IT'S ONLY MUDDY WATER,

SO, WHY IS IT SO HARD TO DISPOSE OF?

Seth Matthesen & Kelvin Self
Ditch Witch®

IT'S ONLY MUDDY WATER, SO, WHY IS IT SO HARD TO DISPOSE OF?

Contact Link for

Latest Information and OSU Fact Sheet

Email: Info@DitchWitch.com

Mention: HDD Mud Residue Disposal Research Information and Provide an Email Address

Kelvin Self, Ph.D., R&D Project Manager, Ditch Witch

Josh Daniel, Grad Student, Plant and Soil Sciences, Oklahoma State University

Chad Penn, Ph.D., Assoc. Professer, Plant and Soil Sciences, Oklahoma State University

The Current Picture about Drilling Mud, Hold Your Breath…

But….

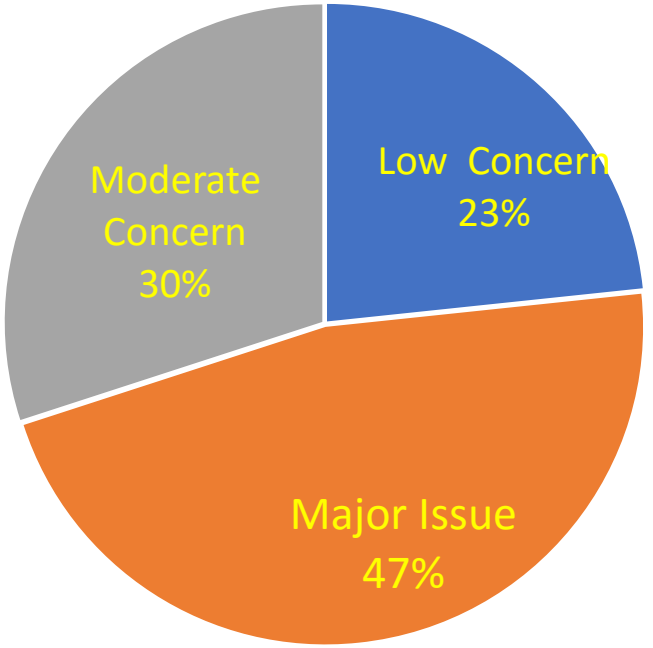
research provides some real time data and measured results for disposal options.

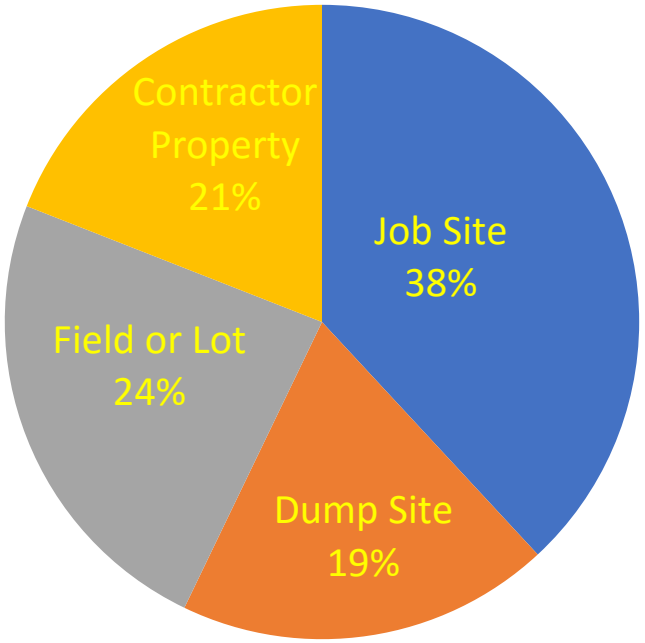
Agenda

1. Survey: Current Mud Disposal Methods and Info
2. Mud Sample Analysis Nationwide
3. Research Of Mud Disposal on Bare & Vegetated Soils
4. Conclusions, Is Land Application Safe and Viable?
5. Prescription for Land Application of Mud Residue

Key Survey Points

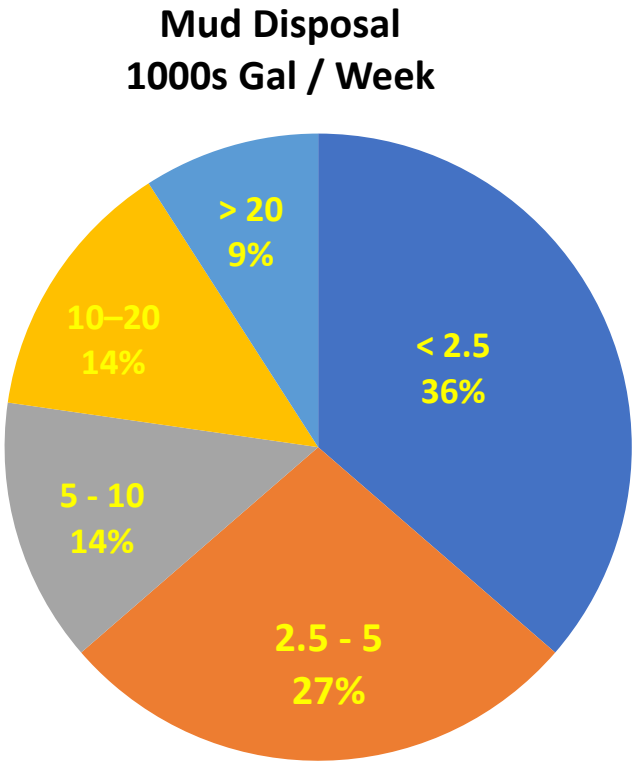
Question: Rank How Big of an Issue Mud Disposal is (10 = Major Issue)



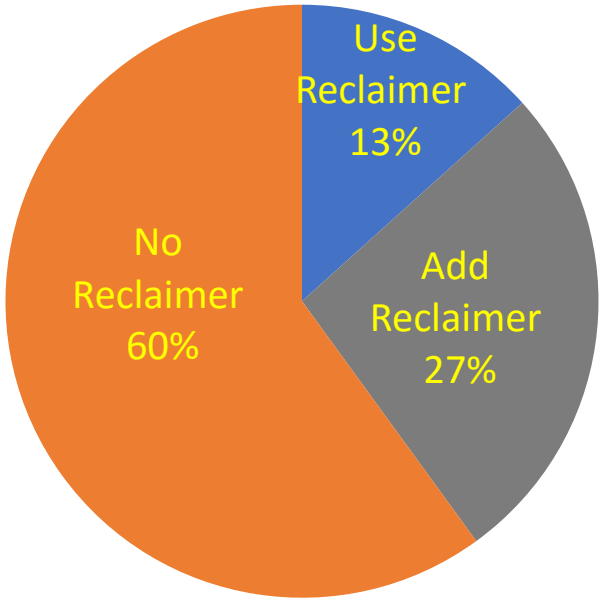


Question: Describe What your Usual "Fluid Disposal" Activity Looks Like?

