DHT 22
4. Bluetooth transmitter
5. Battery Pack

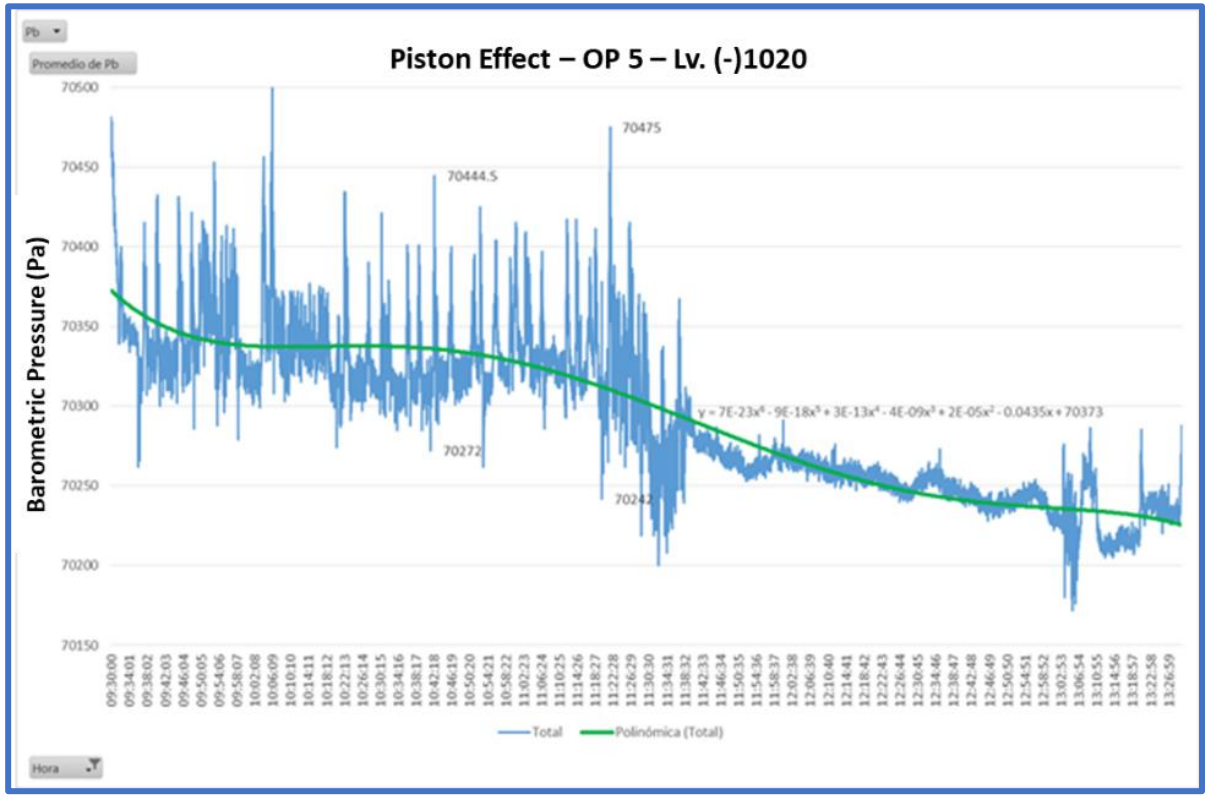


Results

Measurement



Pressure Disturbance:
180 – 375 Pa (1.5 inchWC)



Methodology

Dust Control

Dry

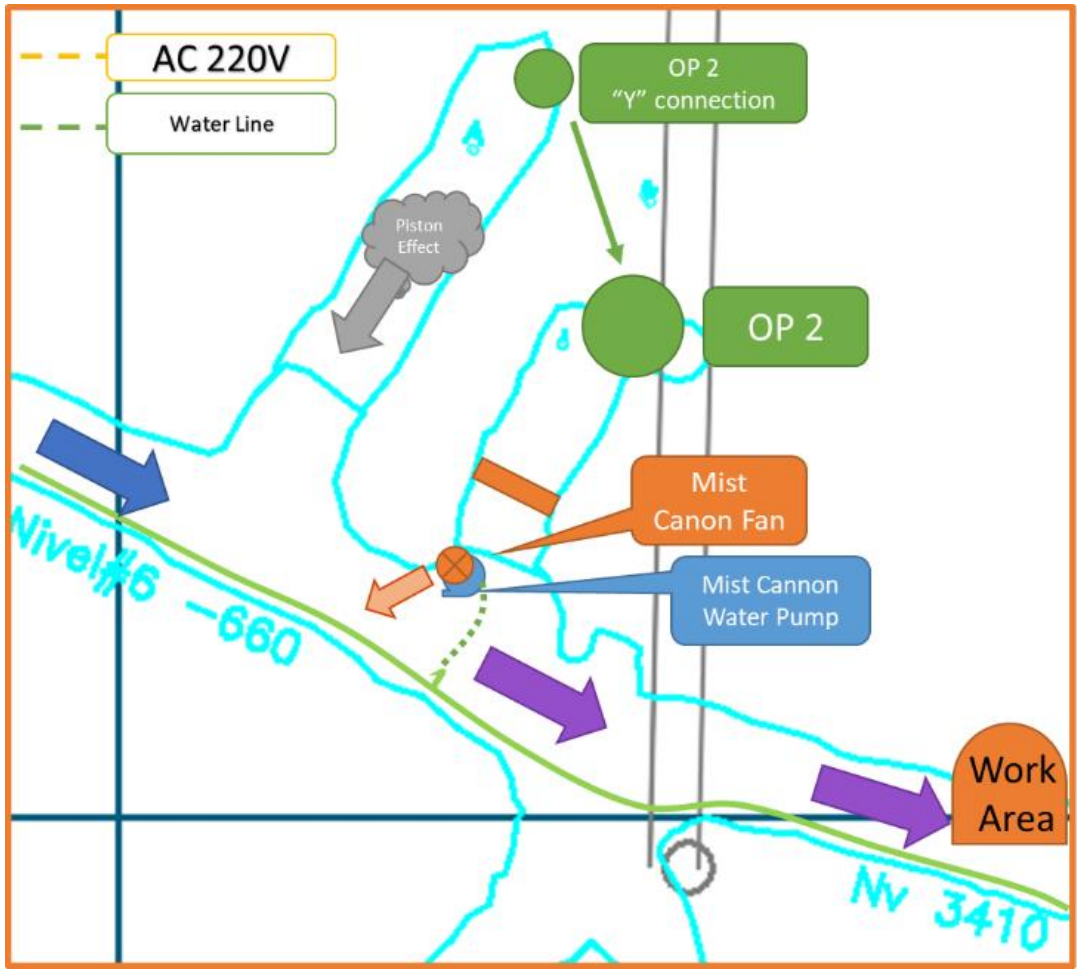
- Gates / Curtain
- Local Extractor
- Accumulation Level
- Exhaust Circuit
- Planned Short Circuit

