# Mitigating Post Blast Fume with Density Modified Explosives

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Hanwha

# Background

- Industry proactively seeking alternatives to lower the risk of blast generated fume
- Many sites have weathered tertiary material that has a high risk of fume
- Increase in industry focus on fume from blasting
- Conventional Bulk Products impose restrictions to reduce risk of fume
- This in turn impacts on downstream processes not least of which is a mines Licence to operate

# Recap on blast generated fume

- Caused by fuel deficiency or low order detonation
- Can be caused by individual or multiple factors:
  - Explosive formulation & quality control
  - Geology
  - Blast Design
  - Product selection & Implementation

**In certain conditions, blast fume could cause minor visual impact through to serious health issues and negative media**

# Blast Fume

Hanwha

NEWCASTLE HERALD
NEWS SITE OF THE YEAR

Tuesday October 11, 2016

News | Local News

## TOXIC SKY: Mine blast goes wrong

JOANNE McCARTHY
20 Feb 2014, 10:30 p.m.

Share Tweet Email

FALLOUT: The sky above Mount Arthur Mine near Muswellbrook turns a bright orange due to the toxic fumes.

Singleton Argus

LOCAL PRODUCTS & SERVICES

Wednesday October 19, 2016

News | Local News

Aa Larger / Smaller  Night Mode

## Dust plume leaves MTW mine near Singleton

Louise Nichols
5 Oct 2016, 1:25 p.m.

Share Tweet Email

AIR QUALITY: The plume of dust created by a mine blast at MTW last Wednesday near Putty Road.

***NOTE: These articles and Facebook posts do NOT refer to the same mine***

# Blast Fume

Belinda Stafa

Like · Reply · August 22 at 5:13pm

Patricia Hansson Sure did was in the garden at Broke, obviously amine Blast Bulga way,yes it was very smelly. I have photos also. Hmmmmm

Like · Reply · August 22 at 5:16pm

FALLOUT: The sky above Mount Arthur Mine near Muswellbrook turns a bright orange due to the toxic fumes.

AIR QUALITY: The p

Singleton Argus

Wednesday October 19, 2016

LOCAL PRODUCTS & SERVICES

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eaves MTW mine near Singleton

Email

Dave Grosser

Like · Reply · August 22 at 6:14pm

Jen Maloney Yep, smelt disgusting!

Like · Reply · August 22 at 6:18pm

***NOTE: These articles and Facebook posts do NOT refer to the same mine***

# Traditional Mine approach

- Blasts are managed to reduce both the risk and possible impacts
- Key considerations:
  - Blast design & Product selection
  - Geology & Ground conditions
  - Blast Implementation and Changes
  - Preceding & Prevailing weather conditions (wind Rosette)
- Possible impacts considered before blast fired with “worst case” scenario adopted

