

SPE-187069:

Mitigating Respirable Crystalline Silica with No Engineering Footprint

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North America

Plants: 40
Revenue: USD 1.4bn
People: 2,448
Products:
*calcium; clays; feldspar;
 HPQ; olivine; silica;
 specialties; others*

South America

Plants: 20
Revenue: USD 178m
People: 1,125
Products:
*calcium; clays; lime;
 mineral sands; silica;
 others*

Europe

Plants: 101
Revenue: EUR 1.2bn
People: 3,957
Products:
*calcium; clays; feldspar;
 olivine; recycled materials;
 silica; specialties; others*

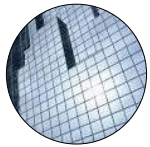
Asia

Plants: 31
Revenue: USD 272m
People: 1,868
Products:
*calcium; clays; feldspar;
 recycled materials; HPQ; silica;
 specialties; others*

Australia

Plants: 21
Revenue: AUD 460m
People: 1,007
Products:
*calcium; clays; feldspar;
 magnesia; mineral sands;
 silica; specialties; others*

Unimin Customers



Glass



SAINT-GOBAIN

AGC



CORNING



Metal & Casting

ArcelorMittal



Ceramics



CASALGRANDE
PADANA
Pave your way

MARAZZI

KOHLER



Functional Fillers

HORN
We orchestrate success™



COLGATE-PALMOLIVE

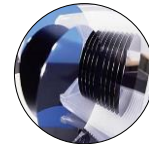


Energy

PIONEER
NATURAL RESOURCES

HALLIBURTON

Apache
Schlumberger



Electronic

Heraeus

Draka

JAPAN SUPER QUARTZ

Unimin Safety Records



Lifesaving Rules

1. Place safety ahead of production
2. See it – Stop it- Report it
3. Assess risks before and during a task
4. Protect against falls from height
5. Lock it –Tag it – Test it
6. No guards – no production
7. Separate people from mobile equipment



Roff, Oklahoma Plant
30 Years without a Lost Time Incident



ZERO MSHA or OSHA Reportable Incidents
“Rock Solid Excellence in Safety Award”

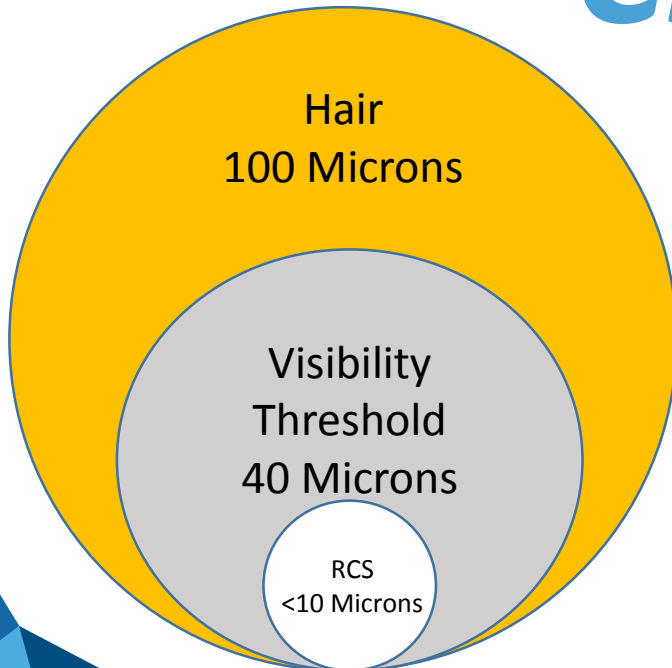


Unimin gives mine to Bat
Conservation



Two Consecutive Years Winner of the
“Sentinels of Safety Award”

What is Respirable Crystalline Silica Dust?



Dust Testing Instruments



Personal Data Ram (pDR)

- Real time dust measuring for
- <10 microns (μm)
- Does not differentiate the types of dust
- Not used for compliance measurement



Dorr Oliver (DO)

- Gravimetric sampling
- Samples are analyzed using an XRD
- Size-selective for respirable fraction
- Used for compliance measurements

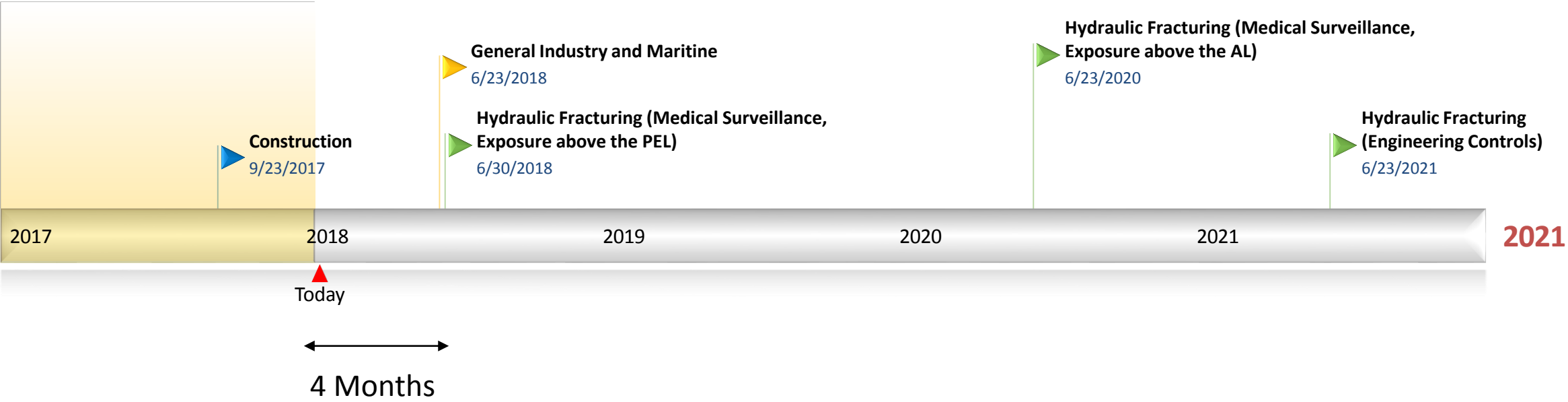
OSHA Silica Standard Outline

- Reduces the personal exposure limit (PEL) of the employees from $0.1\text{mg}/\text{m}^3$ to $0.05\text{mg}/\text{m}^3$ 8 hr. time weighted average (TWA)



