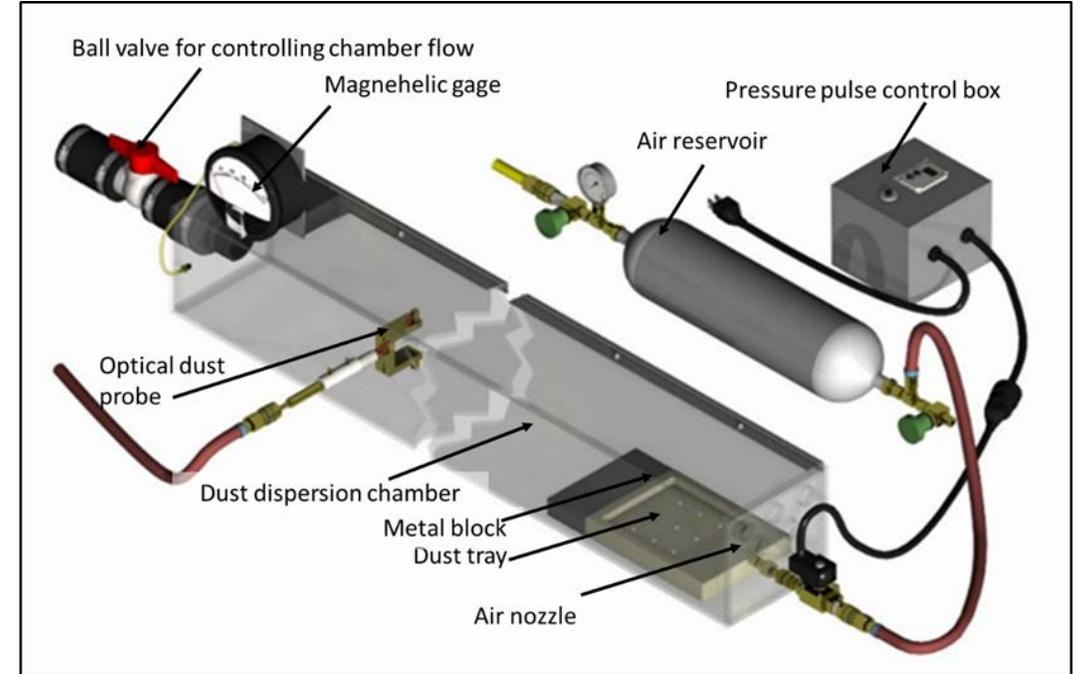
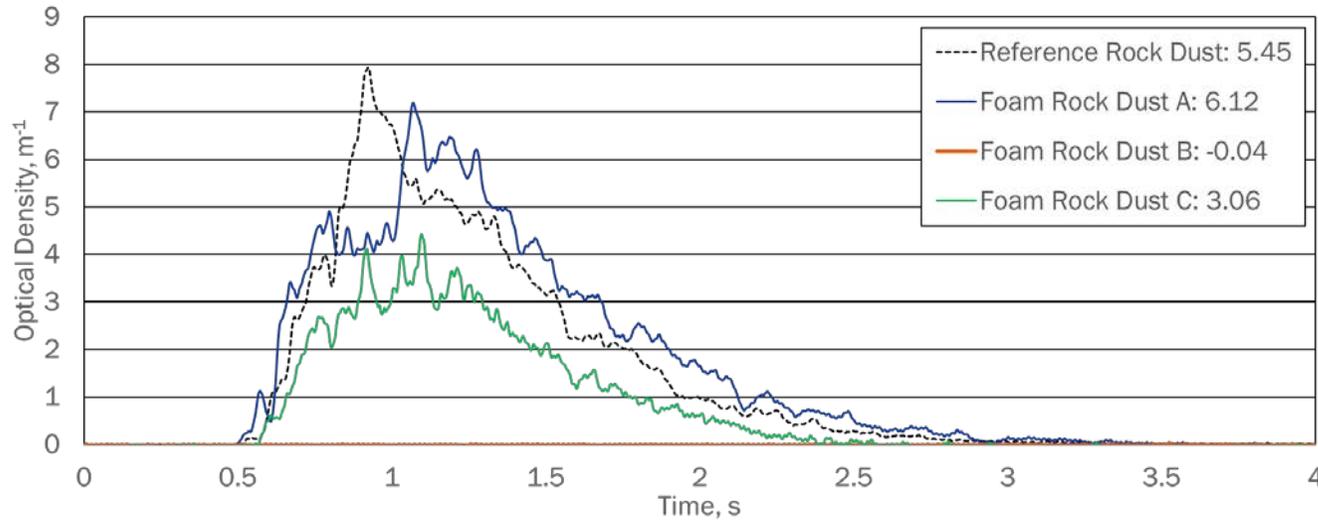