Key Survey Points



Question: How much Mud do you Dispose of per week?



Question: Do you utilize a Reclaimer?

Mud Reclaimer Example

Example:

- Disposing of 8000 Gallons/Wk
- $27/Ton Disposal Fee (or $0.45/gal)
- 60 Mile Roundtrip for Disposal
- Assume Mud Reuse
  Rate is 10:1

Mud Reclaimer Example

Example of Disposing of 8000 Gallons/Wk @ $0.45/gal

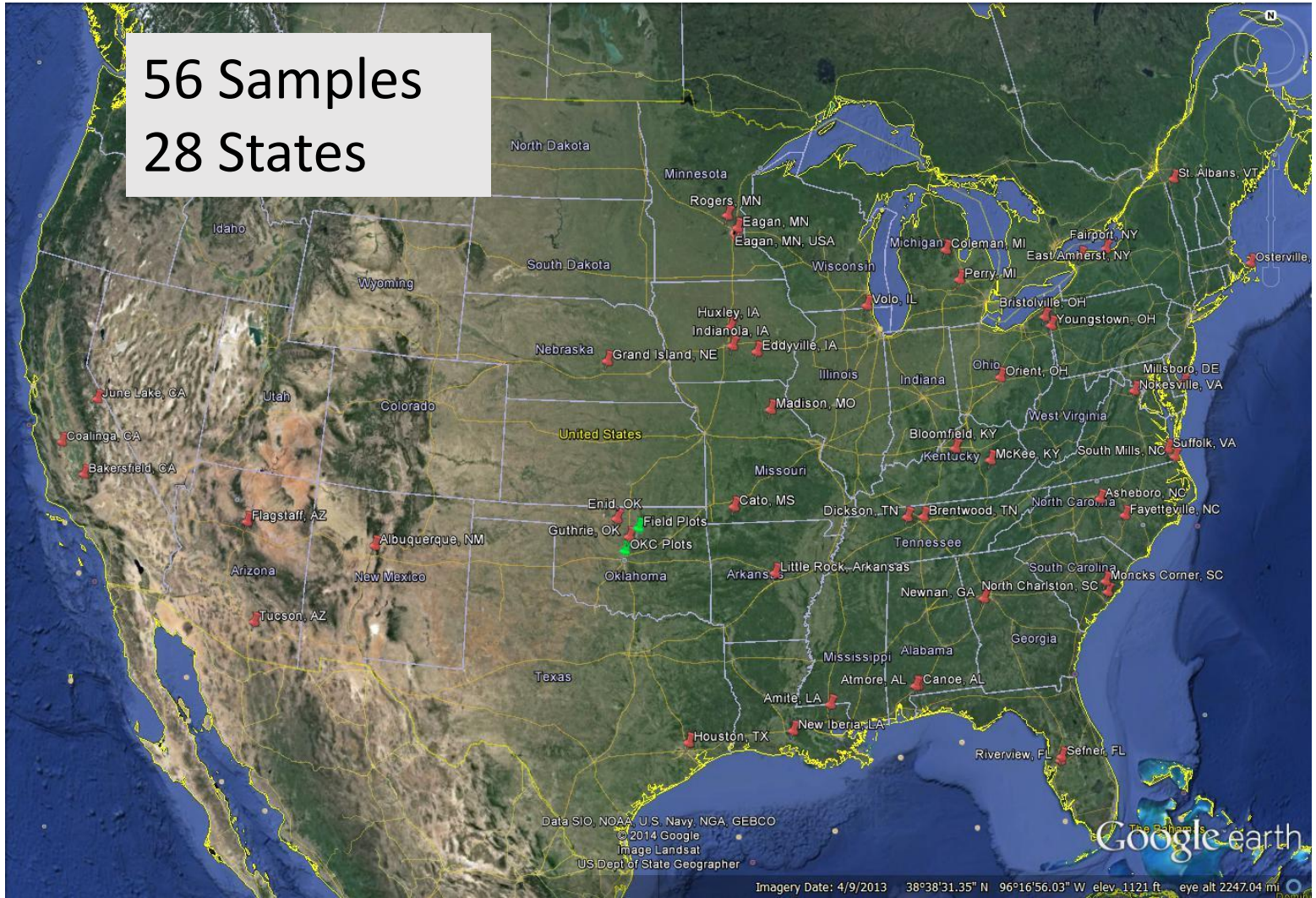
Est. Disposal Fees using Conventional Mud Mixing				Est. Disposal Fees using Mud Cleaner			
312,000	Tot Mud Gal/yr Disposed	**$140,400**	**Disposal Fees $/Year**	134,160	Tot Gal/yr Disposed, incl soil cuttings	**$60,372**	**Disposal Fees $/Year**
24,960	Total Miles Driven/yr	**$28,080**	**Vehicle Op Cost for Disposal**	10,733	Total Miles Driven/yr	**$12,074**	**Vehicle Op Cost**
1,129	Dispoal labor hrs + 1 hr per trip	**$22,583**	**Tot Labor Cost for Disposal**	486	Dispoal hrs + 1 hr per trip	**$9,711**	**Tot Labor Cost for Disposal**
347	Number of Batches Mixed/yr	**$14,560**	**Tot Mud Cost per Year (Labor + Additives)**	35	Number of Batches Mixed/yr	**$1,456**	**Tot Mud Cost per Year (Labor + Additives)**
$ 278,000	Tot Equip Cost (FM25+2Vac+ 2Trucks)	**$92,667**	**Equip Cost (1/3 each yr)**	$ 205,000	Tot Equip Cost (MR90+Vac+ Truck)	**$67,650**	**Equip Cost (1/3 each yr)**
		$298,290	**Yearly Disposal & Operating Cost**			**$151,263**	**Yearly Disposal & Operating Cost**

Everyone says it's harmless, so

why is it so hard to dispose of "Muddy Water"?