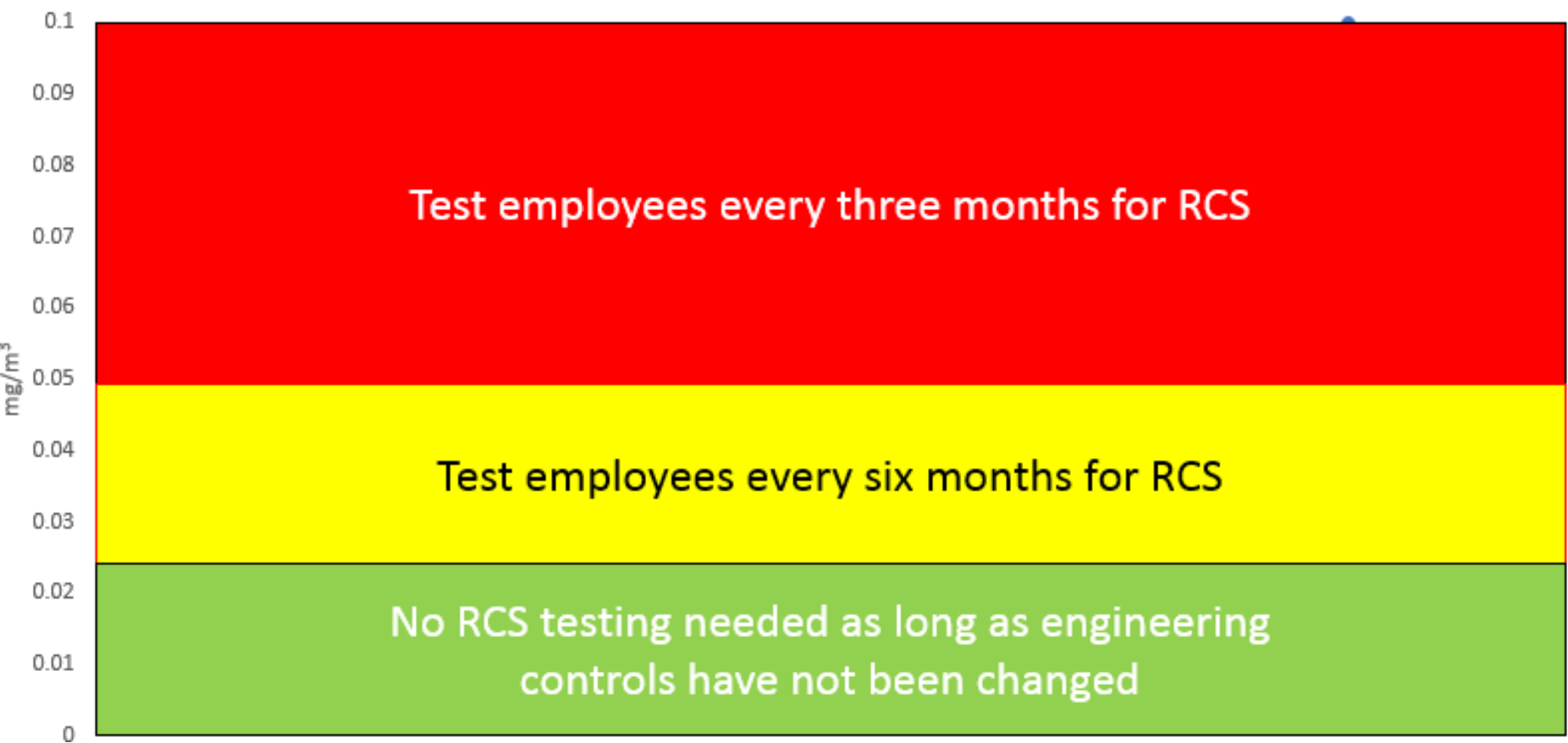
- Creates an action level (AL) of $0.025\text{mg}/\text{m}^3$
- Requires engineering controls and written control plans
- Medical Surveillance of employees
- Requires training of employees on the hazards associated with respirable crystalline silica (RCS)
- Respirators may be required with, but not in place of engineering controls measures

OSHA Time Line



Exposure Monitoring Requirements

RCS Testing of Employees



Offer medical surveillance at no cost to the employee if exposure is above the AL for more than 30 days per year

What are the Big Effects on Hydraulic Fracturing?



Engineering Controls



Medical Surveillance



Routine Testing



Document Exposure Plans



Respirators are last line of defense

Major Types Engineering Controls

Mechanical



Mini-Baghouse/
Isolation



Chemical

A standard periodic table of elements, color-coded by groups. It includes element symbols, atomic numbers, and names. The table is presented within a circular frame.

NIOSH Study of Hydraulic Fracturing Employees

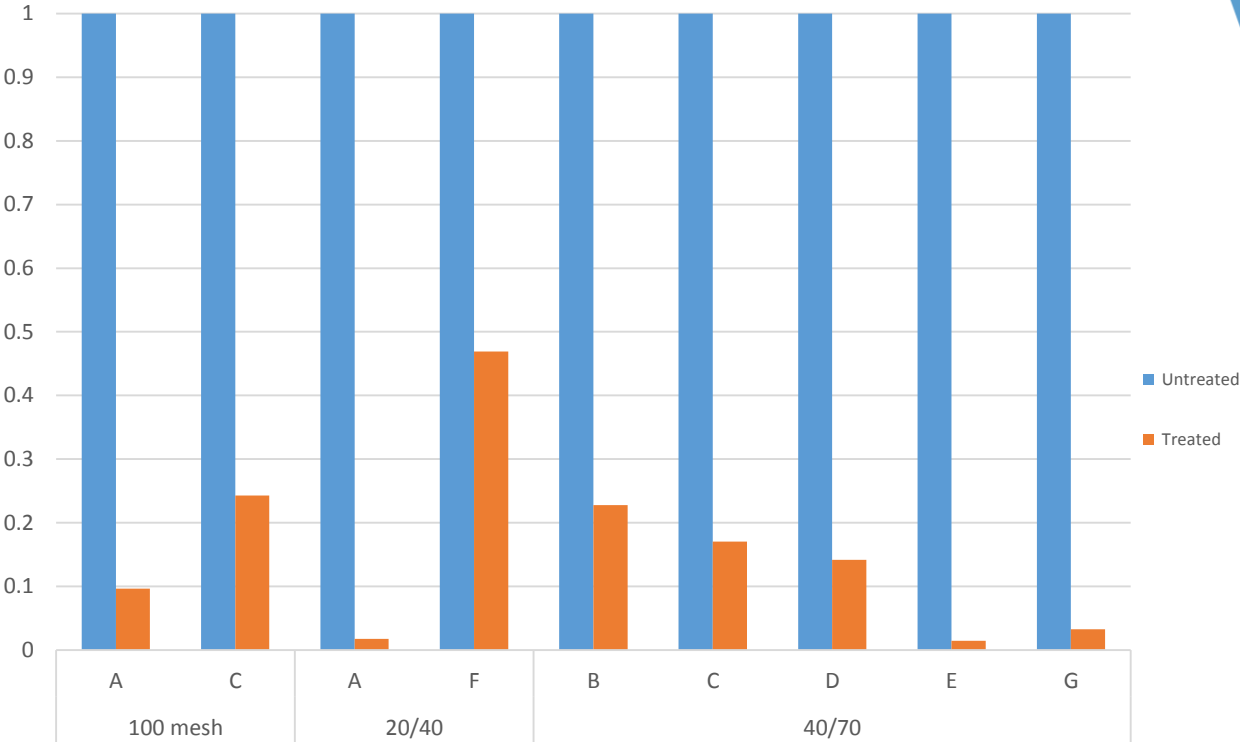
- 6 Frac Sites Studied (5 different plays)
- 111 total samples taken
- High Risk Employees
 - Blender Operator
 - Sand Mover/T-Belt Operator