# Good dispersion characteristics are necessary for the suppression of a coal dust explosions

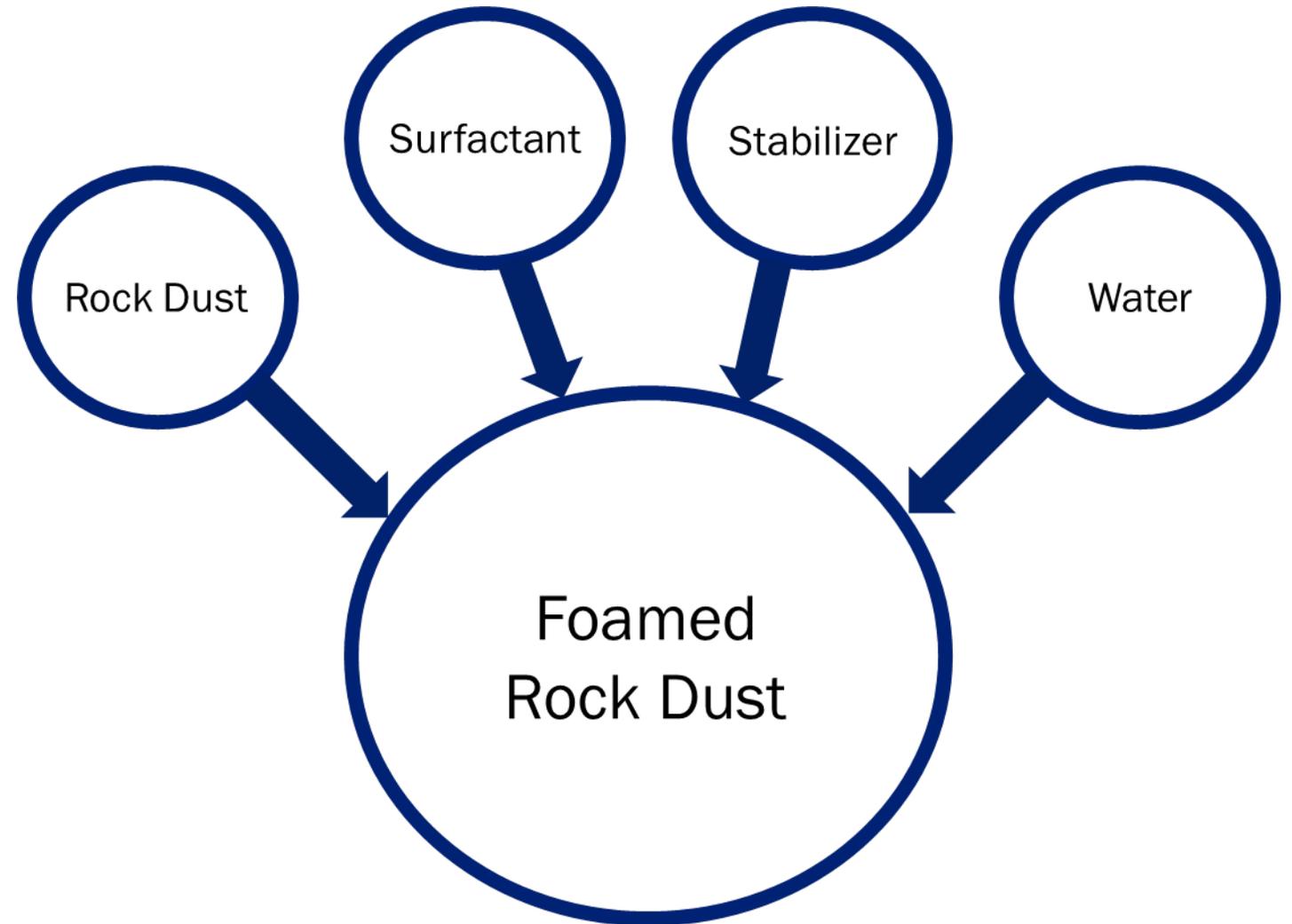
Average optical densities



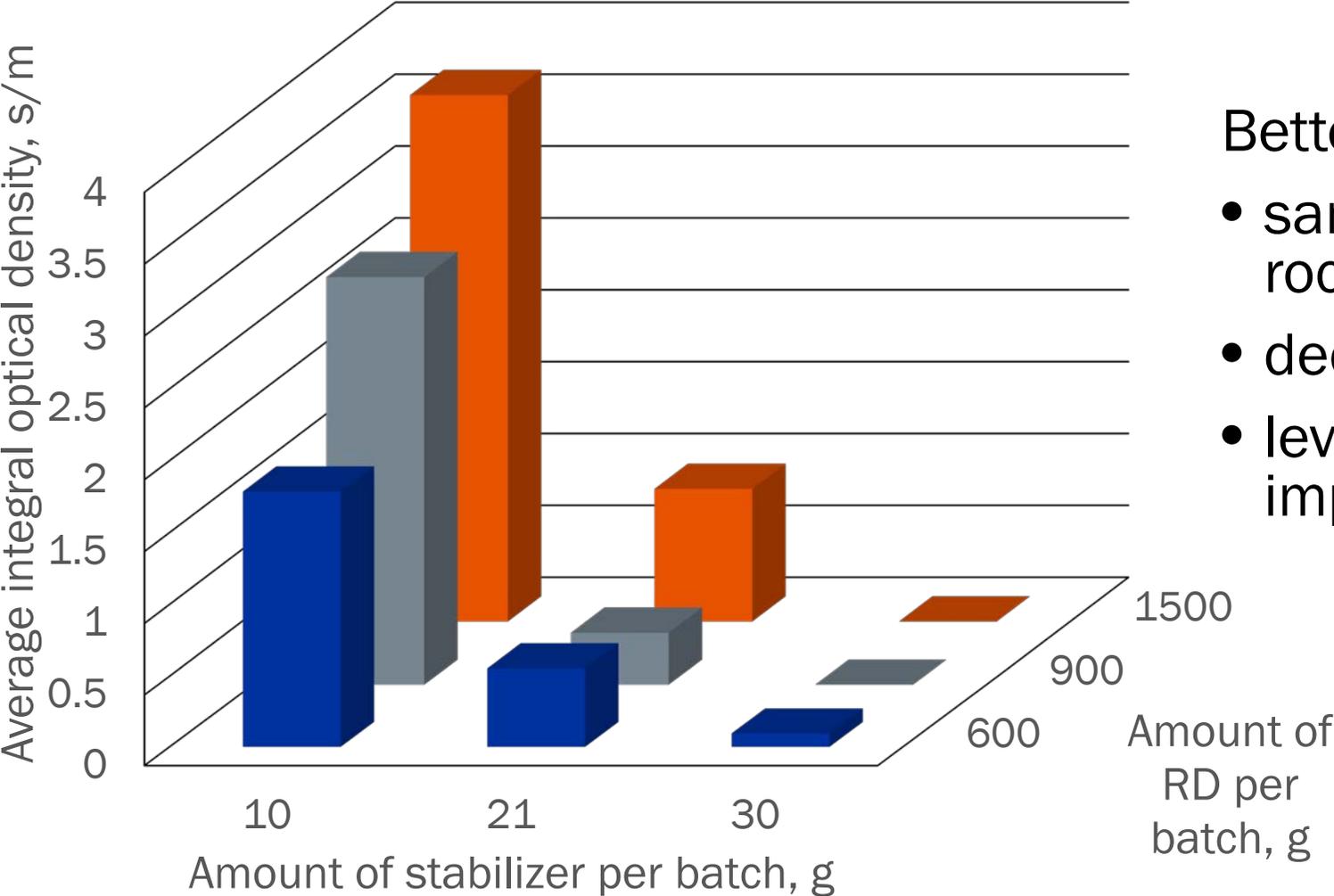
Dispersion chamber schematic (Perera et al., 2016)