Mud Sample Survey and Analysis

Mud Sample Survey



Mud Sample Analysis

- Solids Content
  - Dry sample weight divided by wet weight
- Electrical Conductivity (Dissolved Solids)
- pH (Acid/Base)

Mud Sample Analysis

EC (µS/cm), pH, and Solids Content

Electrical Conductivity		pH		Solids Content	
Mean	1181.4	Mean	7.37	Mean	37%
Median	925.7	Median	7.48	Median	36%
Minimum	118.1	Minimum	4.69	Minimum	4%
Maximum	3950.0	Maximum	9.95	Maximum	72%

Threshold for Saline Soils > 4000

Most Soils Range from 4.5 – 8.5

Mud Sample Analysis

EPA 3050B Solids Digestion

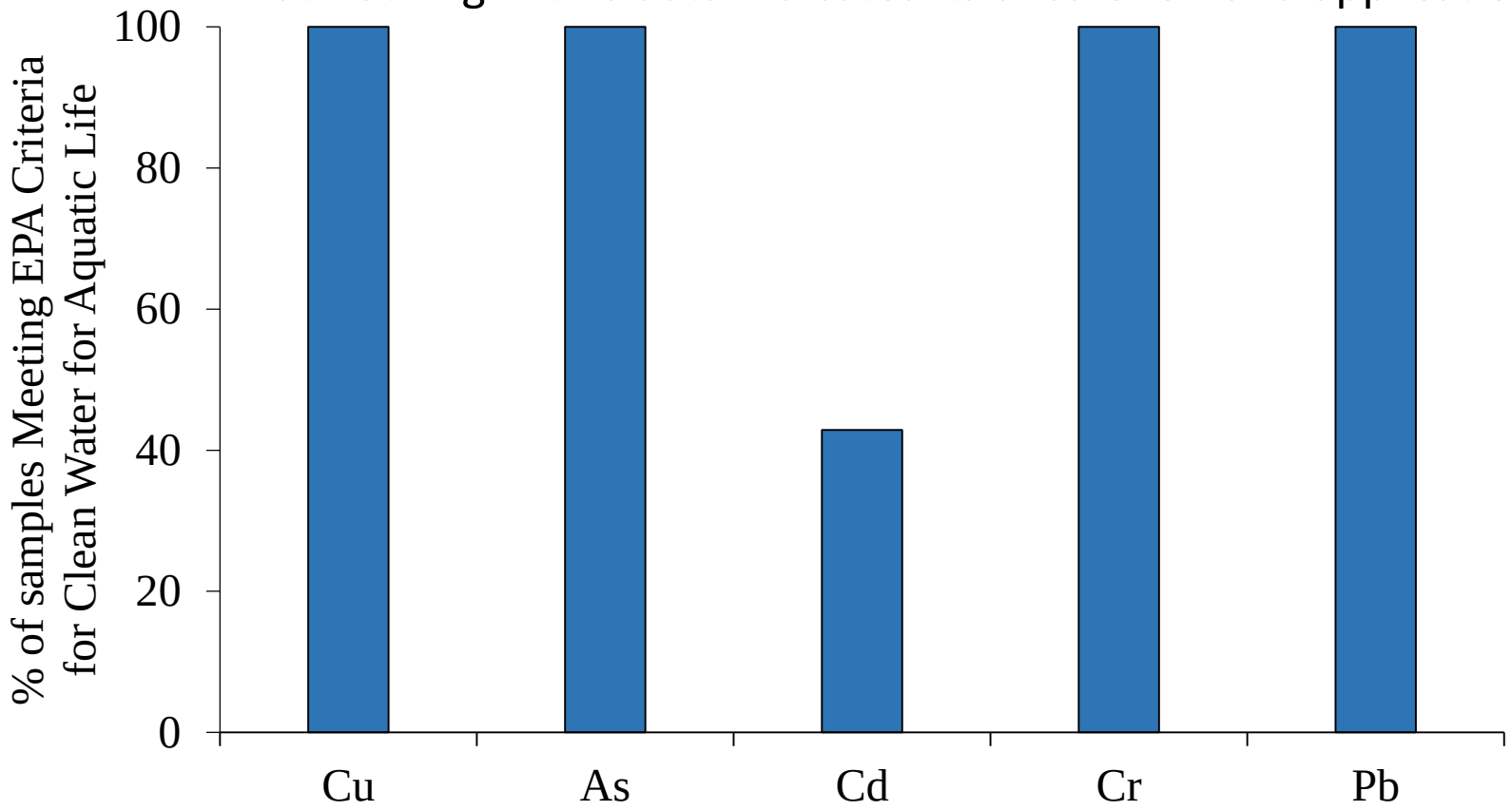
Metal	Typical Levels in Soil (mg/Kg)	Number of Samples Above Range Of Typical Soils
Copper	6 - 80	5
Manganese	80 - 1300	1
Zinc	17 - 125	1
Nickel	4 - 55	0
Arsenic	4 - 9	0
Chromium	7 - 221	0
Cobalt	1 - 22	0
Cadmium	0.06 - 1.1	0
Lead	10 - 84	0

McBride M.B. (1994) Environmental chemistry of soils Oxford university press.