TABLE VI. Samples Above ACGIH TLV, NIOSH REL, or OSHA PEL

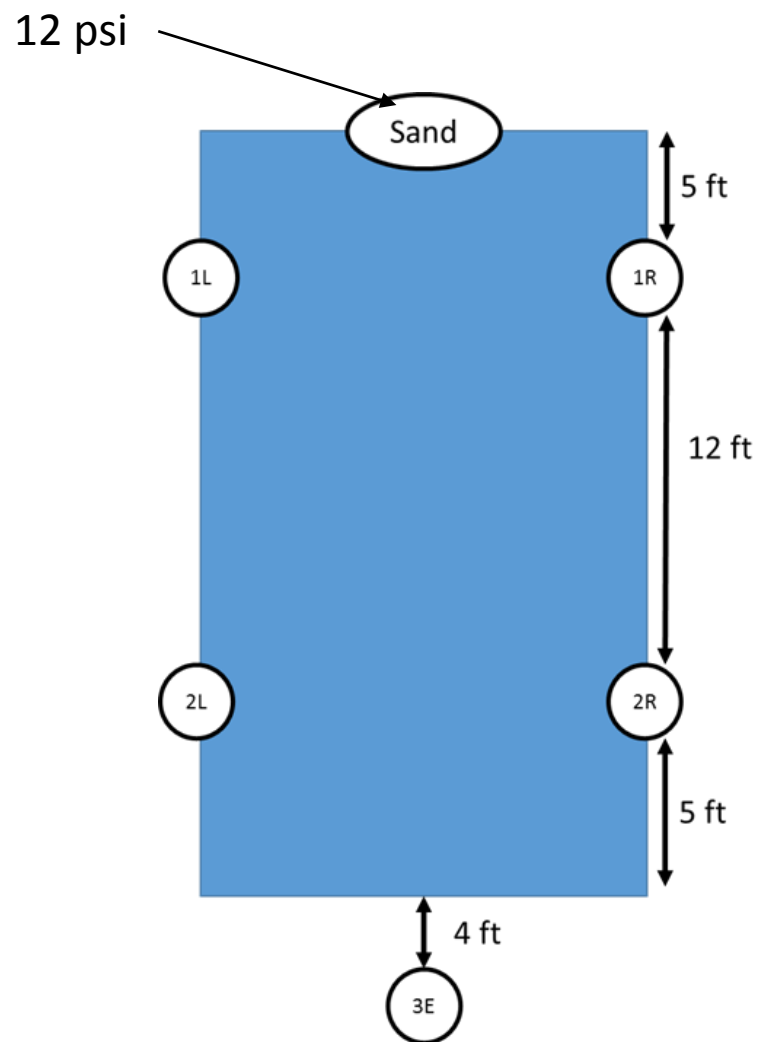
Site	ACGIH TLV	NIOSH REL	OSHA PEL	Total No. Samples
Fayetteville, Ark.	24 (92.3%)	19 (73.1%)	14 (53.9%)	26
DJ Basin 1, Colo.	16 (84.2%)	14 (73.7%)	12 (63.2%)	19
Eagle Ford, Texas	5 (62.5%)	5 (62.5%)	4 (50.0%)	8
DJ Basin 2, Colo.	19 (90.5%)	14 (66.7%)	9 (42.9%)	21
Marcellus, Pa.	25 (92.6%)	23 (85.2%)	18 (66.7%)	27
Bakken, N.D.	4 (40%)	1 (10%)	0	10
Totals	93 (83.8%)	76 (68.5%)	57 (51.4%)	111