Wet

- Mist Cannon

Methodology

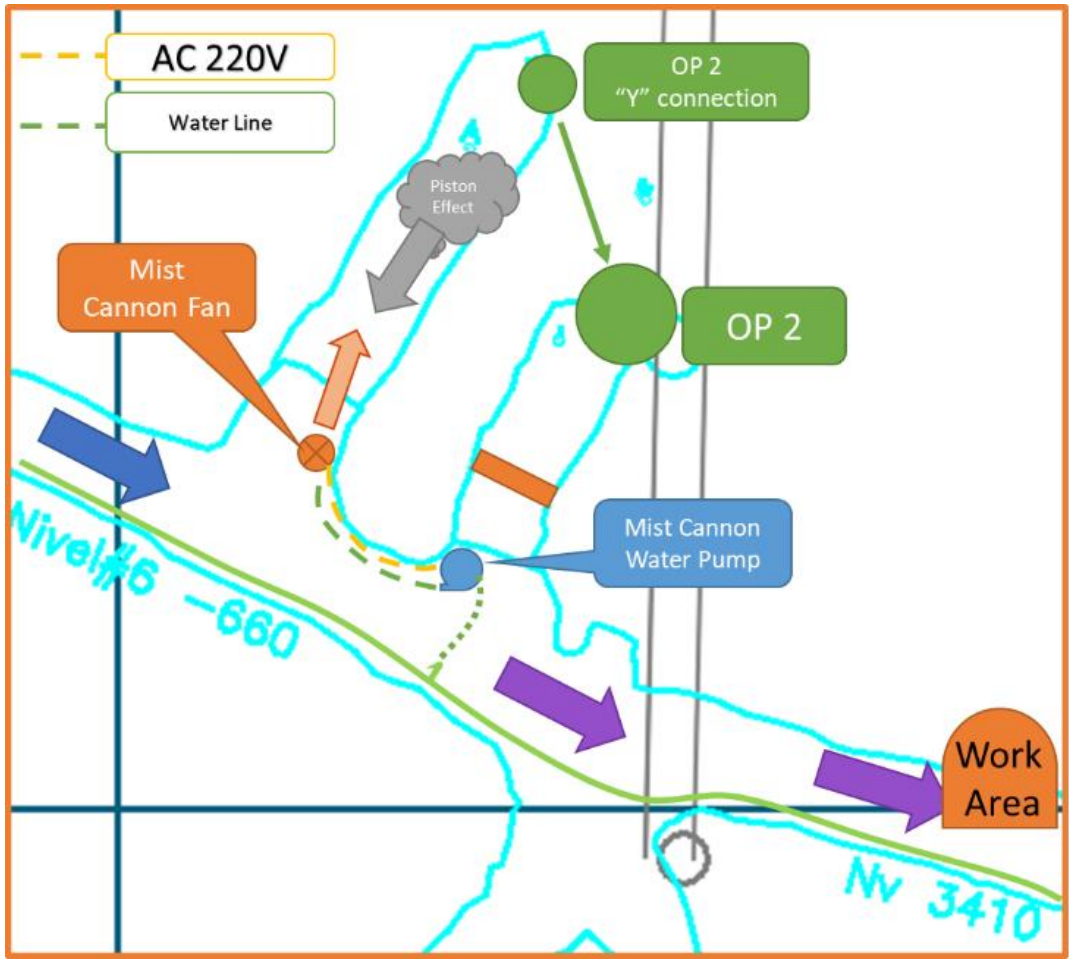
Wet Methods (Mist Cannon)



High Efficiency Mist Cannon

Methodology

Wet Methods (Mist Cannon)



Results

Wet Methods (Mist Cannon)

Results

Wet Methods (Mist Cannon)