# Rock dust foam

- Most promising foam product
- 2-part foam
- Alterations were made to the original formula in the effort to increase the dispersibility



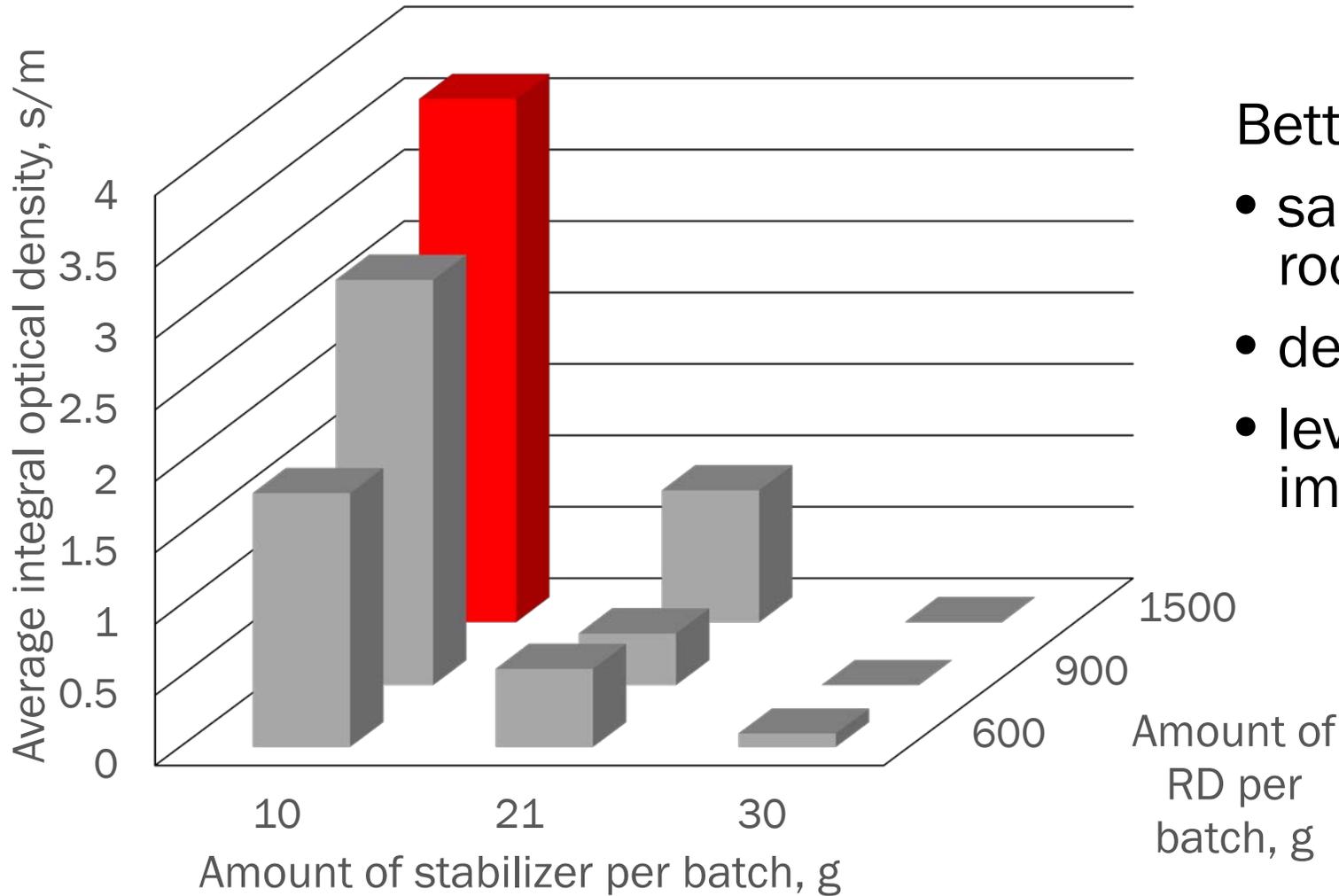
# Formulation trends



Better dispersion was observed for:

- samples with increased levels of rock dust
- decreased levels of stabilizer
- levels of stabilizer having greater impact