0.025 mg/m³ 0.05 mg/m³ 0.1 mg/m³

Internal Chemical Testing

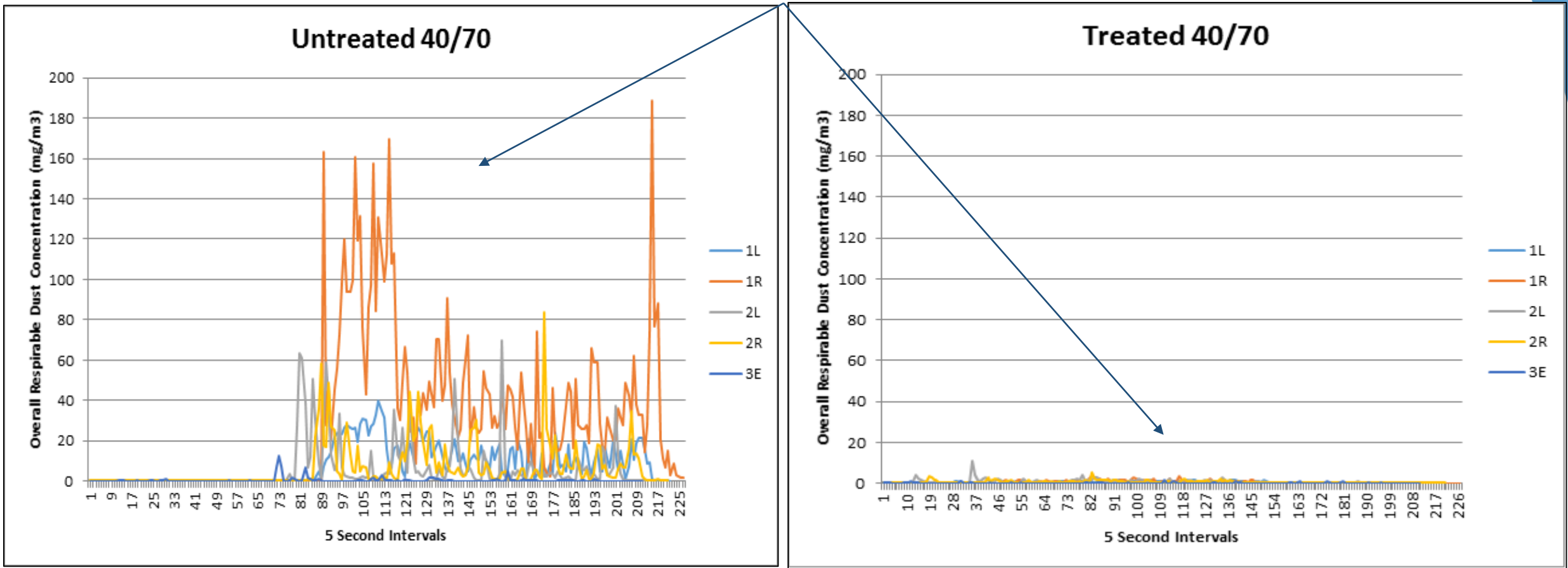


Internal Pneumatic Truck Trial

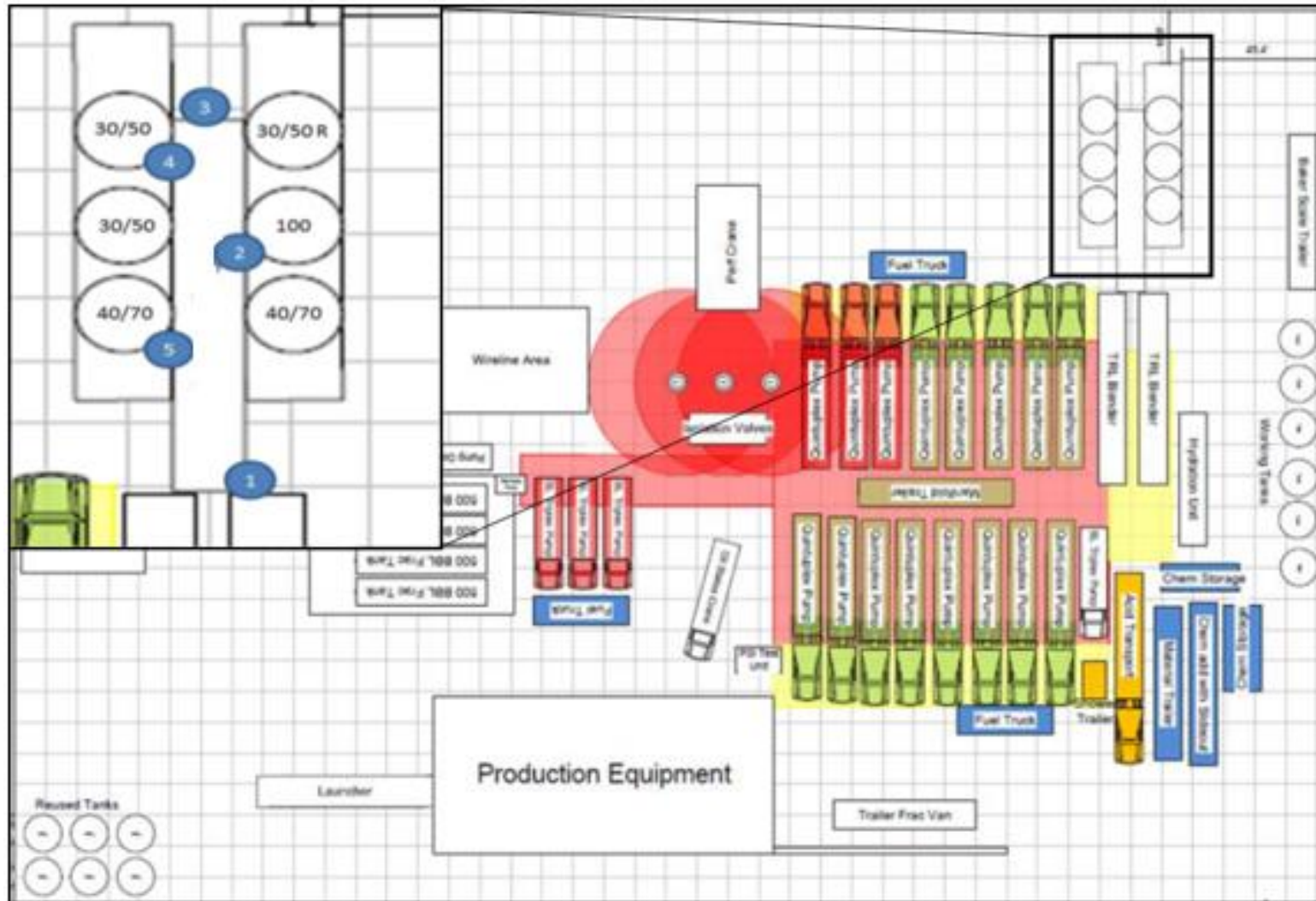