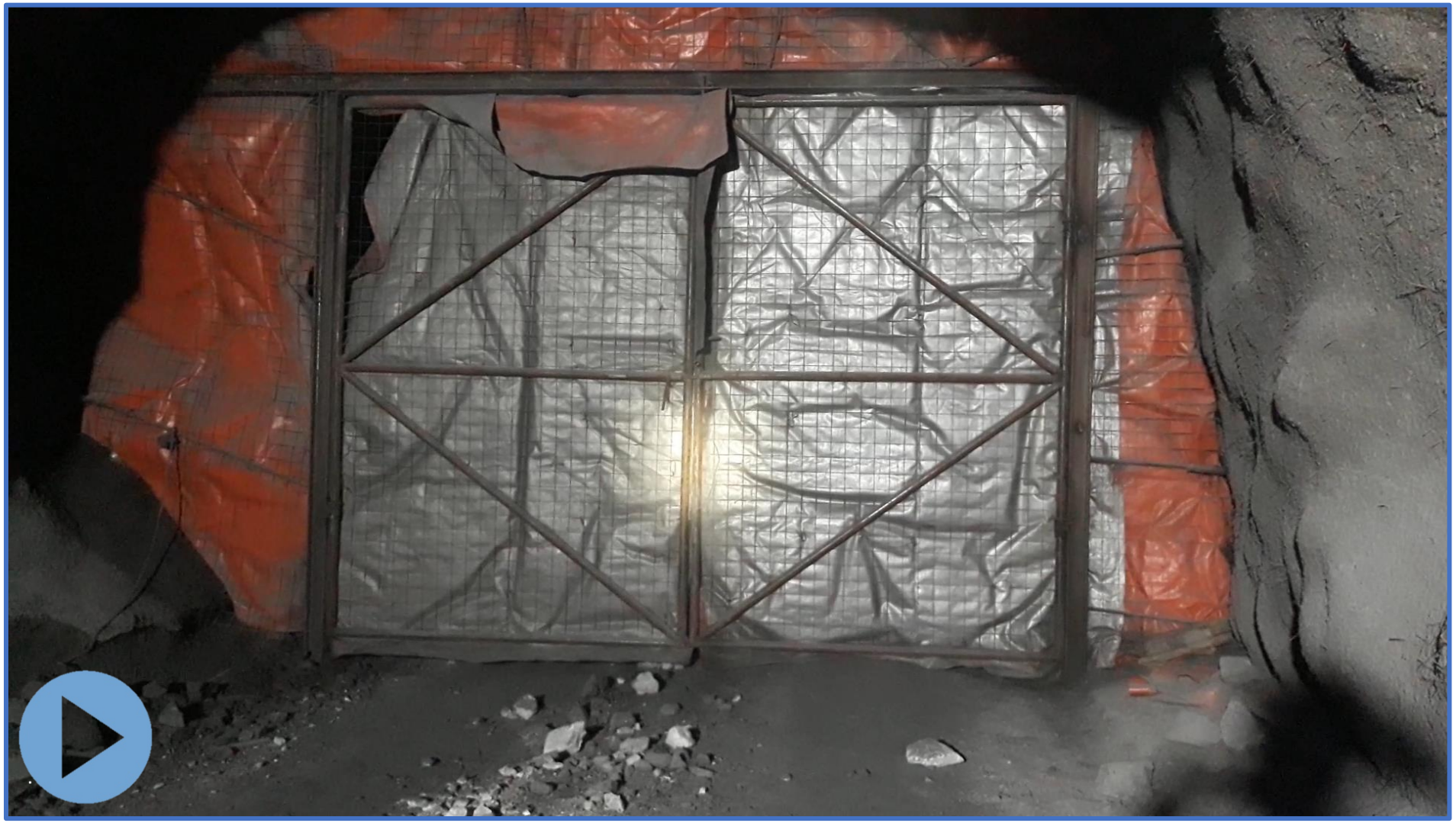
Methodology

Dry Methods (Gates y Curtains)

Results

Dry Methods

(Gates)



Results

Dry Methods

(Gates)

Results

Dry Methods

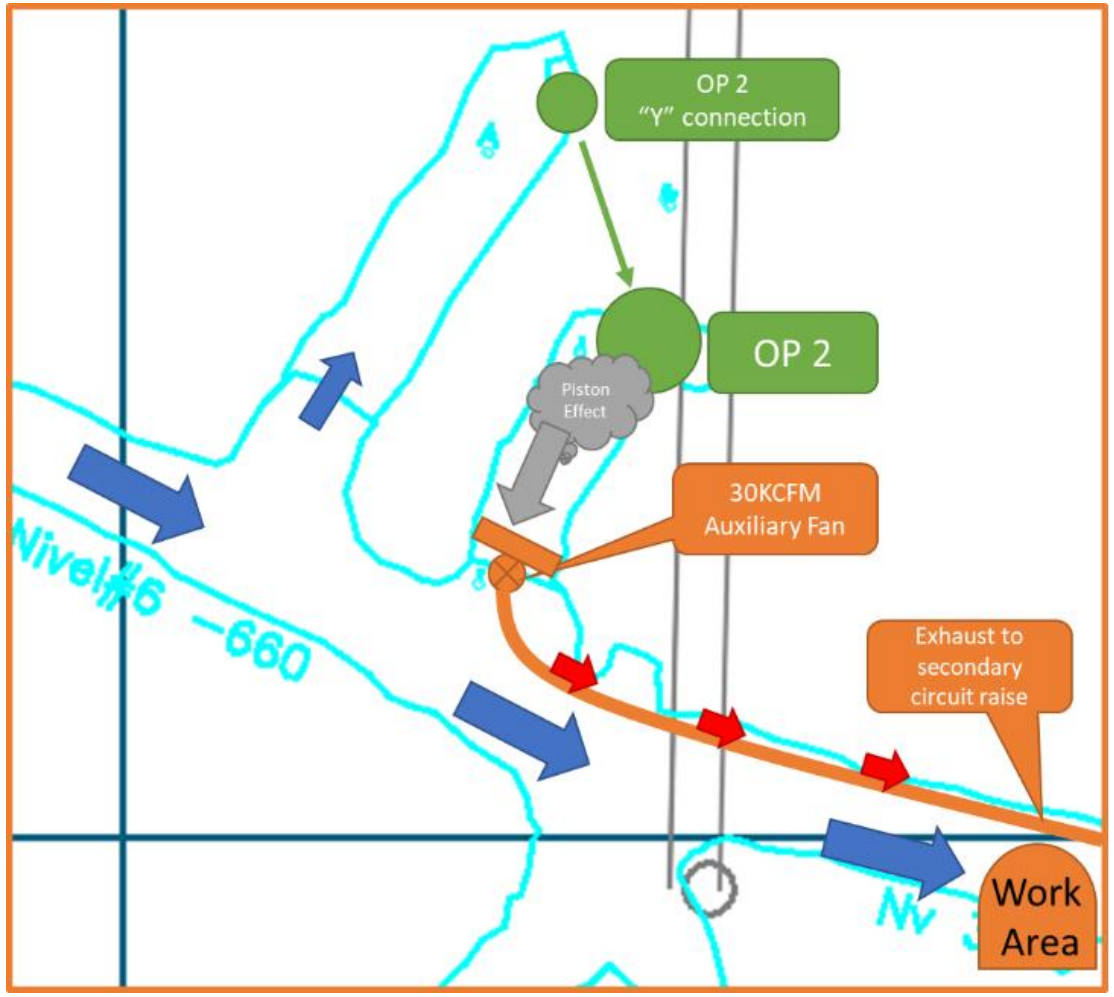
(Curtains)

Hinge supports to improve the flexibility to allow a smoothly transit.

High weight of strips damage the equipment's accessories.