# Formulation trends

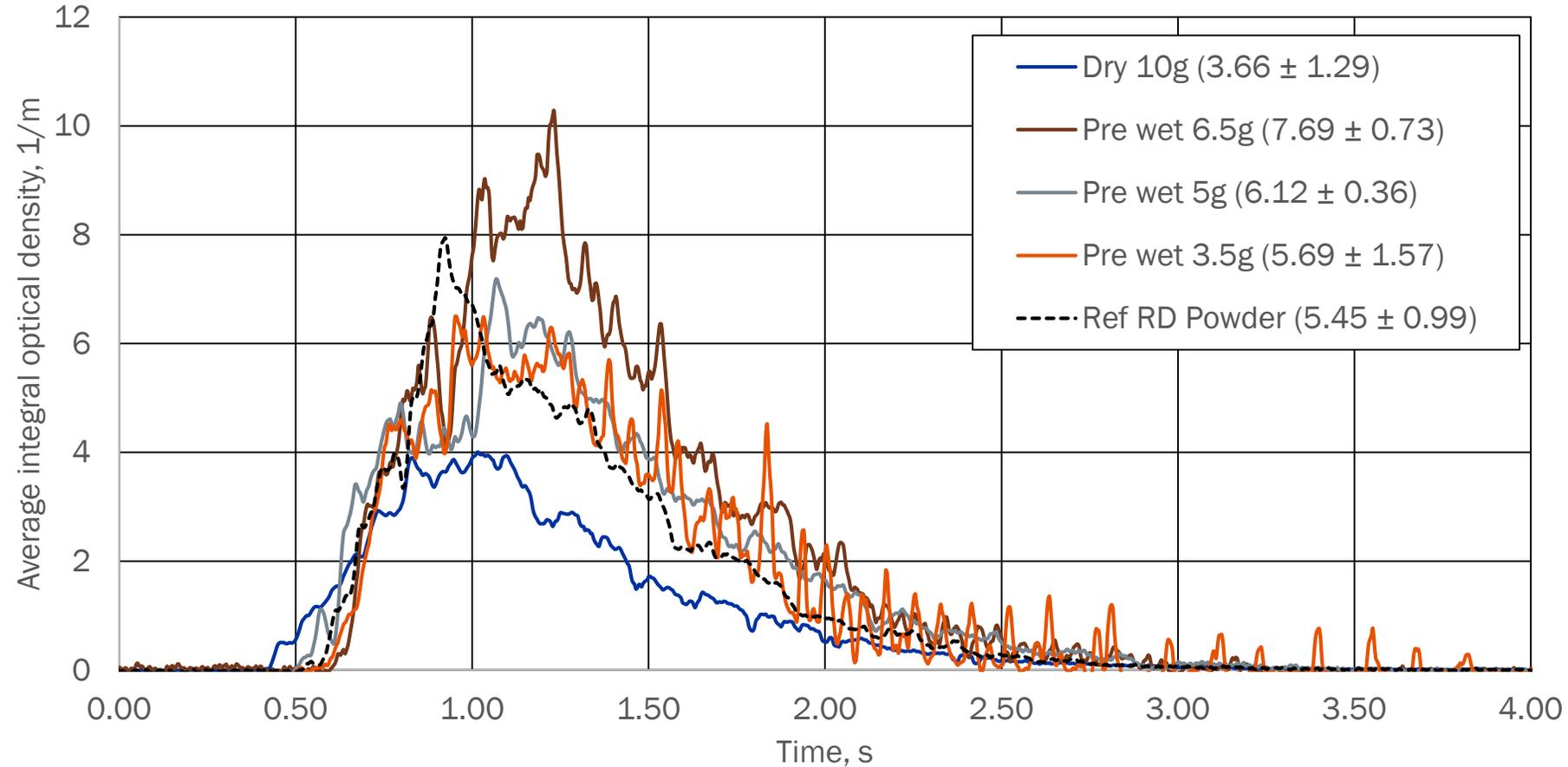


Better dispersion was observed for:

- samples with increased levels of rock dust
- decreased levels of stabilizer
- levels of stabilizer having greater impact

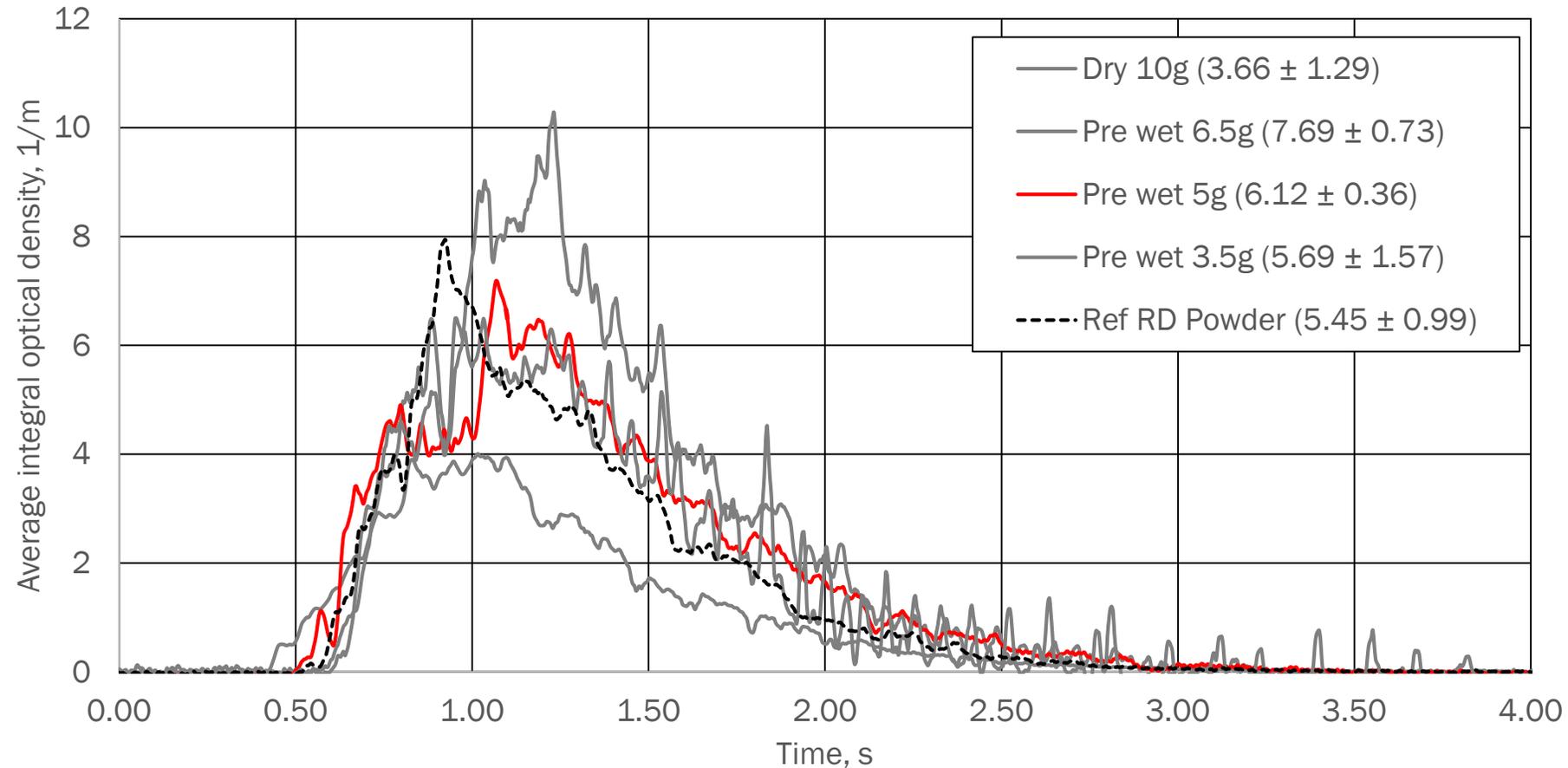
## To gain additional performance:

- rock dust was pre-wet
- stabilizer decreased further



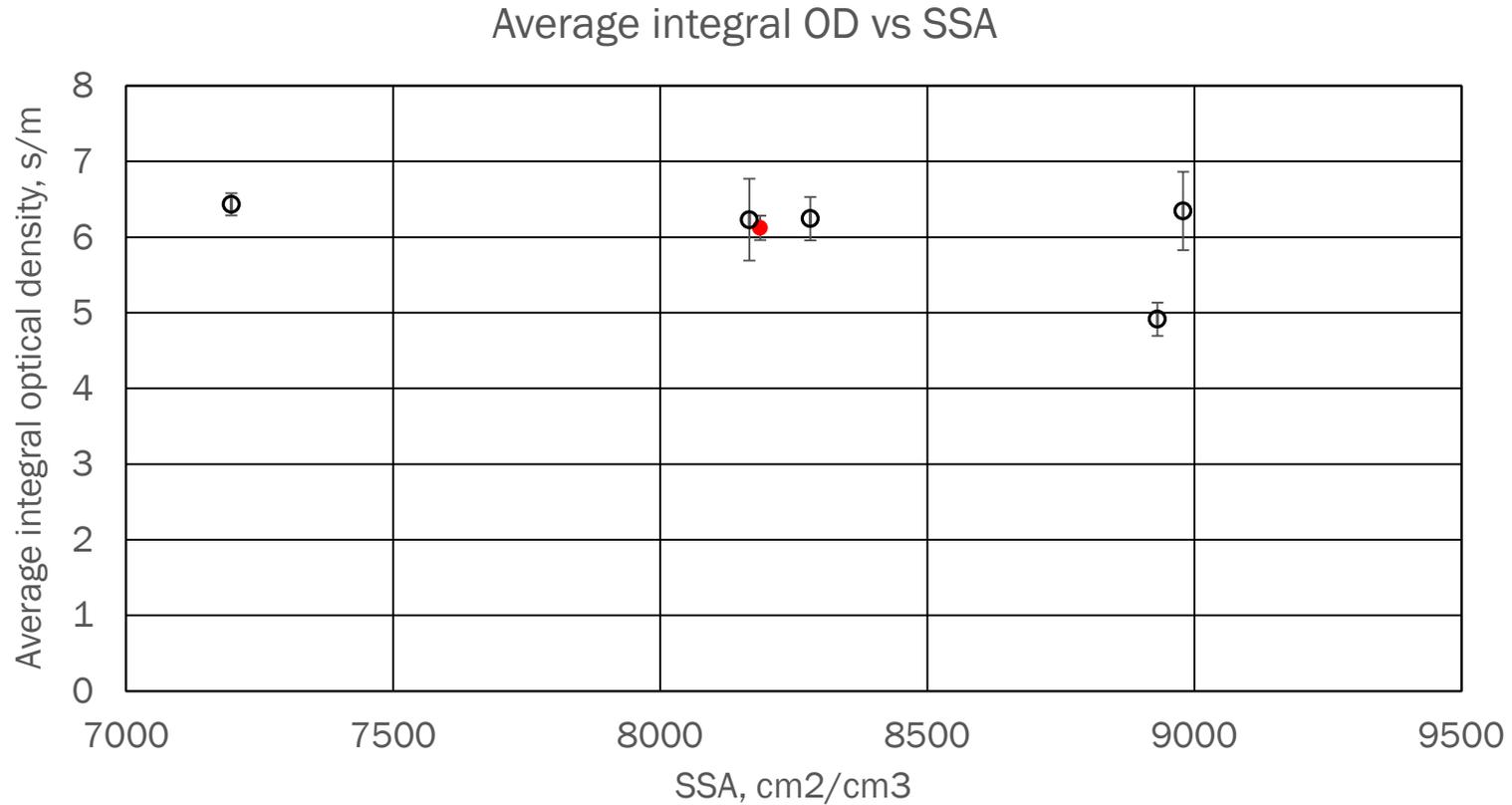
## Chosen formulation:

- least amount of stabilizer
- most consistently met dispersion characteristics



# What is the impact of changing rock dust types if the formulation remains constant?

- Even with some variation in SSA, dispersion characteristics remain sufficient

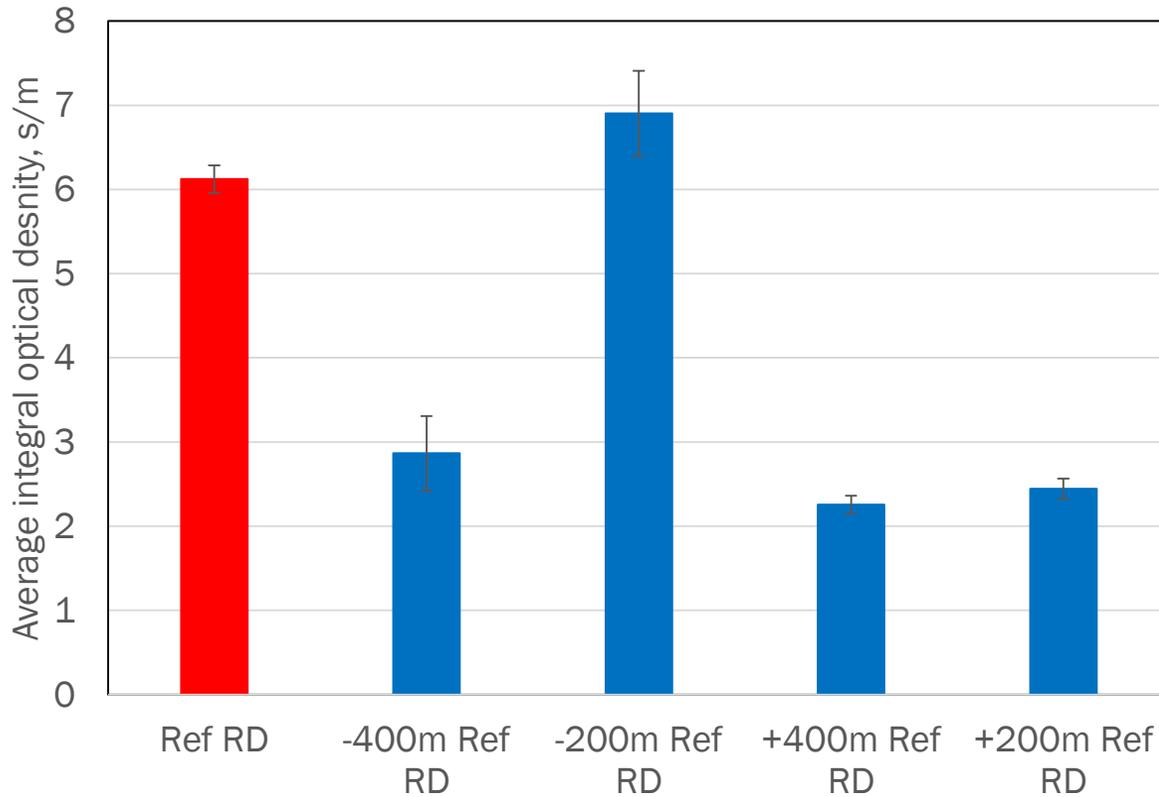


Preliminary data

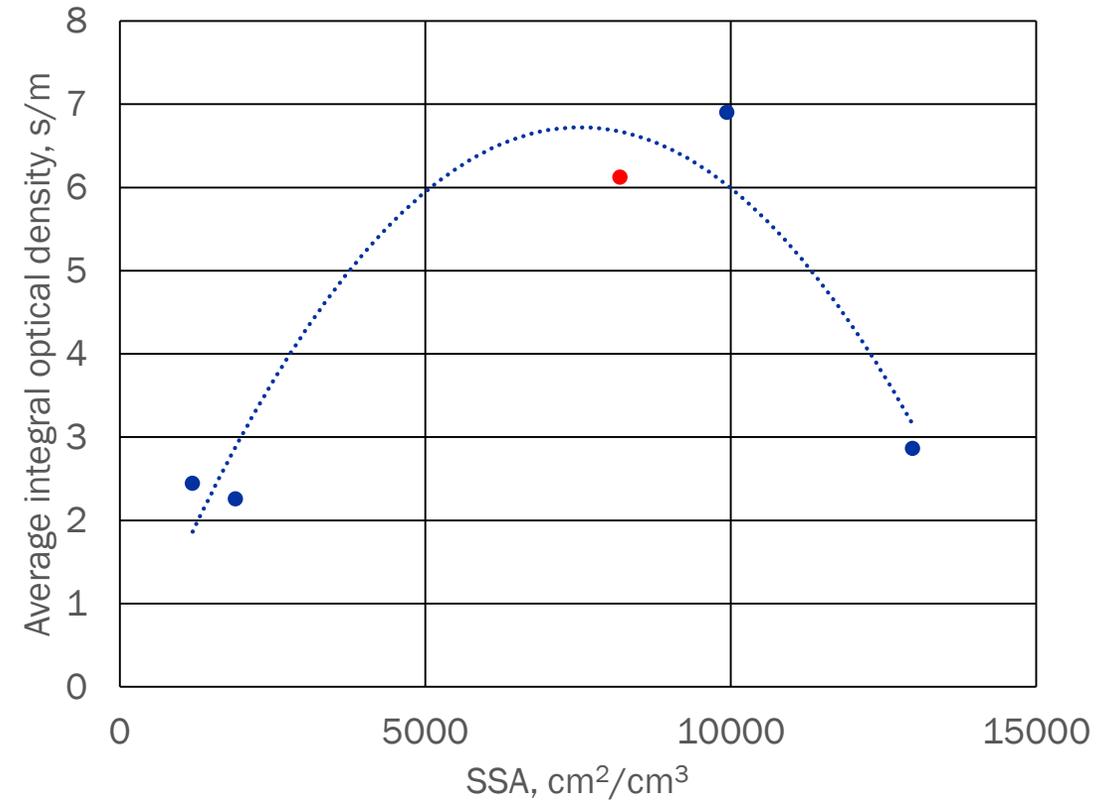
# What is the impact of RD size distribution if formulation remains constant?