Internal Pneumatic Truck Trial

87-98% Reduction in Dust



Area Monitoring Trial

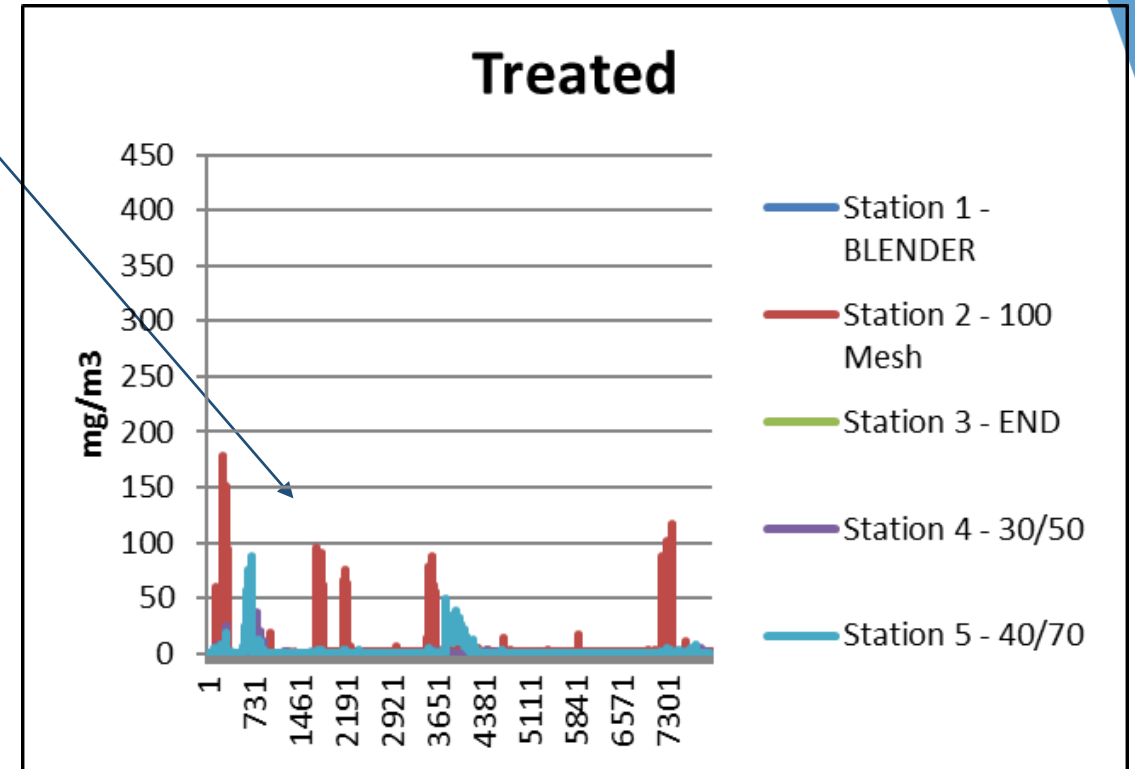
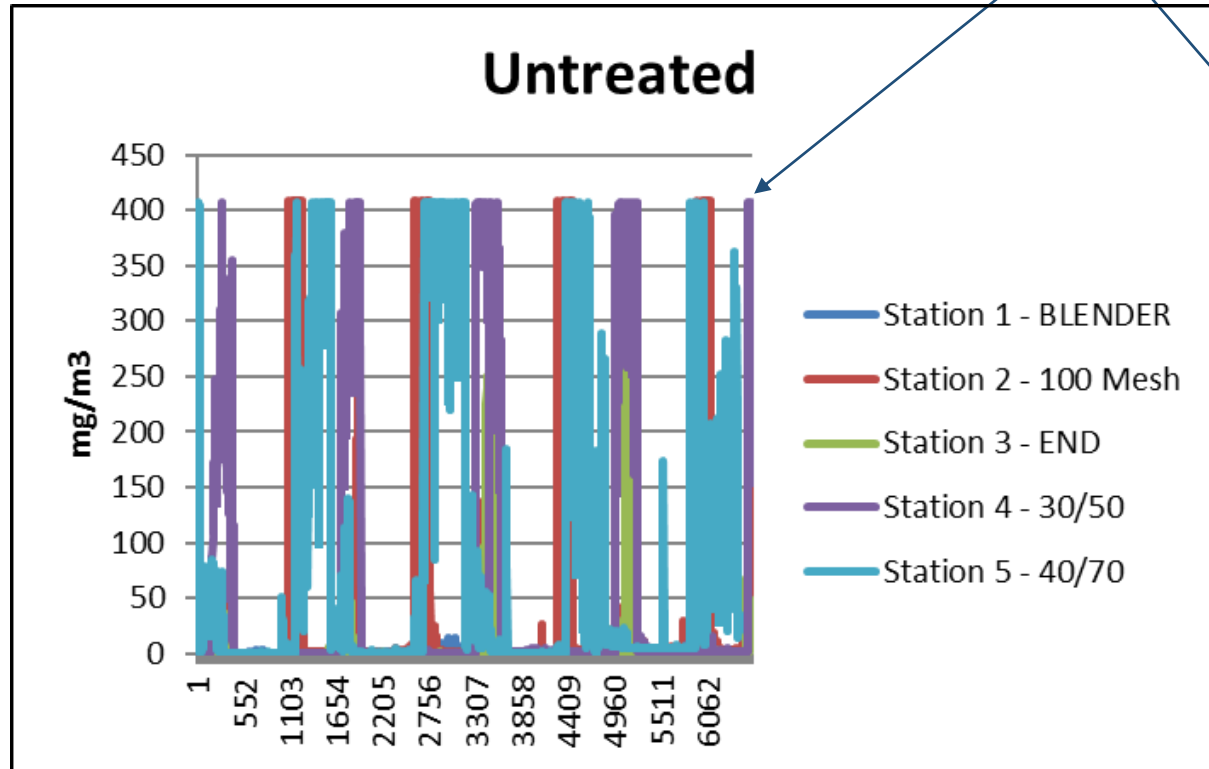