Mud Sample Analysis

Liquid Portion: EPA Criteria for Aquatic Life

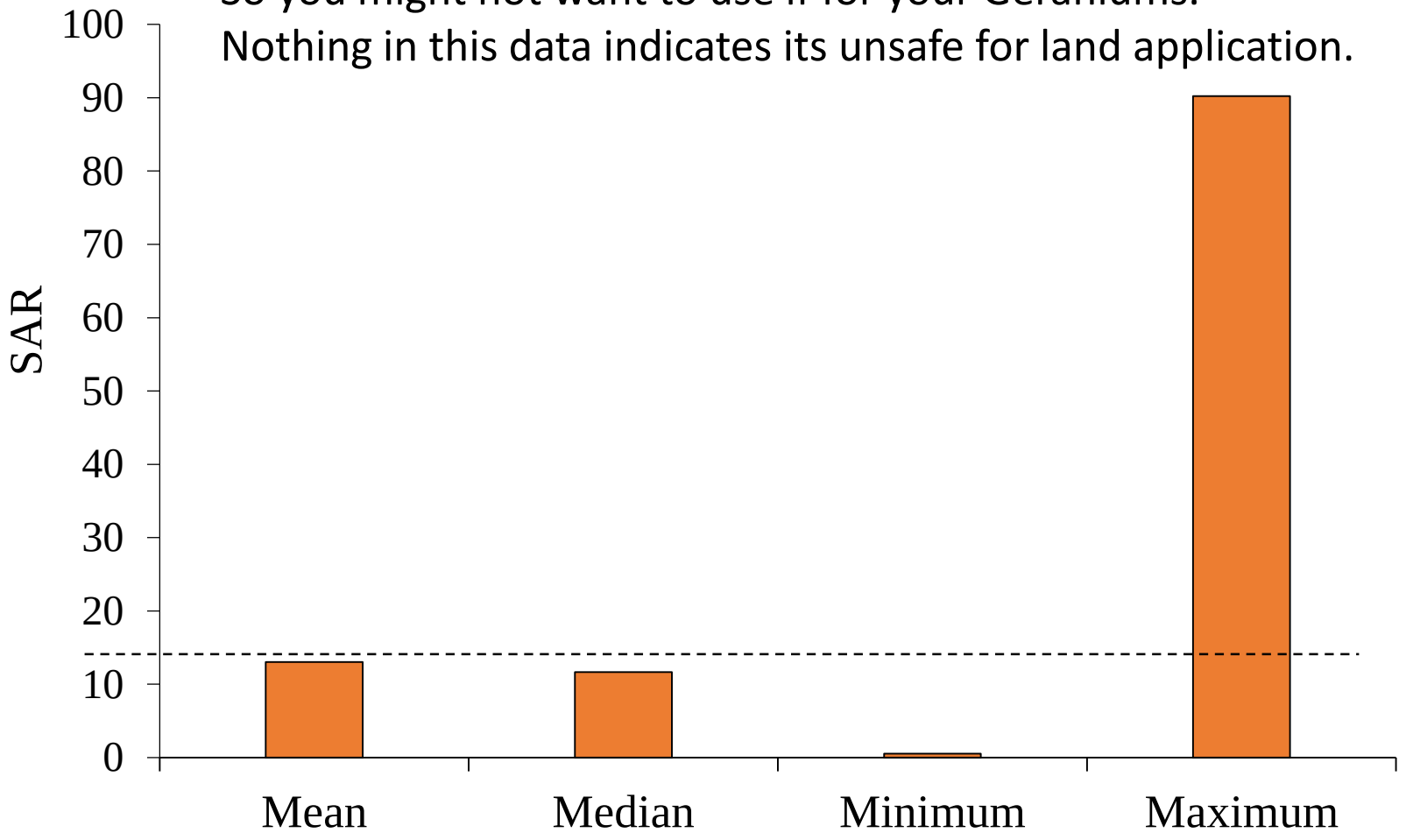
So you might not want to use if for your Aquarium.
But nothing in this data indicates its unsafe for land application.



Mud Sample Analysis

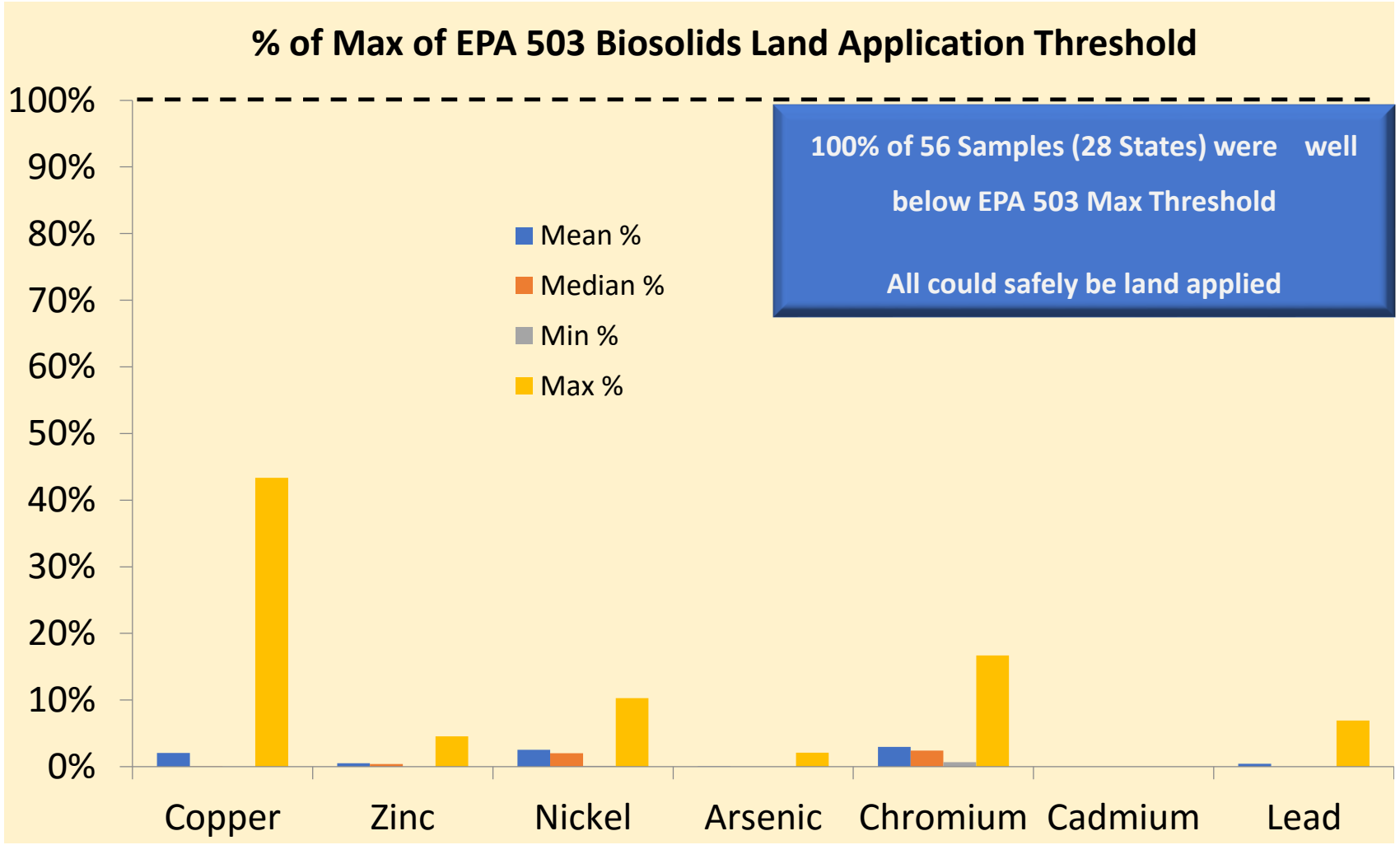
Liquid Portion: Sodium Adsorption Ratio

So you might not want to use if for your Geraniums.
Nothing in this data indicates its unsafe for land application.