Methodology

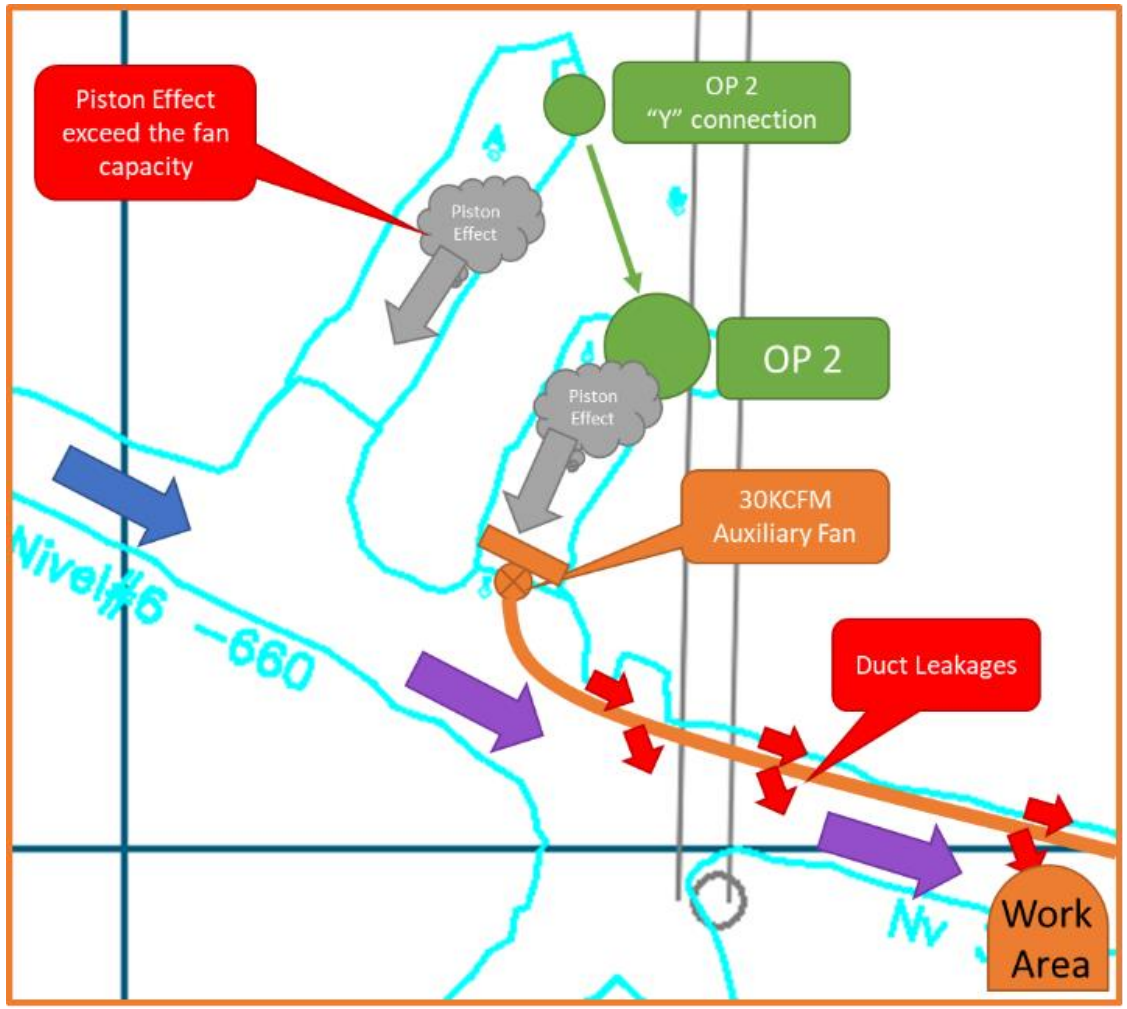
Dry Methods (Local Extractors)