# Traditional Mine approach

Fume Management Zone

Admin

Workshop

Camp


Blast areas

Equipment Clearance

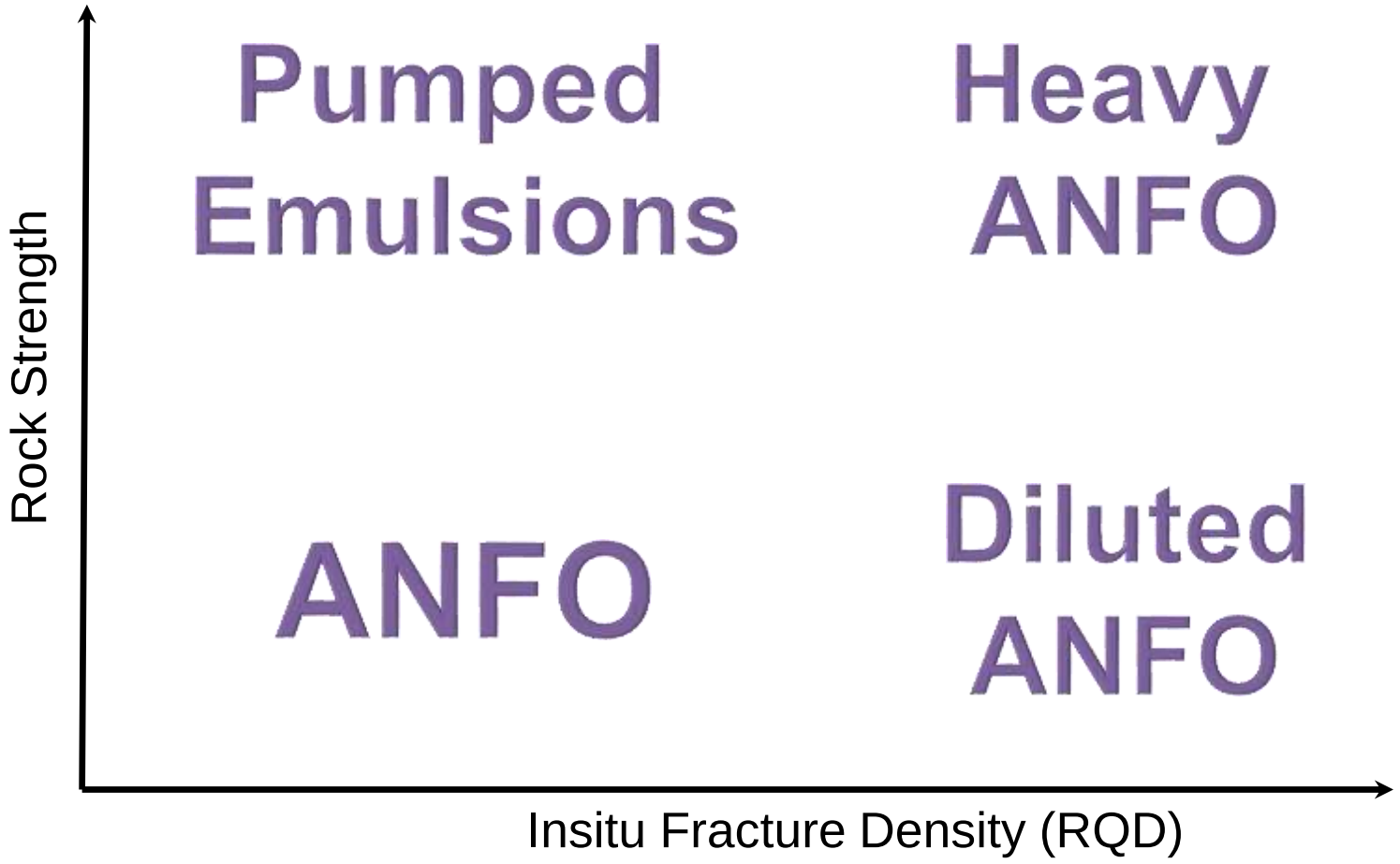
Personnel Clearance

# Traditional Mine approach

- **So what are our options?**