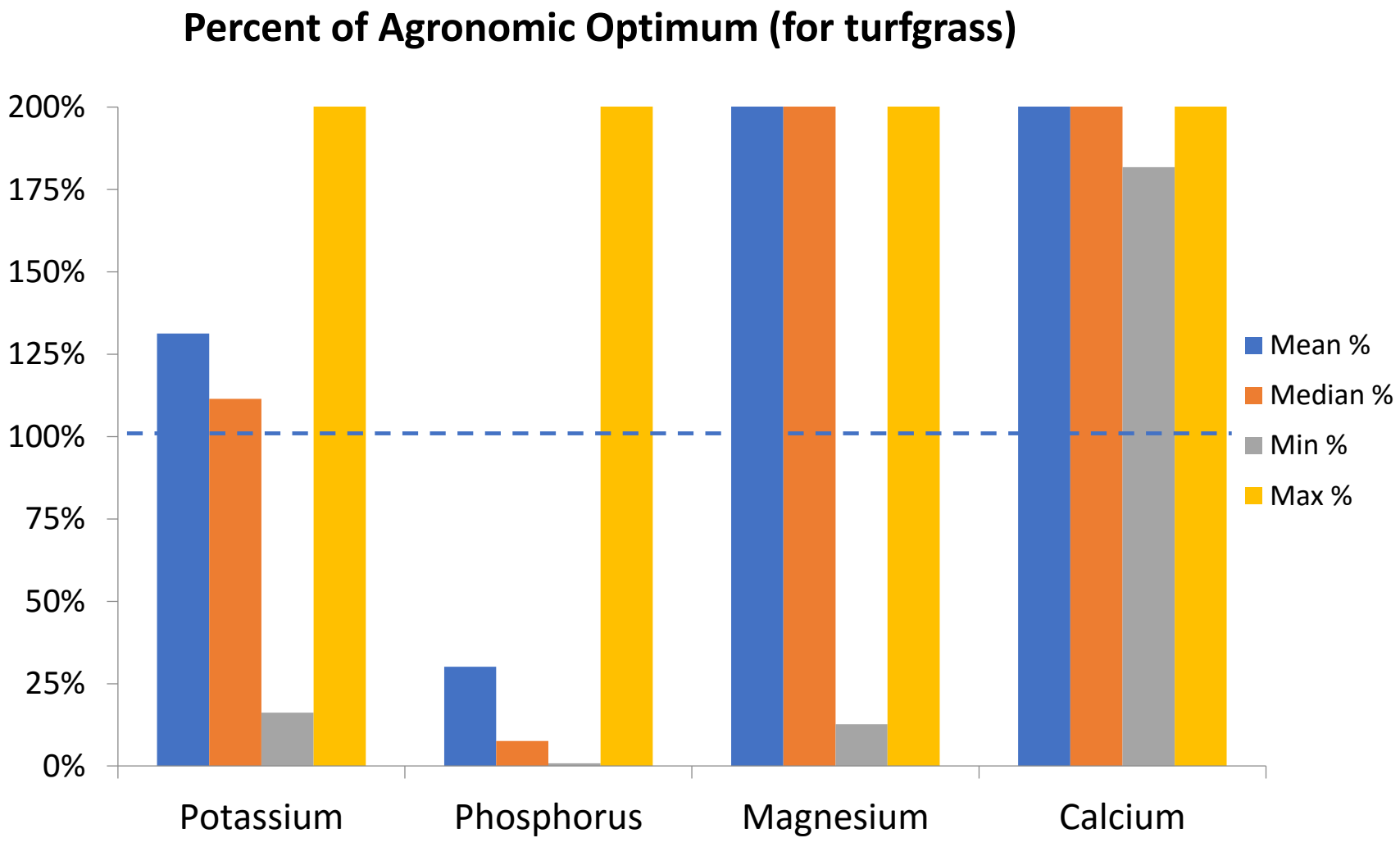
Mud Sample Analysis

Total Metals in Solid Portion



Mud Sample Analysis

Plant Available Nutrients



Nationwide Mud Sample Survey
The “Big Picture”