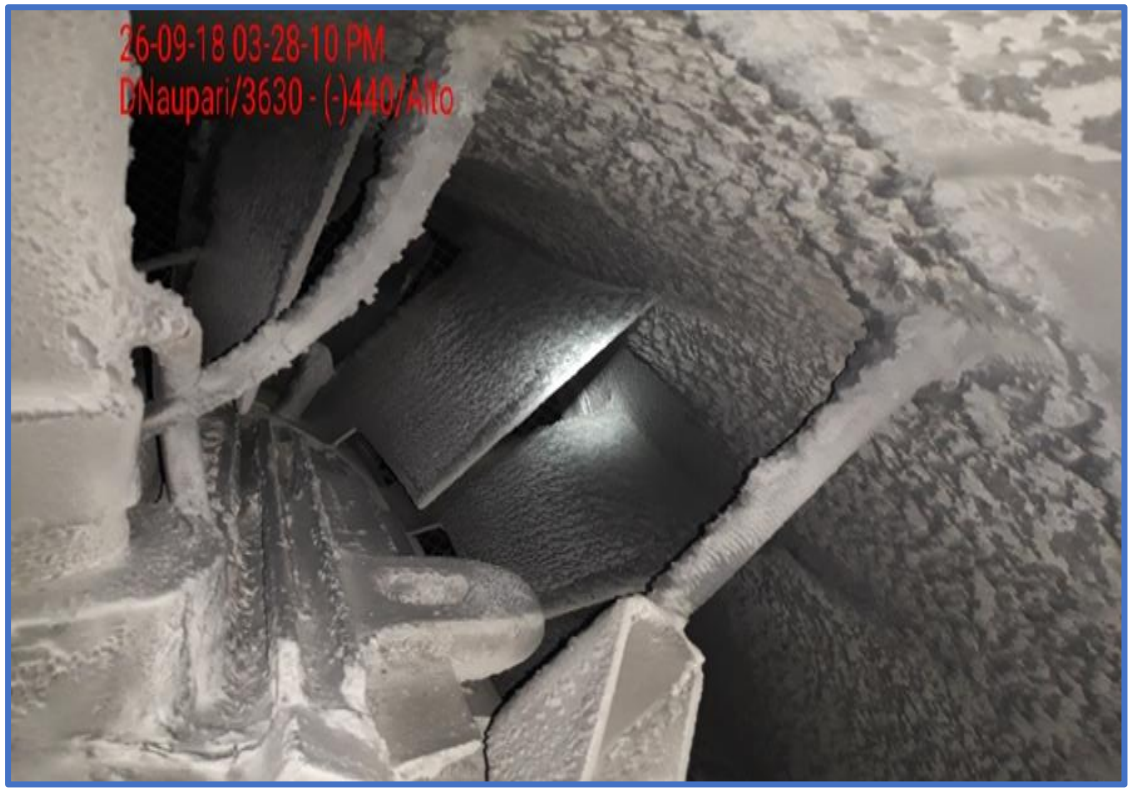


Local Extractor
(Auxiliary Fan)
30 KCFM

Results

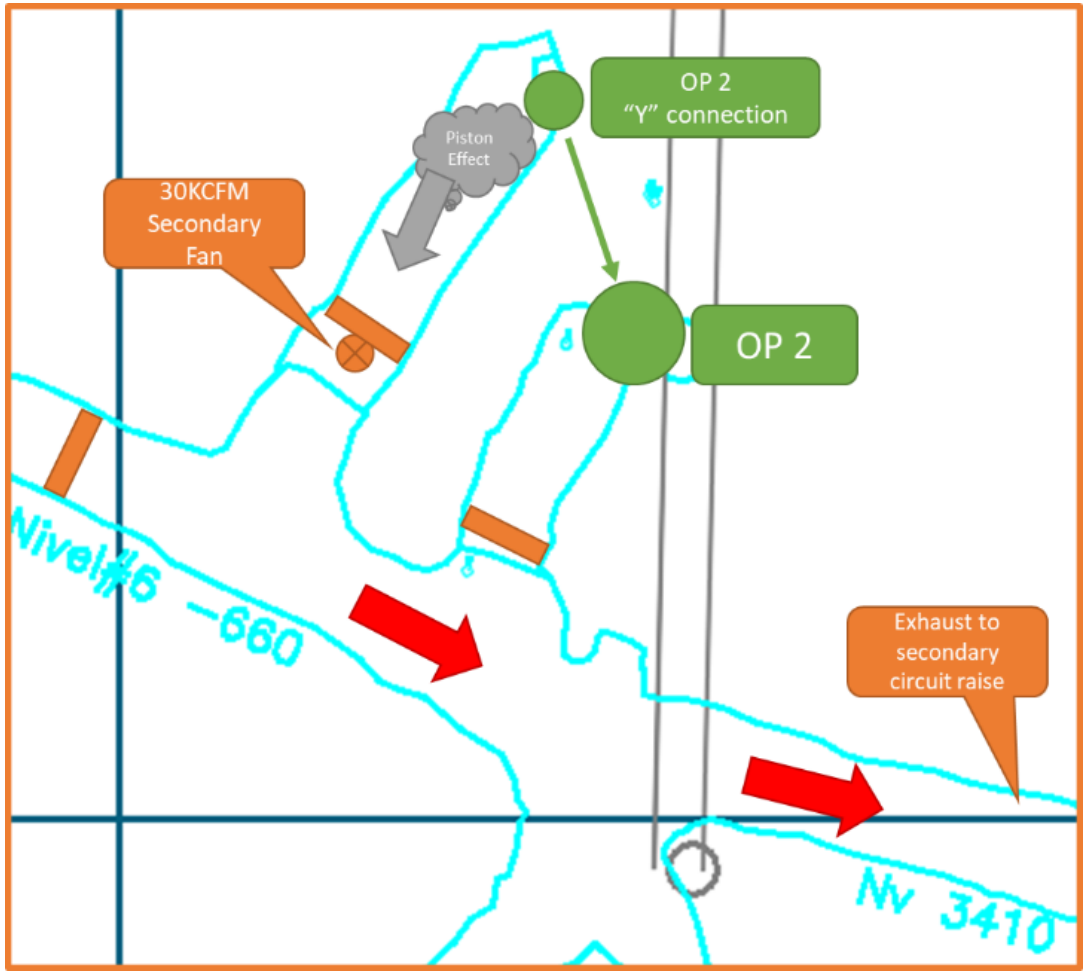
Dry Methods (Local Extractors)





Methodology

Dry Methods (Dust Accumulation Level)

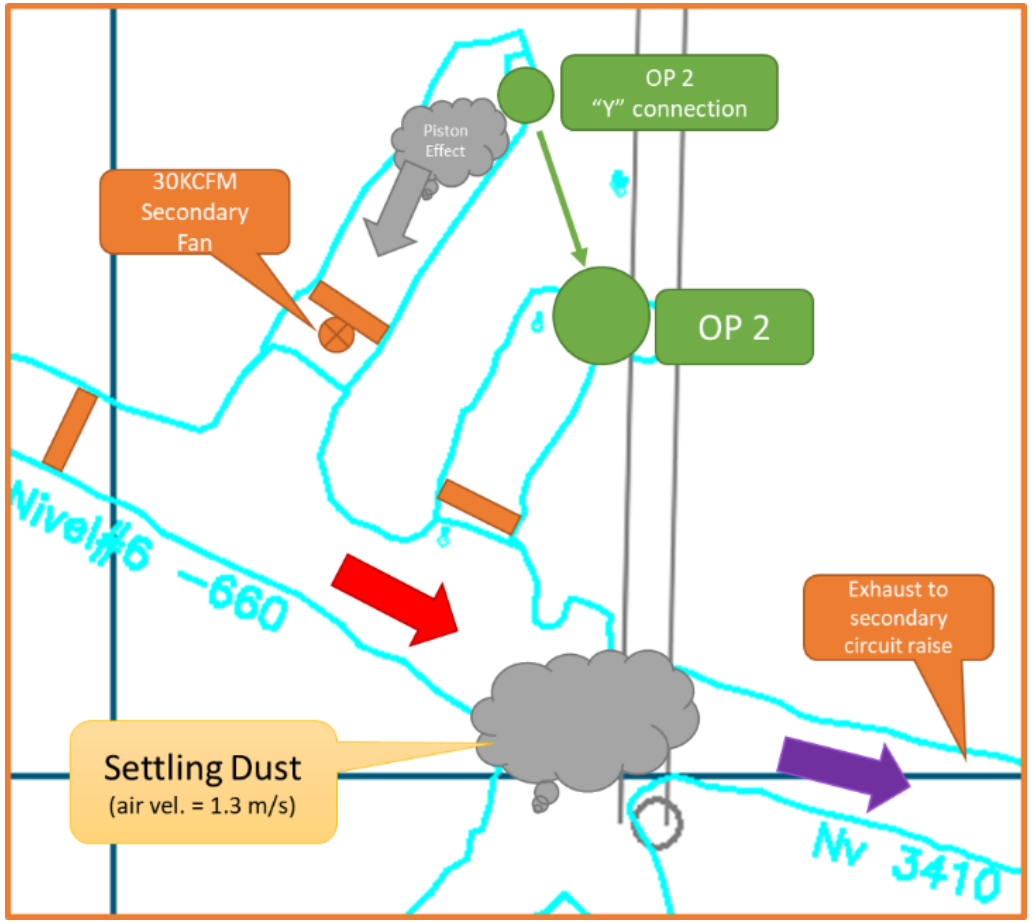


Local Extractor
(Secondary Fan)
30 KCFM

Results

Dry Methods

(Dust Accumulation Level)