Area Monitoring Trial

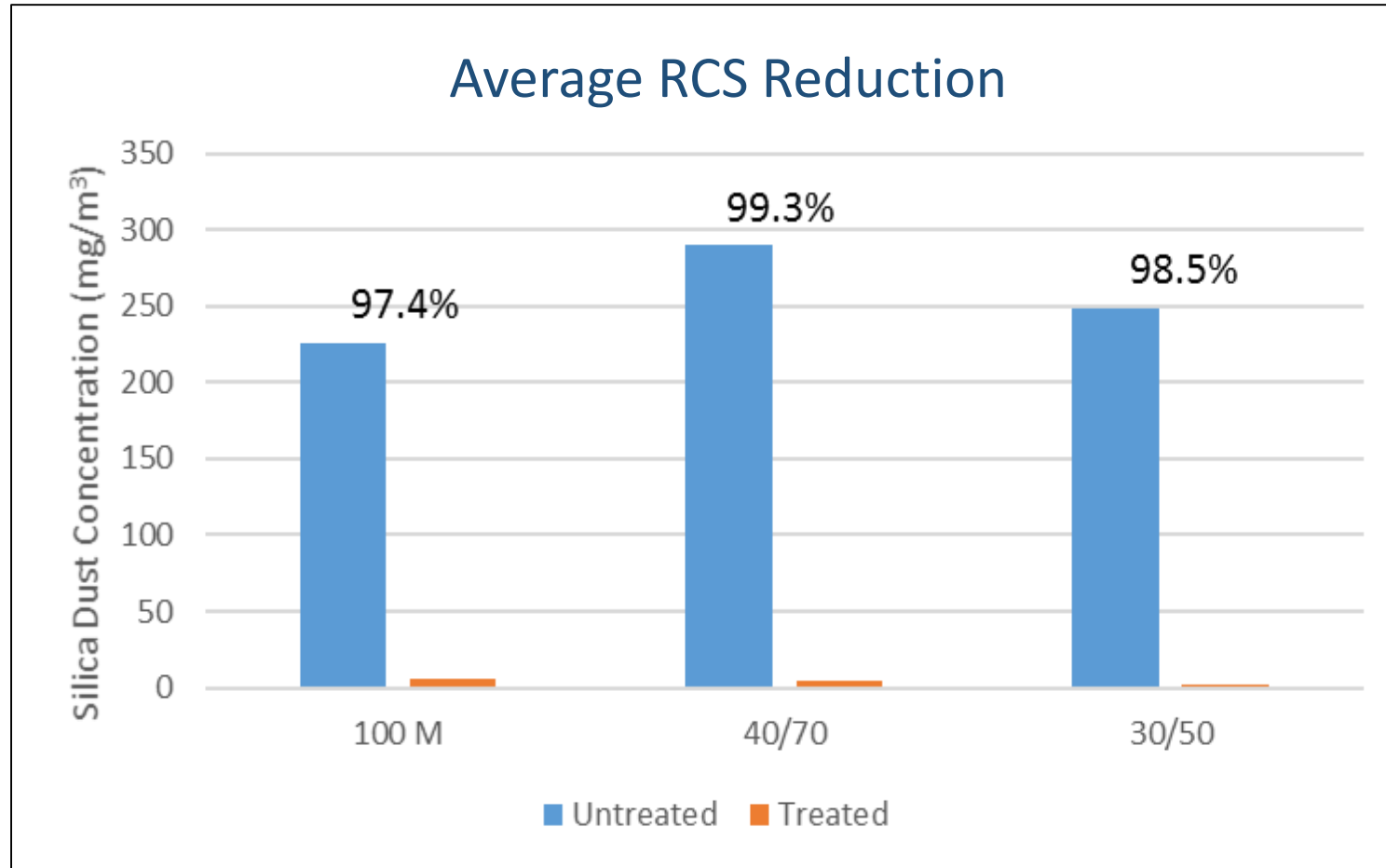


Area Monitoring Trial

Unable to detect total dust reduction as the pDr was saturated



Area Monitoring Trial



Personal Exposure Monitoring



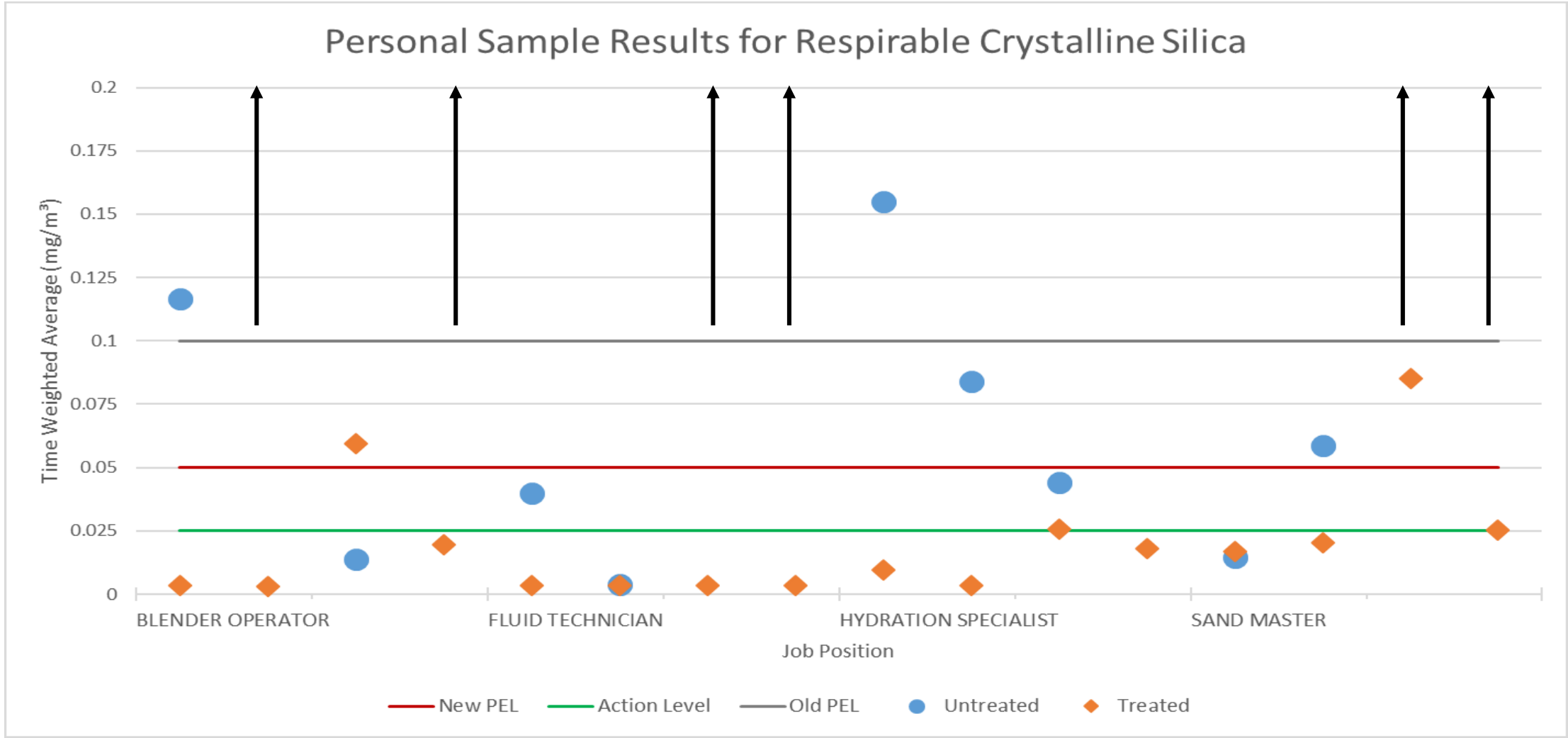
FLUID TECHNICIAN

HYDRATION SPECIALIST

BLENDER OPERATOR