Potting Soil **vs.**

100 % could be used as Soil Amendment

HDD Residual (Mud) Land Application Studies

Two field studies

1. Vegetated Bermuda Pasture or Hayfield (Cover)

2. Bare plots with all Vegetation Removed (Bare)

Covered Plots

Mud Residue Applied at rates

of: 0, 10, 20, 30, 40 & 50

Tons/Acre of Solids portion

50 T/Ac Plot
Immediately after application

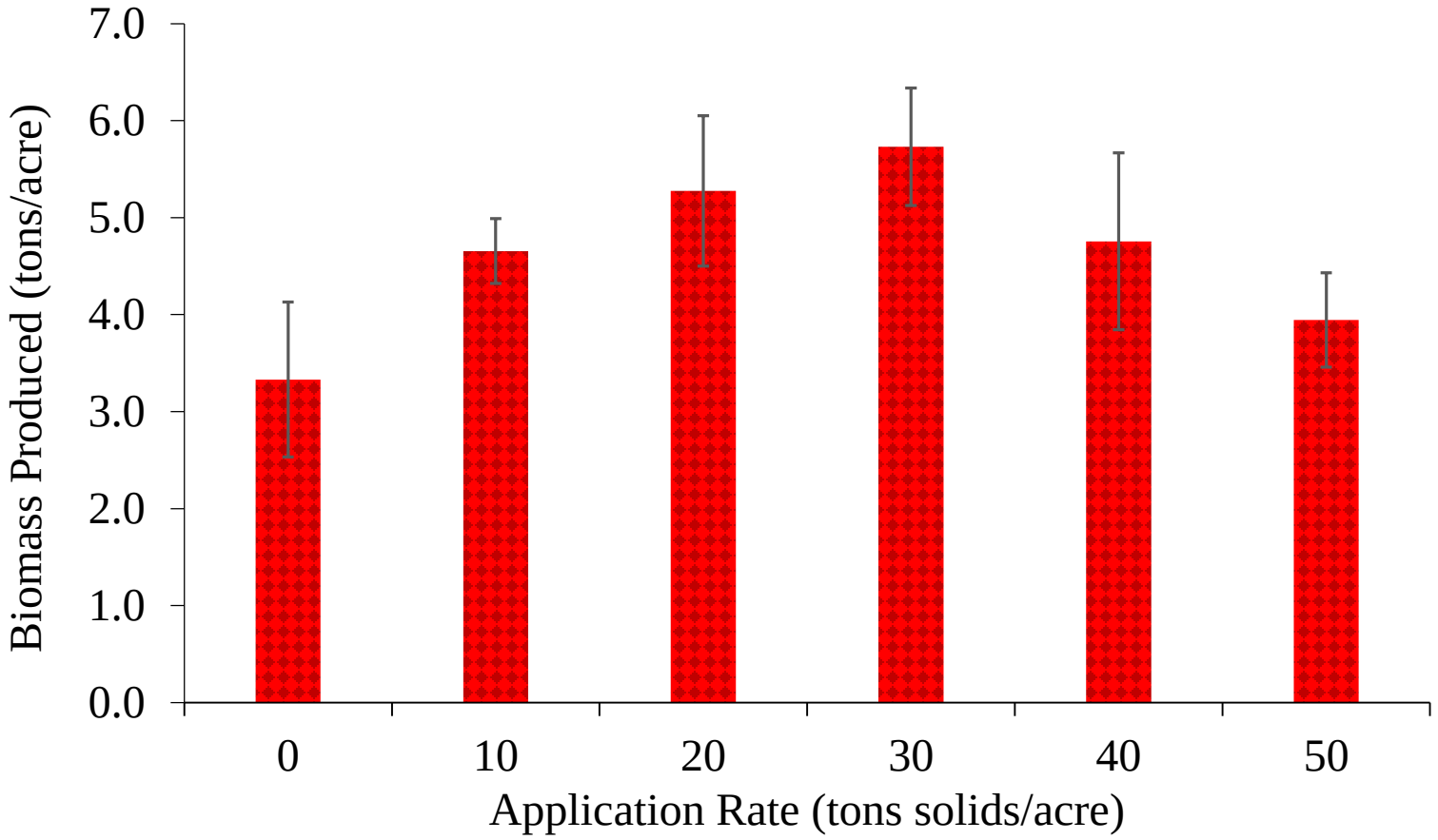
Covered Plots

Row of plots after Application
50 Tons/Acre Plot in foreground

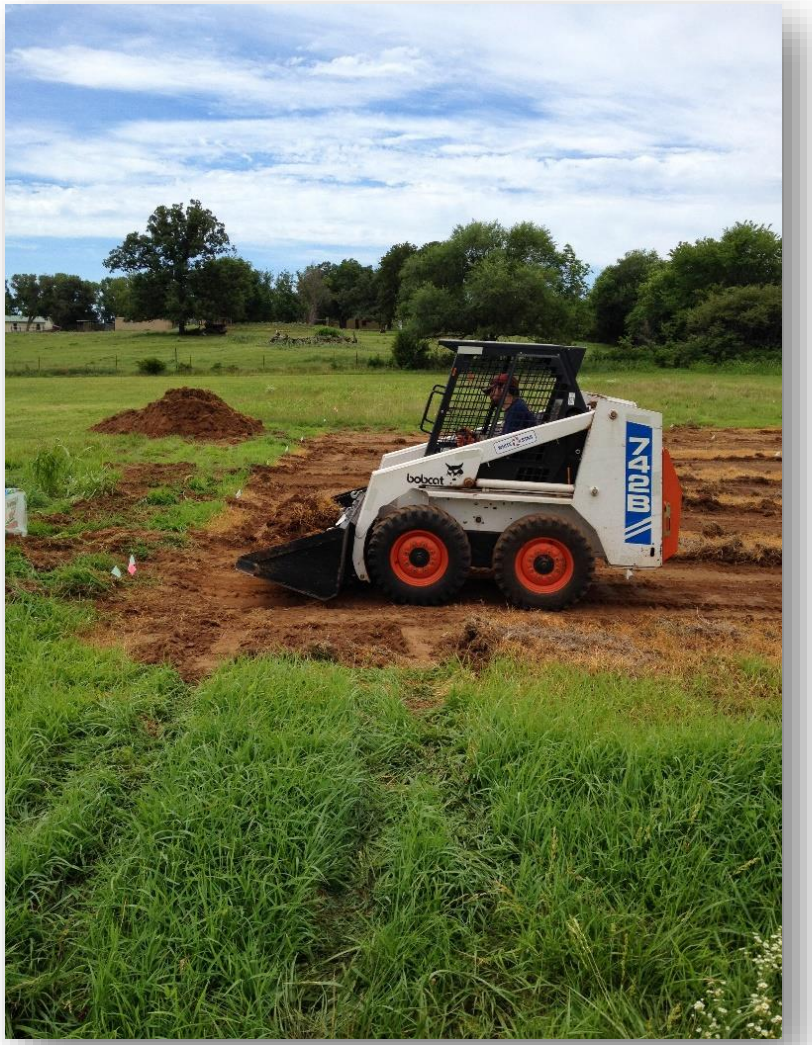
Days later
after a rain

Covered Plots: Biomass after 120 days

- Means appears to indicate an increase in Biomass w/ application of mud
- But Statistical analysis shows no significant difference at 95% Conf Level