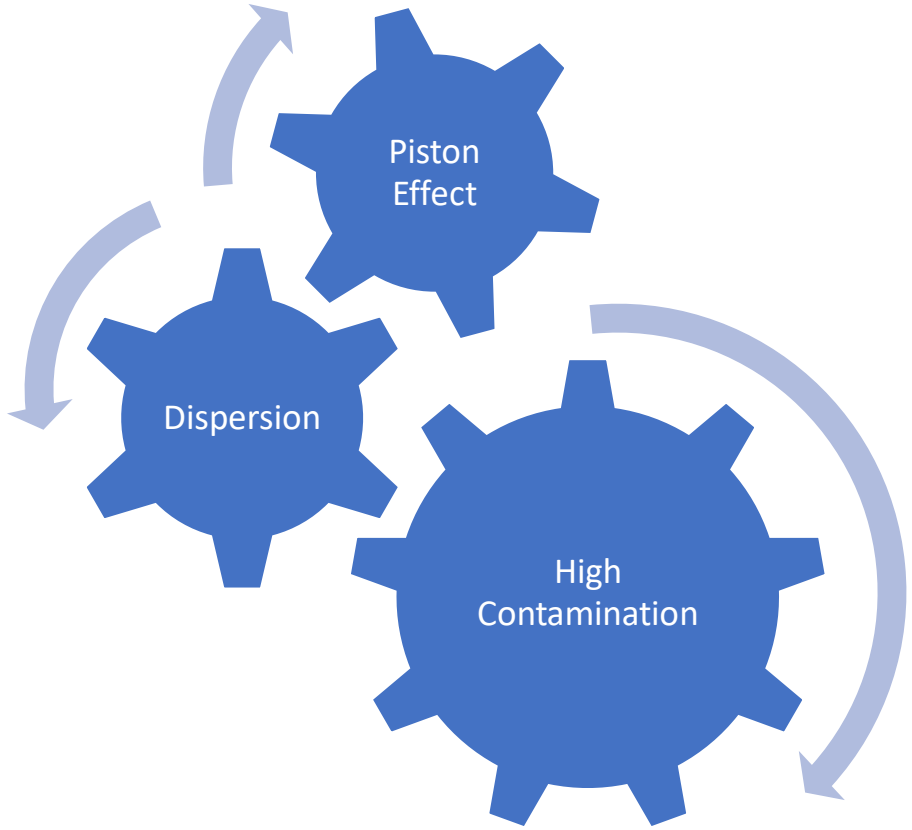


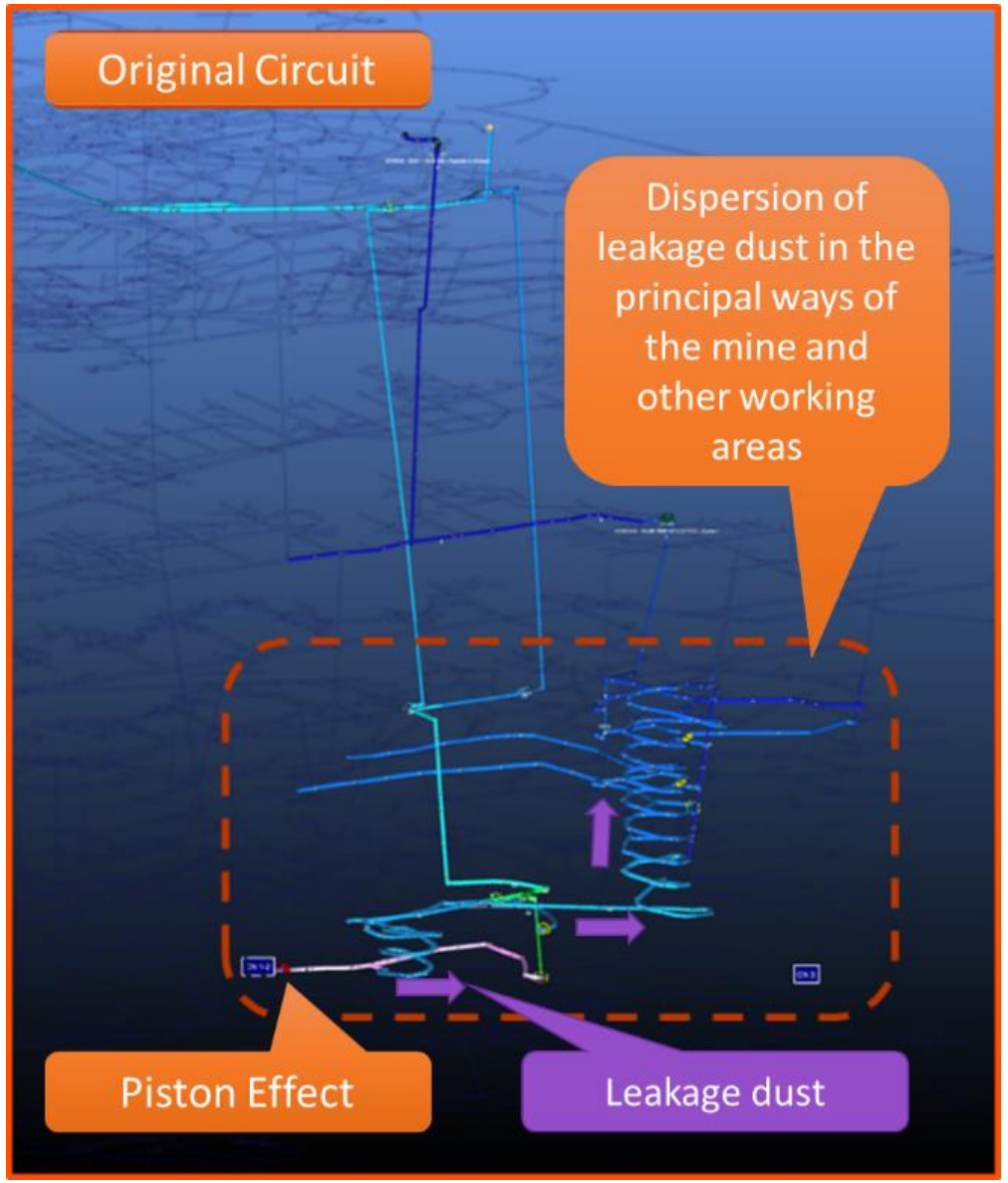
Accumulation of dust with a settling velocity of 1.3 m/s

Condensation

Methodology

Dry Methods (Independent Exhaust Circuit)