SAND MASTER

Personal Exposure Monitoring



The Big Difference

Supply Chain Engineering Controls

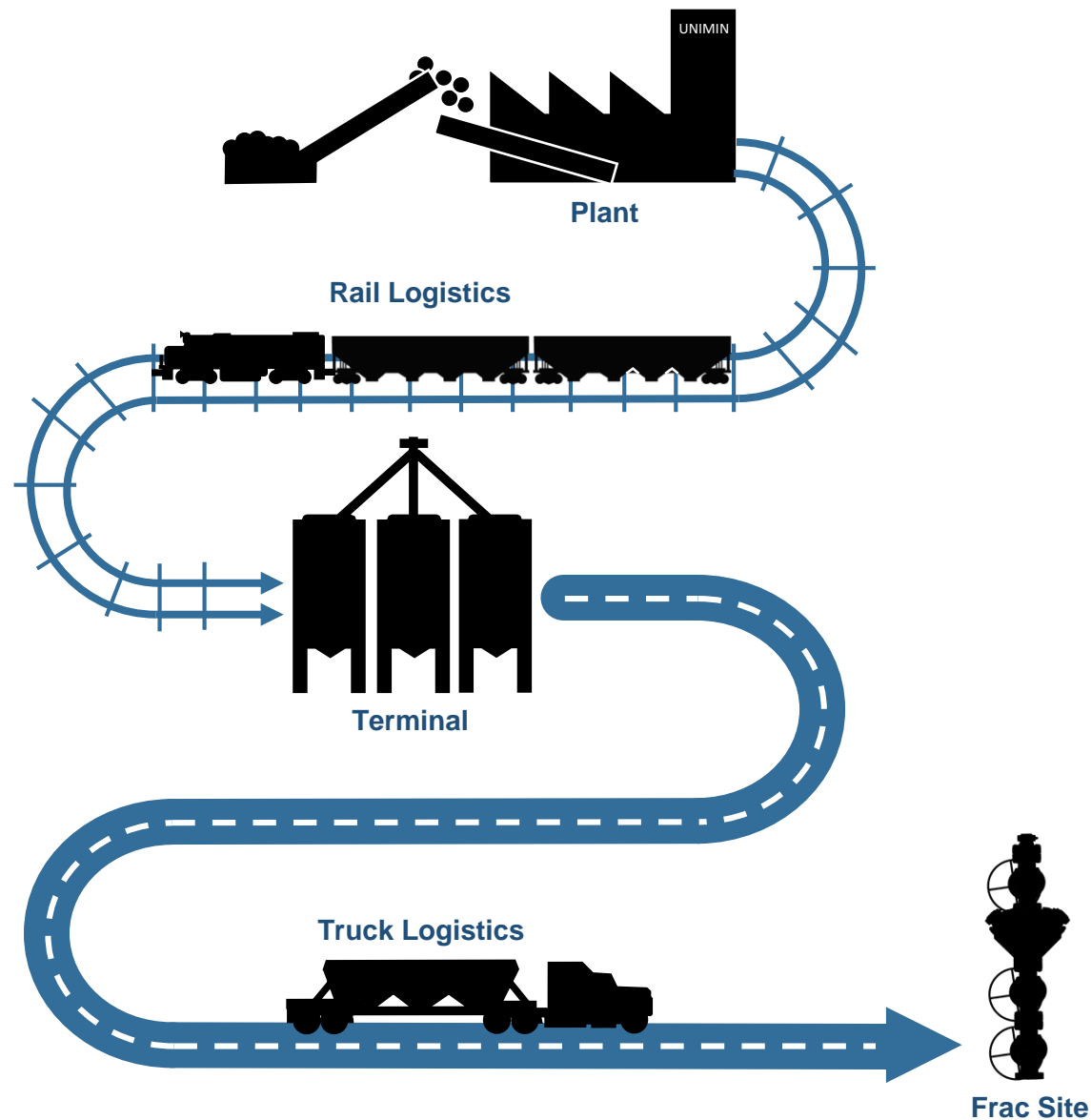
Mechanical



Isolation



Chemical



Supply Chain Engineering Controls

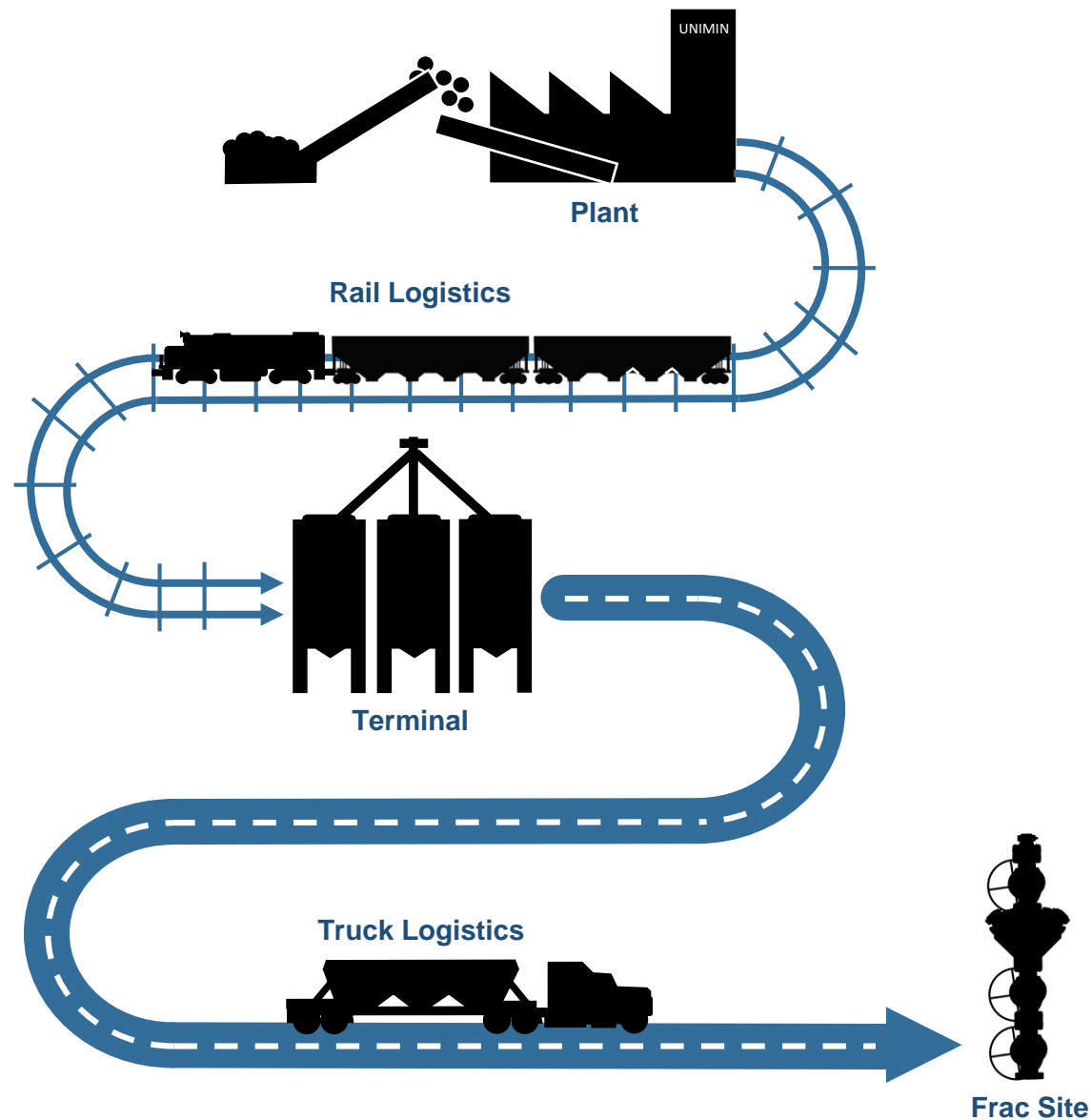
Mechanical



Isolation



Chemical



Supply Chain Engineering Controls