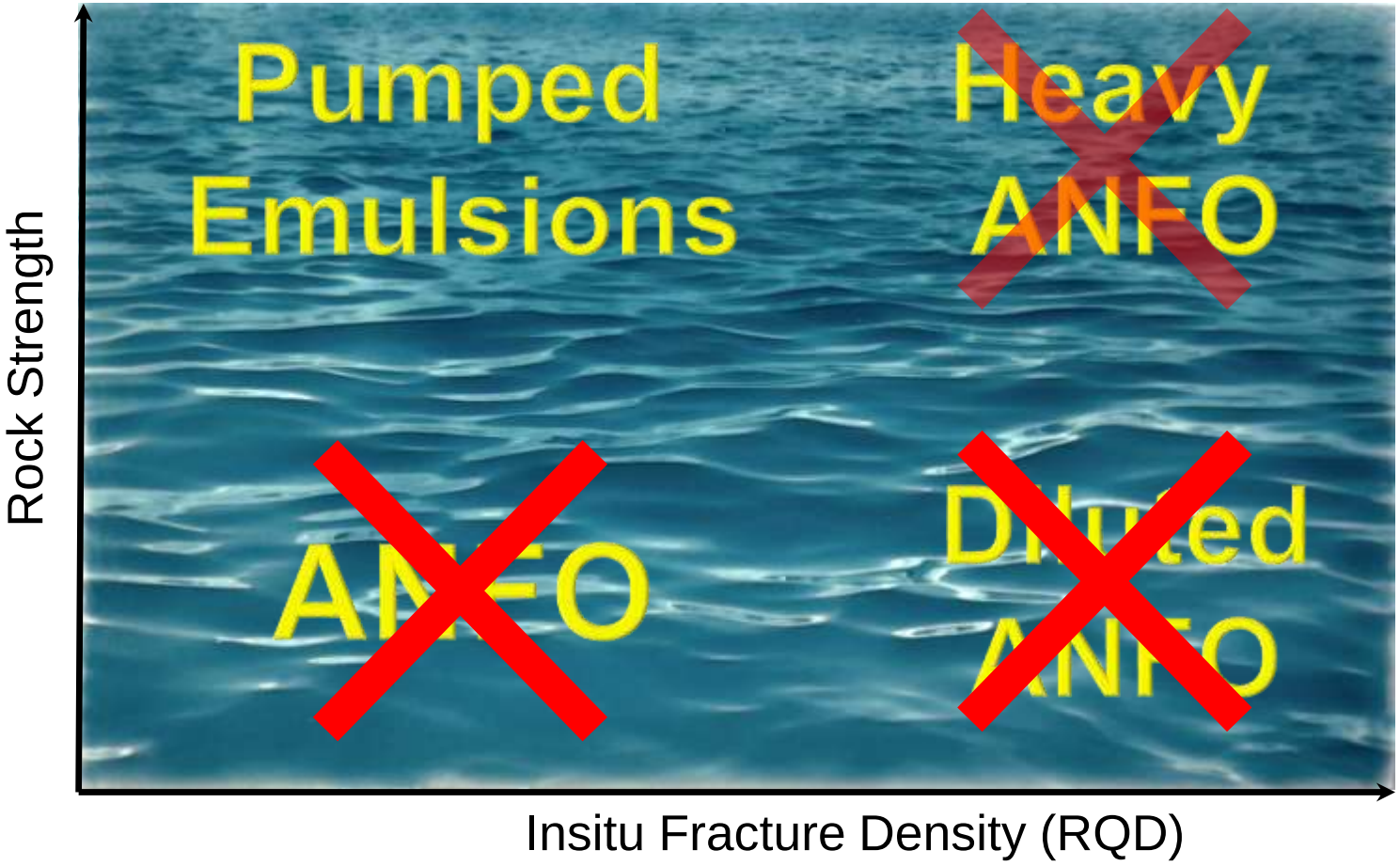
# Bulk Product Energy Chart

## Generic Bulk Explosives



# Bulk Product Energy Chart

## Generic Bulk Explosives

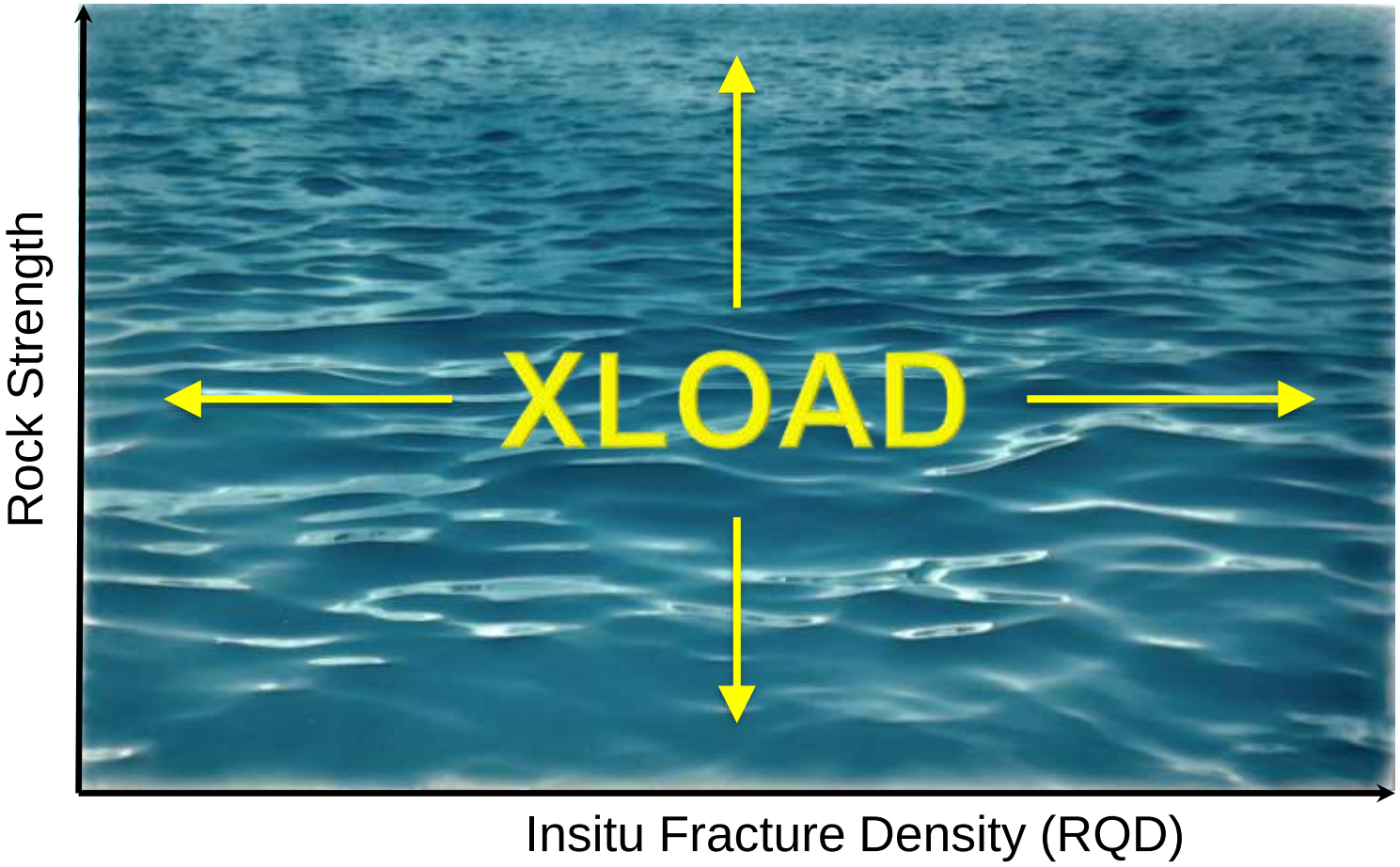


# Traditional Mine approach

- **The Substitution of dry hole product for high emulsion content products can lead to:**
  - **increase in energy in the blast hole leading :**
    - **Flyrock**
    - **Vibration damage**
    - **Blast overpressure**
    - **Increase in powder factor & blast costs**
  - **Slower charging**