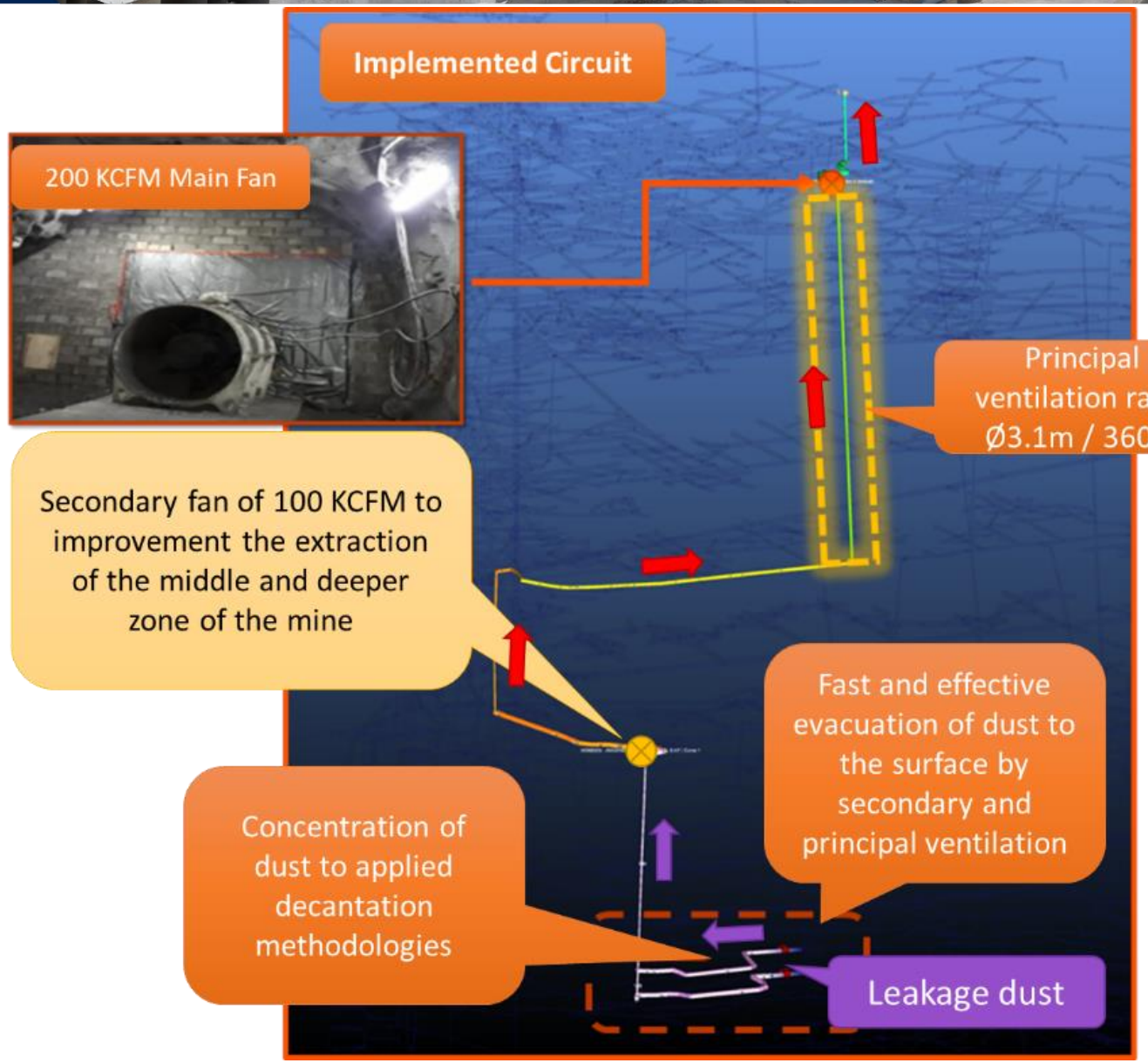
Results

Dry Methods

(Independent Exhaust Circuit)

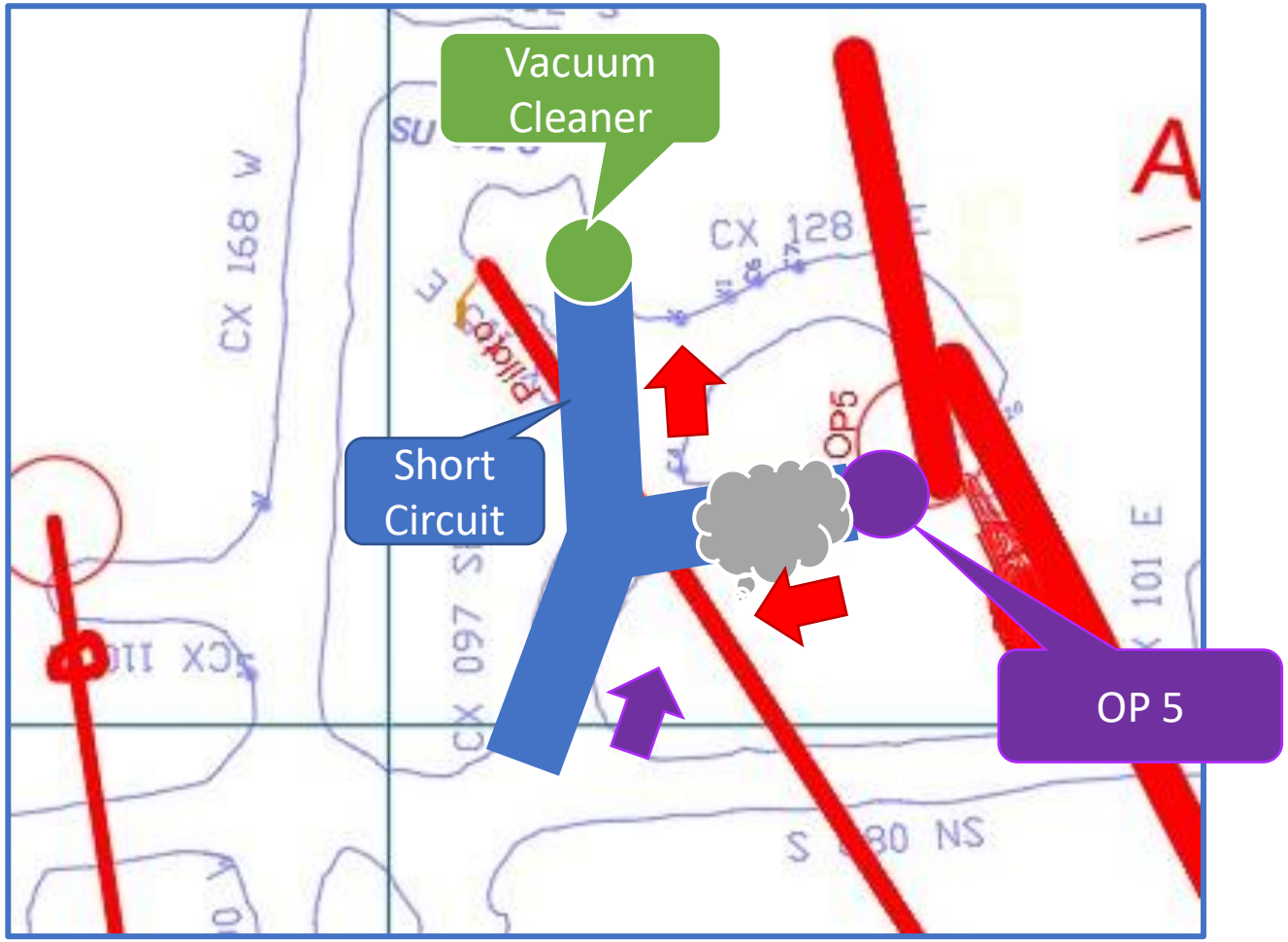
The dispersion of the dust was controlled and directed to an effective exhaust circuit with exit to the surface.