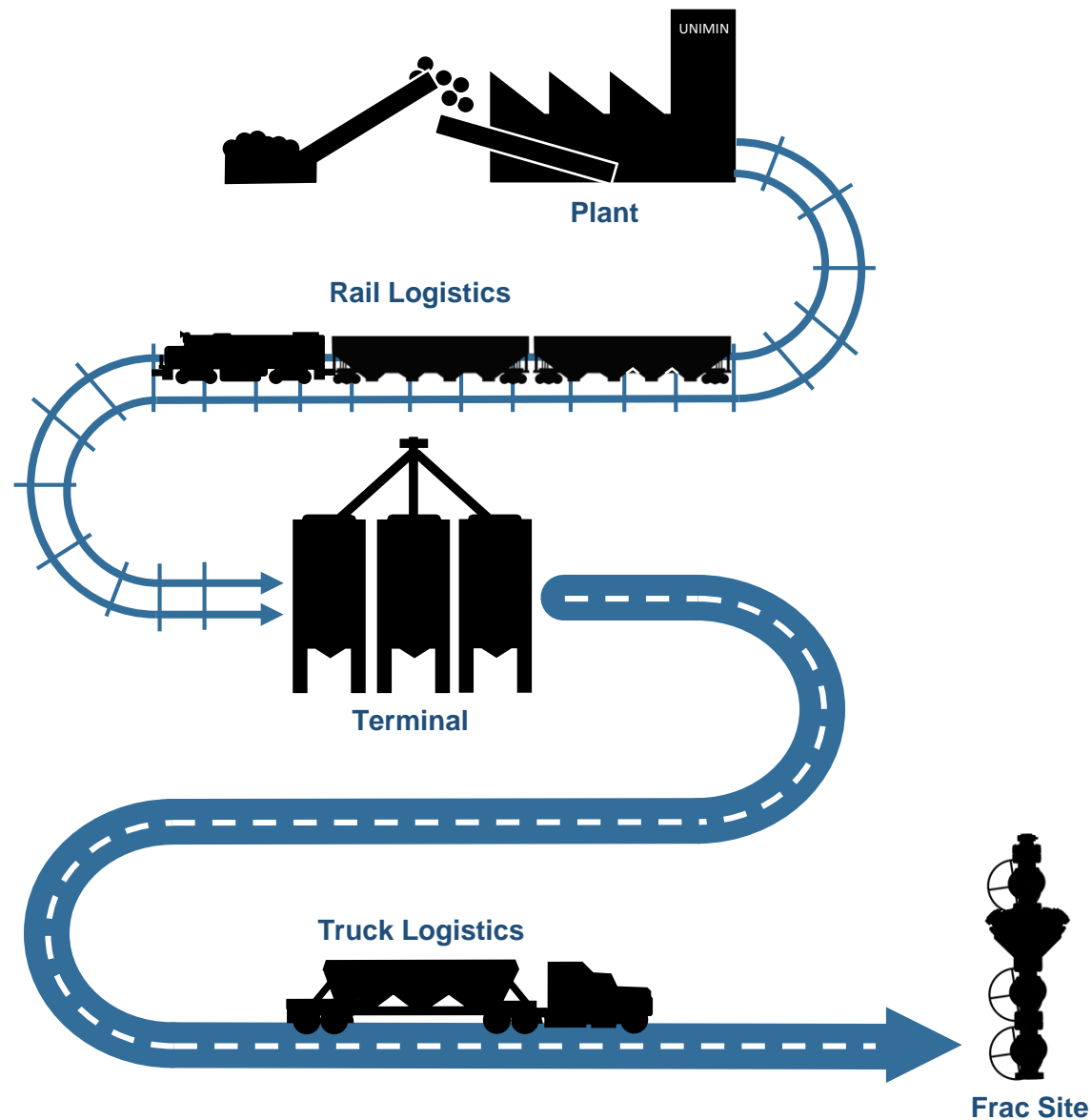
Mechanical



Isolation



Chemical



Conclusion

- Measurements proven below the new action level
- Serves as an engineering control for the supply chain (mine to well)
- Transparent to your operations
- Long shelf life
- SPE Paper-187069

Thank You!

Questions?