- Both extremely fine and coarse material resulted in poor performance

Average integral OD of classified RD



Average integral OD vs SSA



400 mesh = 38 micron

200 mesh = 74 micron

Preliminary data

# Pilot scale application testing



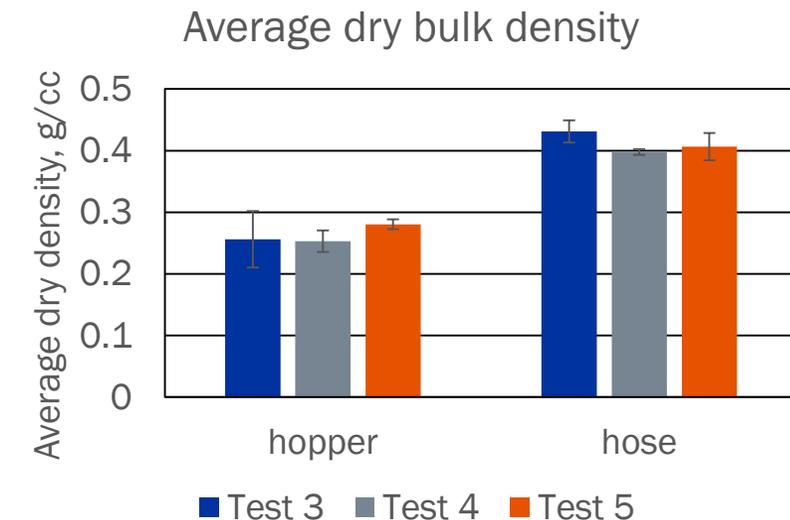
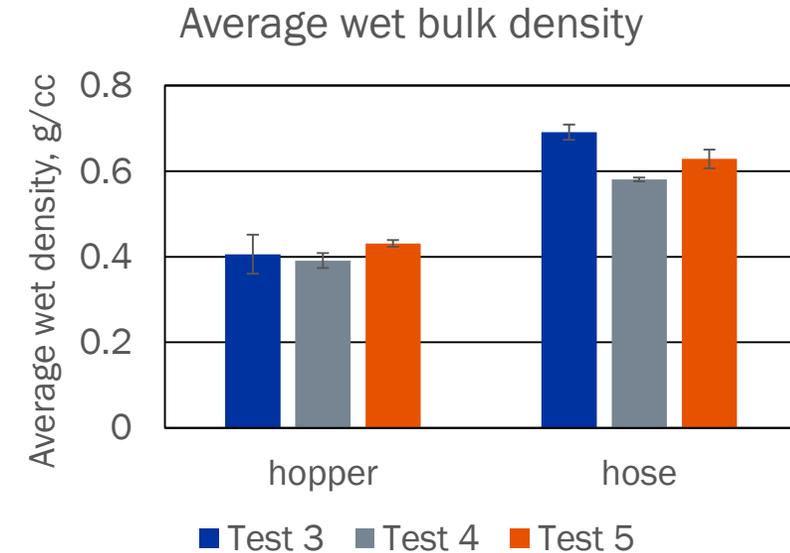
- Three experimental replicates with five technical replicates
- Samples taken from hopper and nozzle
- Looking for reproducibility

# Pilot scale reproducibility

Density increases indicate nominal breakdown of the foam at the pump

Overall product is very reproducible

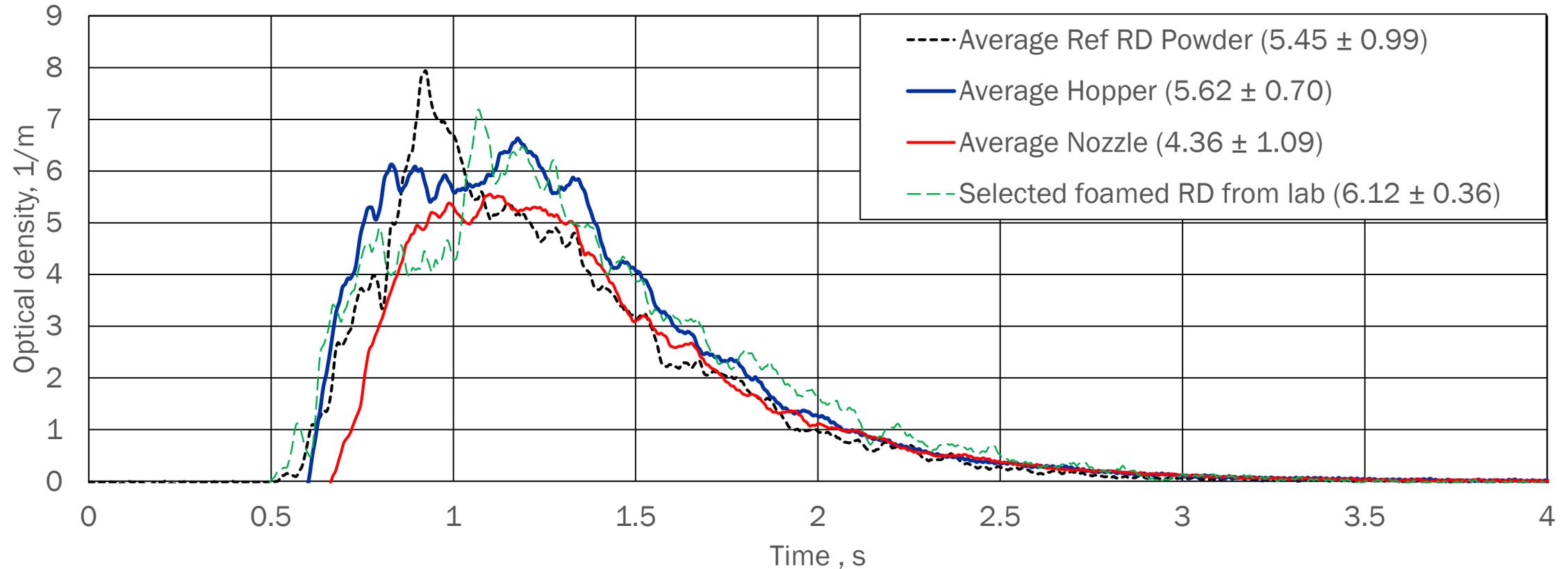
Test #	Hopper Wet Density, g/cc	Outlet Wet Density, g/cc	Nozzle Wet Density, g/cc
3	0.36	--	0.57
4	0.37	0.52	0.59
5	0.38	0.51	0.57