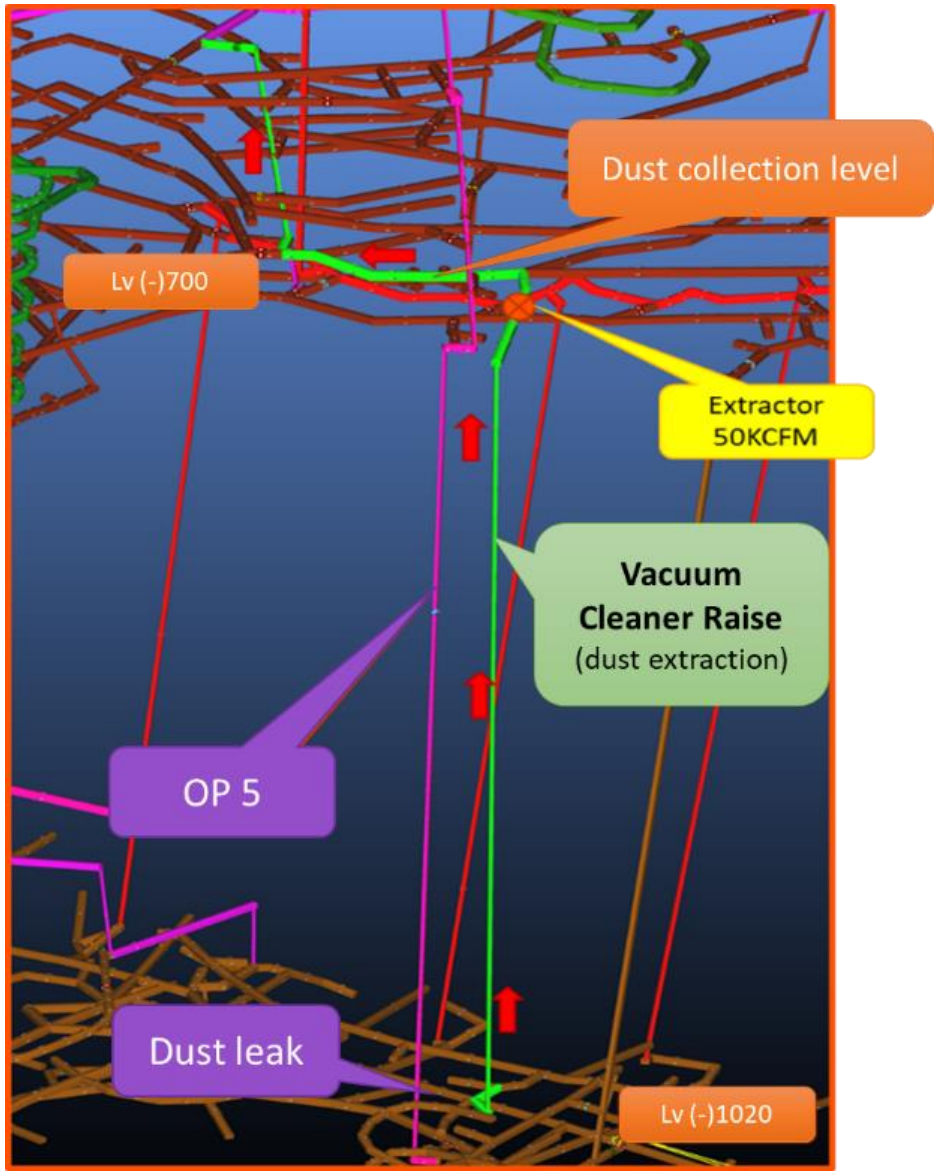
Part of the dust was settling in the accumulation level.



Methodology

Dry Methods (Planned Short Circuits)



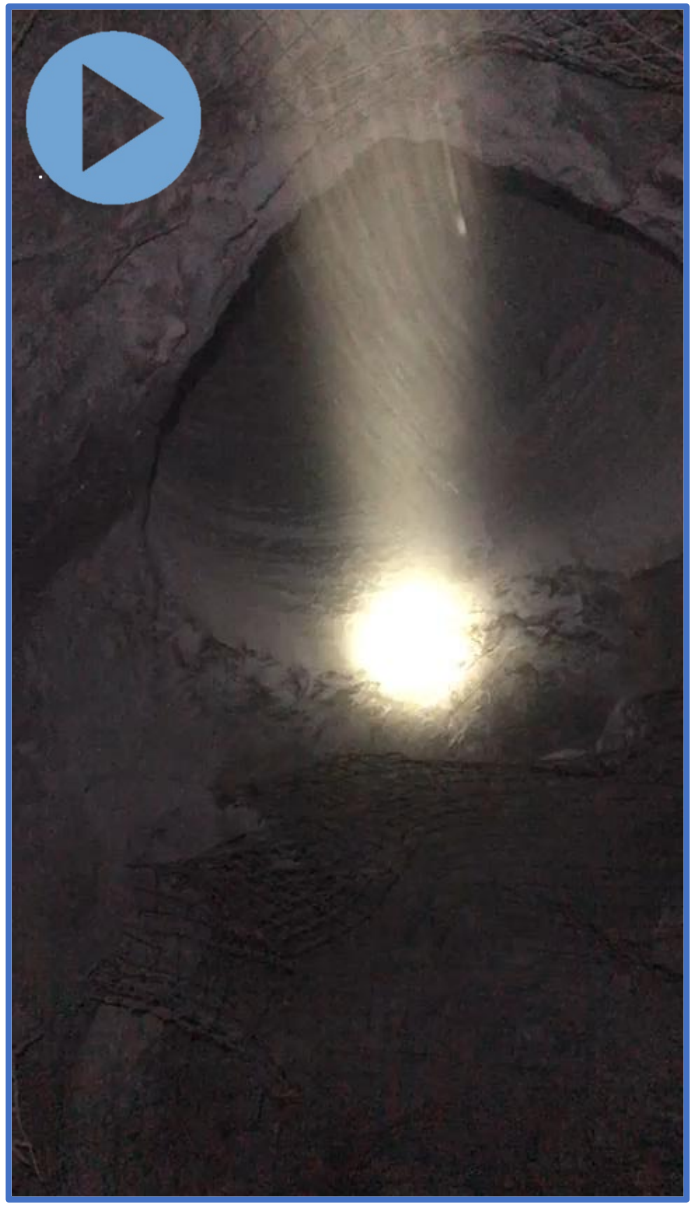


Results

Dry Methods (Planned Short Circuits)

Results

Dry Methods (Planned Short Circuits)



Conclusions

- Piston Effect is an intensive phenomenon of about 1.5 inches of water and 100KCFM
- Mist cannon facilitate the agglomeration
- Local extractors can be applied but only with a high flow rate
- Gates and curtains are effective to control the dispersion
- If the infrastructure is available we can try to made effective exhaust circuits
- The planned short circuits is an alternative to avoid the dispersion

Thanks

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