Bare Plots



Plots Scraped Clean and Leveled

Uniformly Seeded with Bermuda Grass

Bare Plots

Mud Applied at rates of:
0, 10, 20, 30, 40 & 50 T/Ac

50 T/Ac Solids, in Foreground

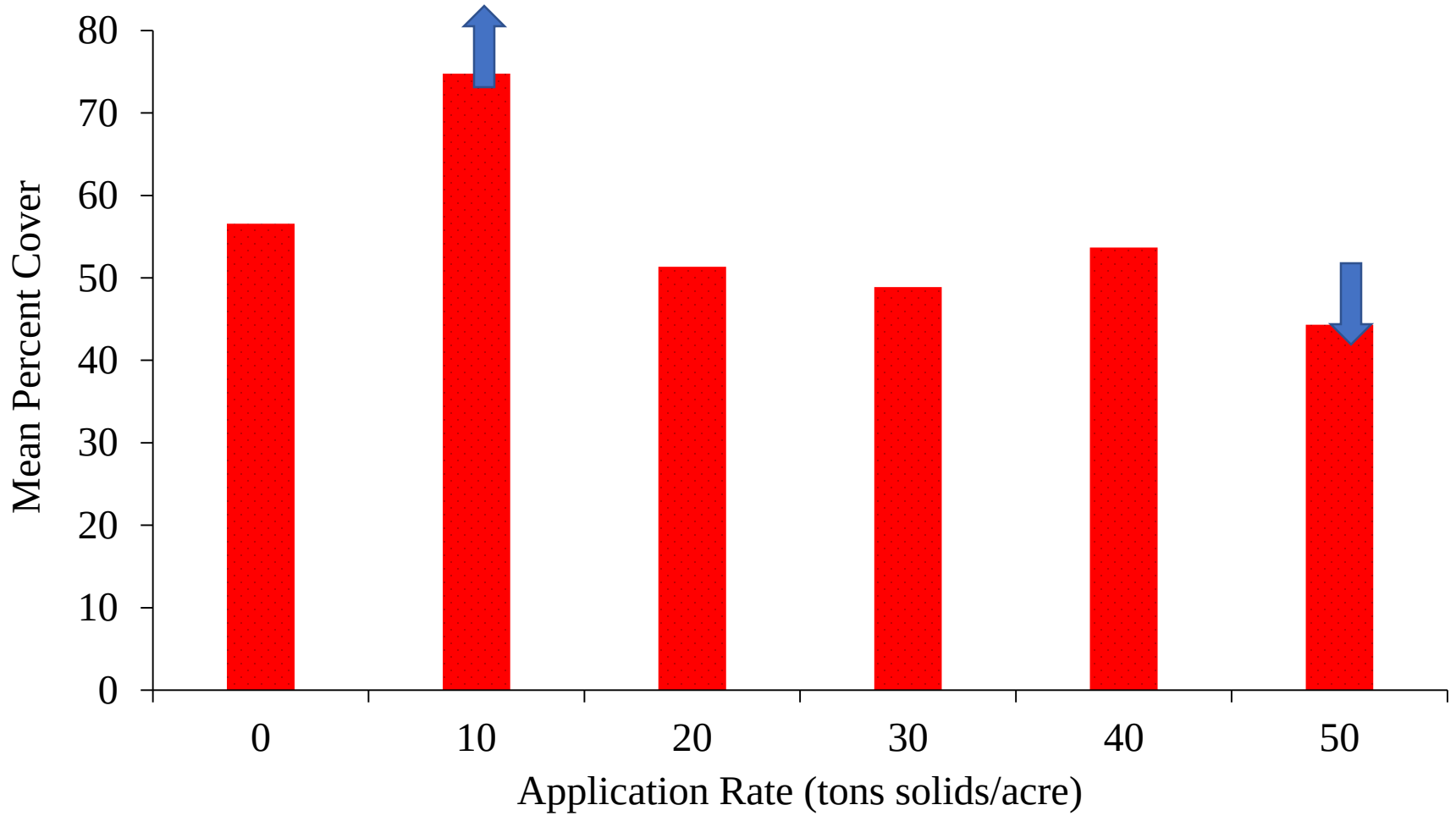
Next Day

Bare Plots

- 120 Days After Application, No Irrigation

Bare Plots: Day 60

- 10 T/Ac produced significantly higher cover than control and other rates
- 50 T/Ac was significantly lower than control



Conclusions for Land Application Studies

1. Sample Days 0, 7, 30, and 90
   - No significant chemical change in the soil for all rates on both covered and bare plots

2. Yield on covered plots
   - No significant difference in yield for all rates on covered plots
   - Though means seem to indicate an increase in yield w mud

3. Percent cover on bare plots
   - 10 tons per acre significantly higher than control and other rates
   - 50 tons per acre significantly lower than control
   - All other Plots were not significantly different than control

Summary of Research

- Nationwide Sample Analysis - Chemical & Physical Characterization
  1. Solids Portion: No harmful amounts of heavy metals found
  2. All samples fell far below EPA 503 Heavy Metal Criteria for EQ Biosolids.
  3. Water Portion: Cd in some samples was only constituent found above EPA Criteria for Aquatic Life (Note, this is a criteria for surface water).
  4. **All samples were Safe for Land Application**
- Field Study
  1. No significant difference in biomass yield
  2. No significant chemical change to soil after application
  3. Possibly aids in germination at the lowest rate applied (10 tons/acre)
  4. Possibly hinders germination at the highest rate applied (50 tons/acre)
  5. **Safe for Land Application**

❖ Caution: though no indication of excess contamination was found, that does not mean none exist everywhere. Exercise care if drilling at a site that is suspected of being in a contaminated area; have soil or mud tested before disposal.

“Prescription” for Land Application

1. Investigate the jobsite, is the HDD Job site in a known or historical area for contamination?
    - If Yes: Test or Dispose Mud Residue at appropriate dump site.

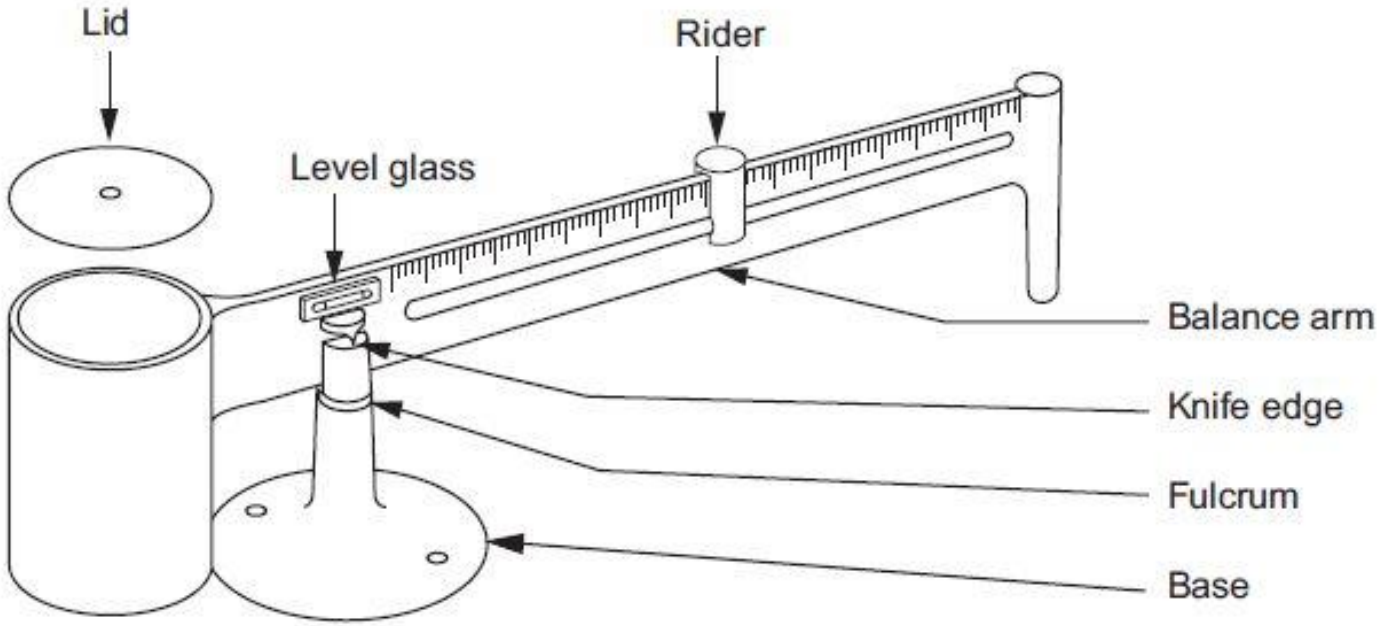
2. Establish desired application rate of solids 10-50 Tons/Acre
    - Note for watery light muds, heavy application rates can require > 1 inch
    - Vegetated: Do not exceed 50 tons/acre of solids.
    - Bare Plots: Do not apply more than 40 tons/acre to bare soils.
        - Exercise caution for watery muds, they will easily flow across bare soils