Preliminary data

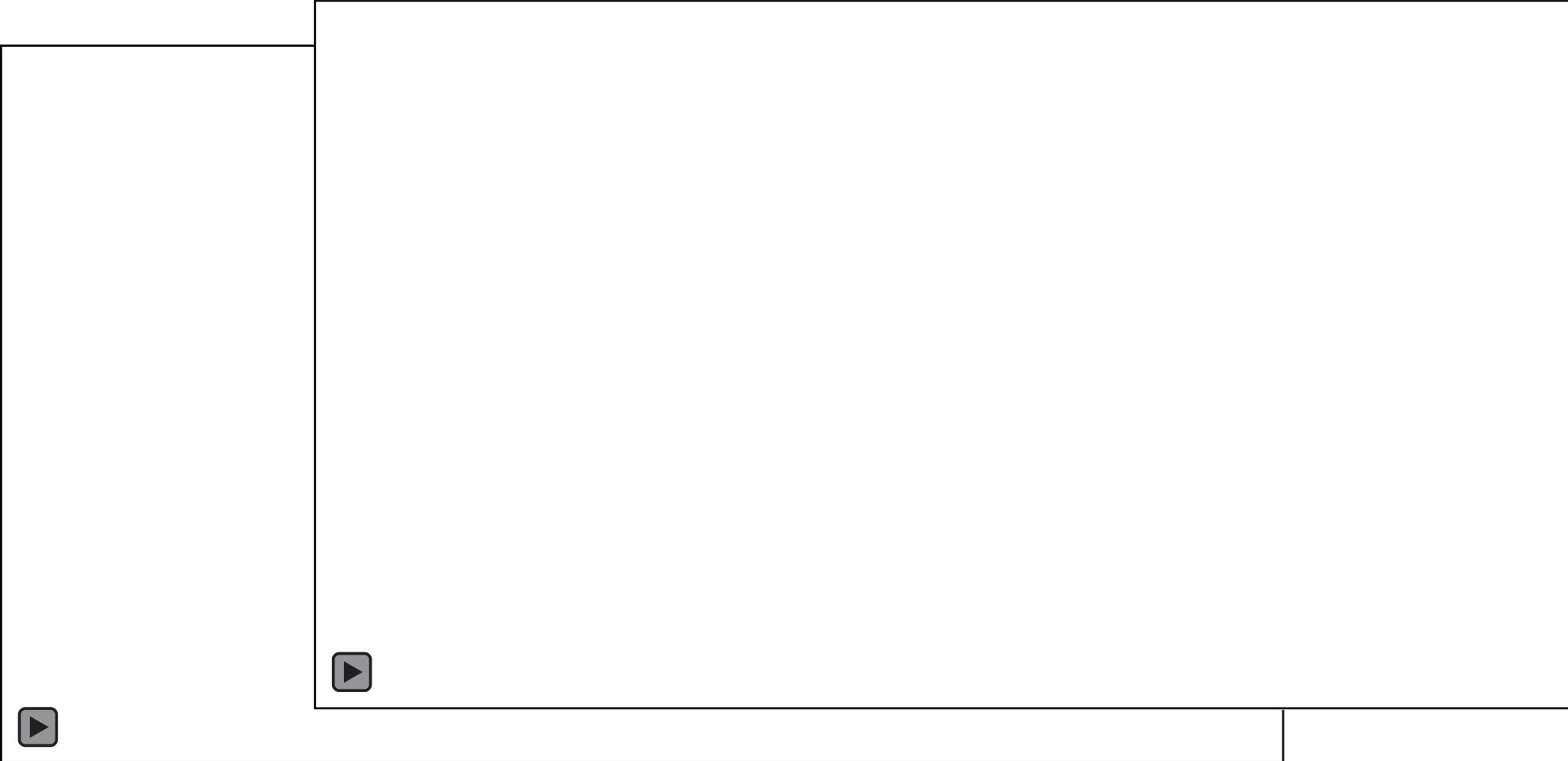
# Some adjustments to the formulation are required

OD traces of hopper and nozzle samples with Reference rock dust powder and lab sample



Preliminary data

# Current trials looked at the nozzle types - results are pending



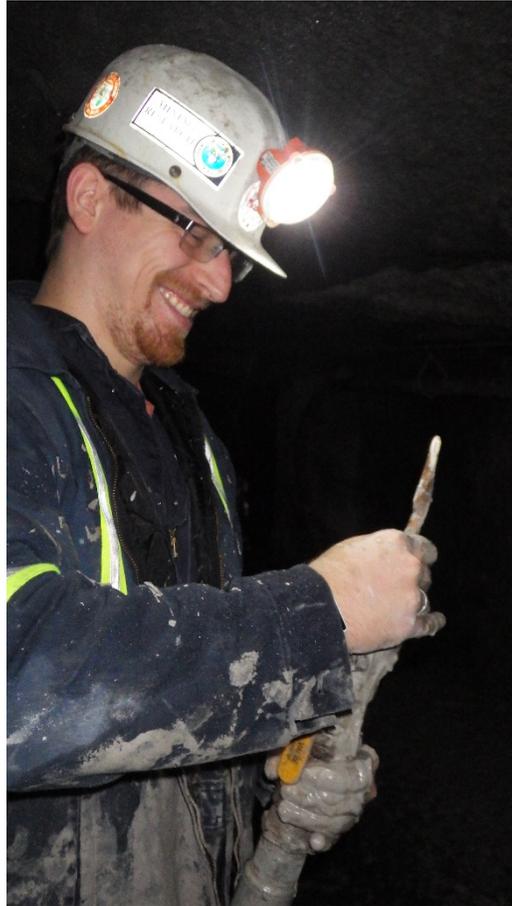
# Summary

- Foamed rock dust disperses similar to the Reference rock dust
- Dispersion characteristics are reproducible with different rock dusts
- The size distribution of the rock dust does impact the performance
- Results are reproducible in the field
- Slight degradation is seen during application which impacts dispersion characteristics
  - By far, the best performing foam tested to date
  - Priority for large-scale tests

## Future work

1. Conduct large-scale explosion tests at EMB with stakeholders agreement on test protocol (CY19/20)
2. Work with partnership to optimize the application methodology
3. Develop procedures for in-mine usage with regards to logistical concerns

# Questions?



**NIOSH Mining Program – [www.cdc.gov/niosh/mining](http://www.cdc.gov/niosh/mining)**