# Bulk Product Energy Chart

## Density Modified Explosives



# Relative Energy of XLOAD

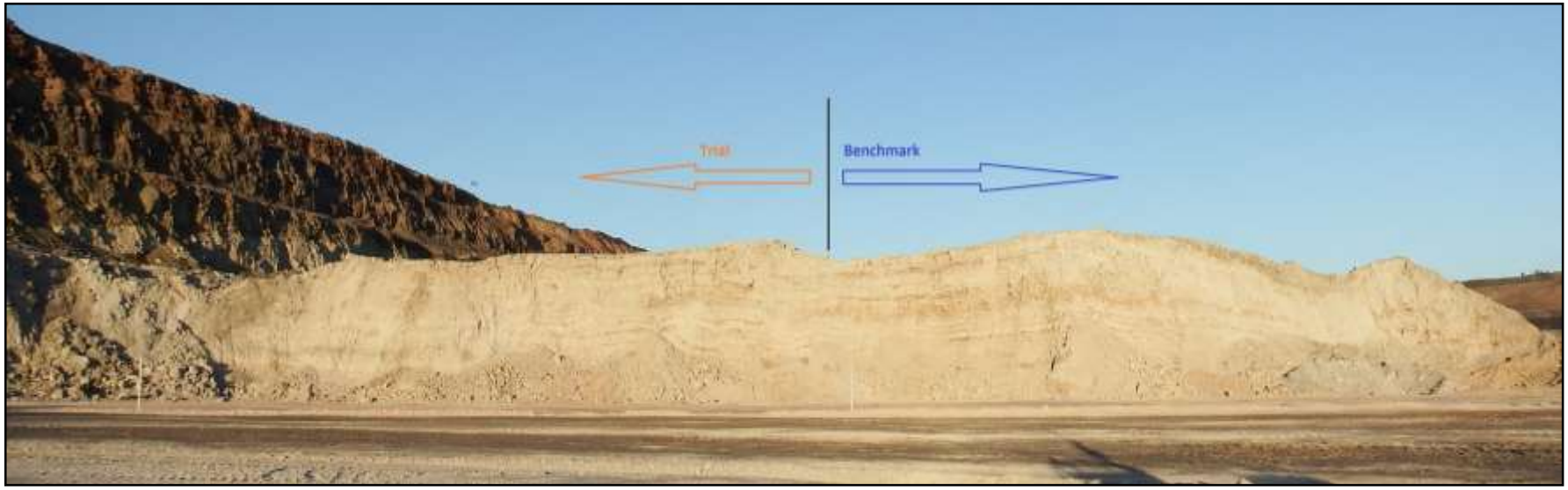
| Type | Density (g/cc) | Energy (MJ/kg) | Bulk Strength | Water % |
|---|---|---|---|---|
| ANFO | 0.82 | 2.26 | 100 | <1% |
| Heavy ANFO | 1.25 | 2.29 | 150 | ~6-10% |
| Pumped Emulsion | 1.23 | 1.99 | 124 | ~11-14% |
| XLOAD 60-100 | 1.00 | 1.96 | 106 | ~6% |
| XLOAD 70-110 | 1.10 | 1.98 | 118 | ~7% |
| HiDEX 20 | 1.00 | 2.35 | 127 | ~3% |

# Case Study 1

- **Benchmark blasts used the standard site blast design parameters & products**
  - **Designed for 40% emulsion heavy ANFO but required to use gassed 70% blend for wet conditions**
- **3 comparison Blasts loaded with XLOAD**
  - **1st Blast 10% reduction in powder factor**
  - **2nd Blast 20% reduction in powder factor**
  - **3rd Blast 25% reduction in powder factor**

# Case Study 1

- **Dig face comparison between Trial product and benchmark product**



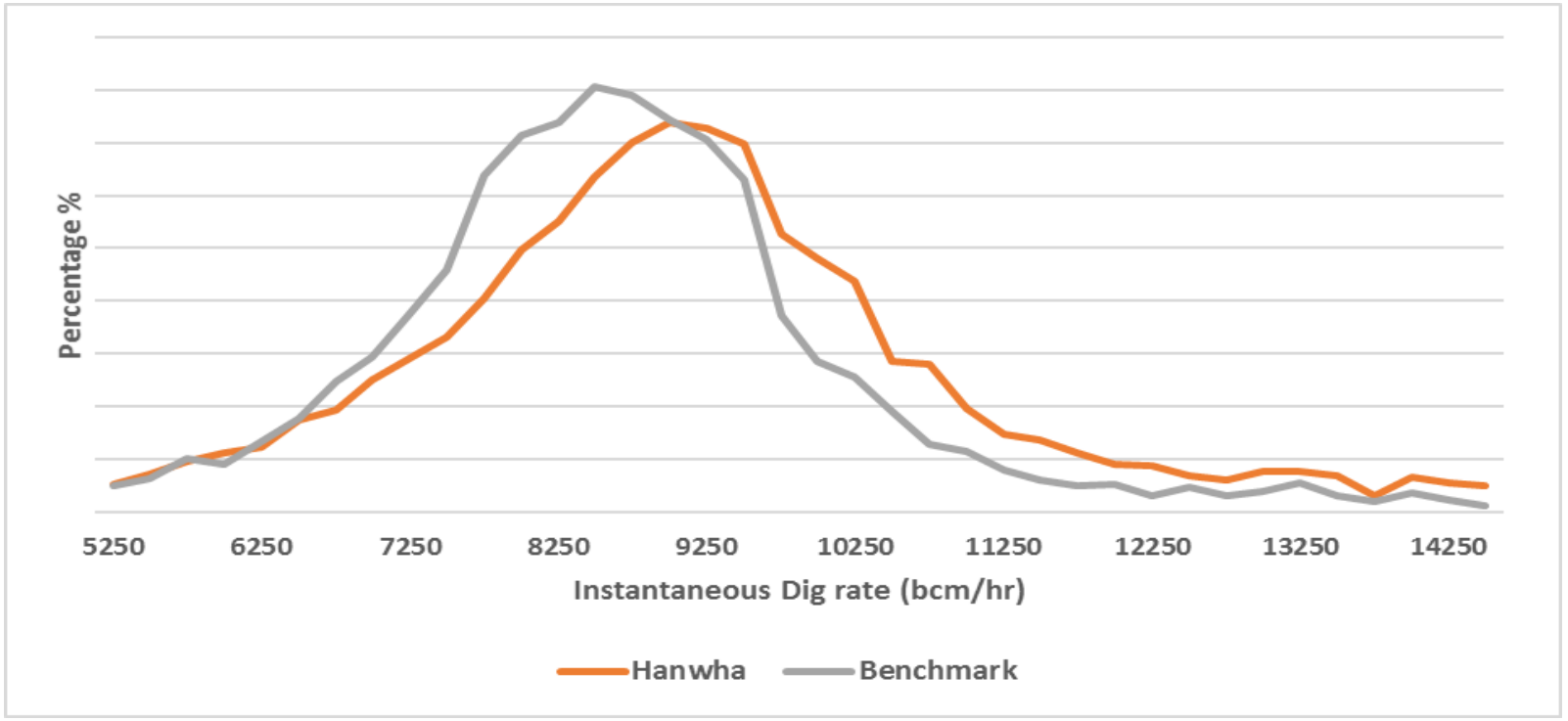

XLOAD 60-100 Generic 40% emulsion HA

# Case Study 1

## ➢ Instantaneous Dig Rates:

### Benchmark Blasts Vs Trial blasts

### (6% improvement in dig rate)



# Case Study 1

- No fume observed from the three trial blasts
  - Both Benchmark blasts had fume
- 6 % increase in productivity from shovel for trial blasts over benchmark blasts
- No operational or environmental incidents
- Cost neutral against benchmark Heavy ANFO
  - Cost saving against gassed 70% emulsion blend

# Case Study 2

- **Standard overburden blasts designed assuming dry holes**
  - **Using 20% emulsion heavy ANFO (density ~1.00 g/cc)**
  - **Auger loaded for rapid shot turnaround**
- **Shotfirer able to decide on final product loaded:**
  - **Wet holes that can be dewatered**
    - **XLOAD 60-100 loaded (density 1.00 g/cc)**
  - **Wet holes unable to be dewatered**
    - **XLOAD 70-110 loaded (density 1.10 g/cc - full column density)**

# Case Study 2

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- No fume observed from these blasts
- No change in productivity
- Powder factor stays consistent

# Density Modified Product - XLOAD

- A blend of emulsion, ANFO and polystyrene beads
- Emulsion is a high density, low water content emulsion (1.48g/cc)
- Emulsion provides high water-resistance & reactivity resistance
- Polystyrene provides ability to adjust product density without chemical gassing
- Density range 0.9 to 1.2 g/cc
- Consistent Product density in-hole

# Summary

- Very low fume risk
- Energy that can be tailored to match ground conditions (no Surprises)
- High loading rates at lower densities
- Powder factor stays consistent with design