“Prescription” for Land Application

Continued:

3. Mix or agitate the tank before application

4. Measure Mud Residue Density in (lb/gal)
   - Mud Balance (lb/gal)



"Prescription" for Land Application

Continued:

5. Knowing that typical soils and rock have density around 22 lb/gal or less, and water is 8.3 lb/gal. You can calculate the Total Volume of Mud Residue required to apply over one acre. Use Equation below or Graphical Method on next page.

- In Equation Below, Insert ***Mud Density (lb/gal)*** from step 4 and ***Desired Solids Application Rate (Tons/Ac)*** from step 2.

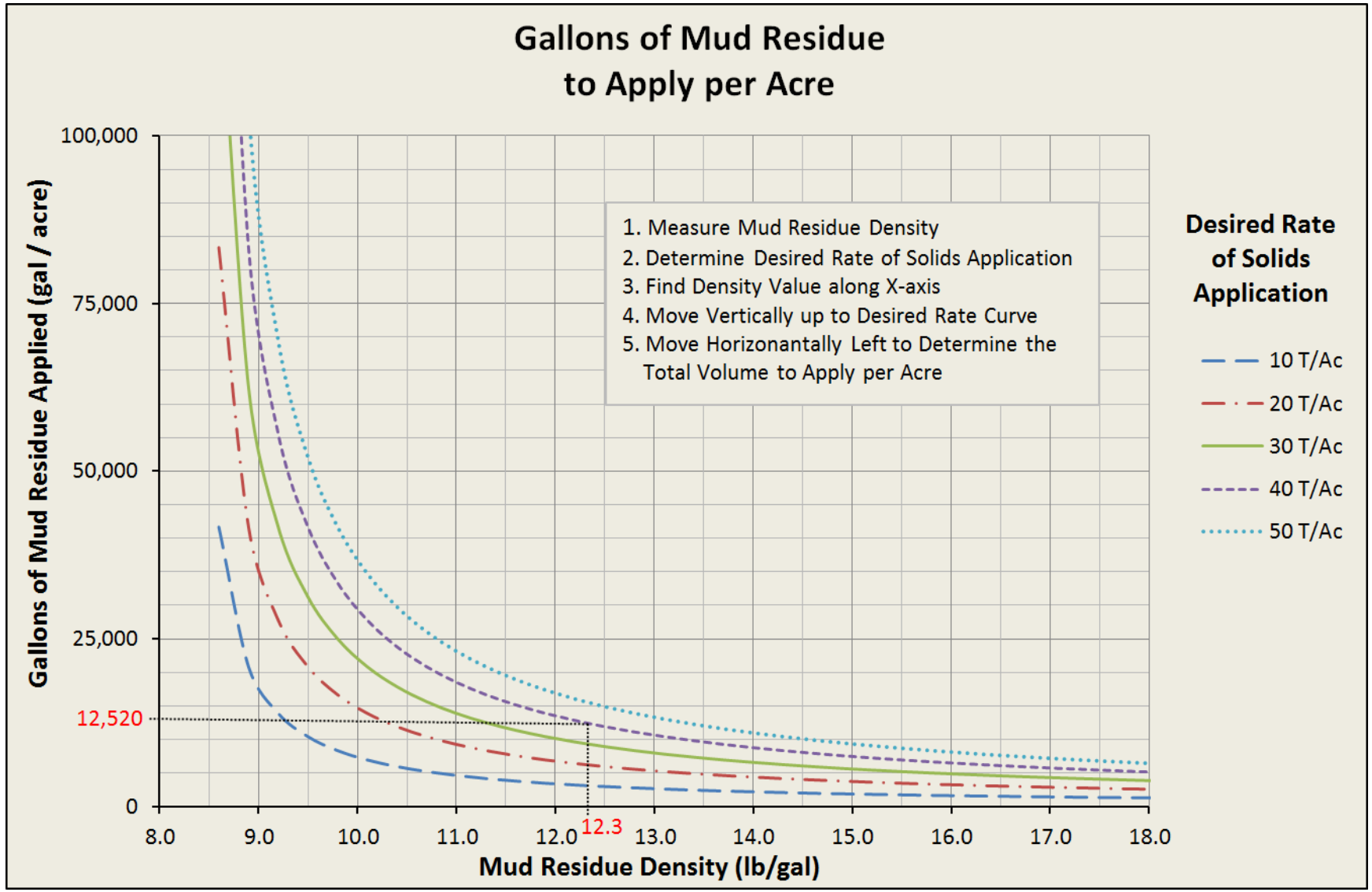
$$\frac{\textbf{Tot Gallons Mud Residue}}{\textbf{Acre}} = \frac{\textbf{Tons}}{\textbf{Acre}} \; X \; \frac{1250}{\textbf{Mud Density}\left(\frac{lb}{gal}\right) - 8.3}$$

  - Example, to apply a desired 40 ton/acre of solids with mud density of 12.3 lb/gal.

$$\textbf{12,500 Gal/Ac} = \frac{40 \; \textbf{Tons}}{\textbf{Acre}} \; X \; \frac{1250}{12.3\left(\frac{lb}{gal}\right) - 8.3}$$

Indicates that you would need to apply 12,500 gal/acre of mud residue to apply 40 tons of solid material per acre.

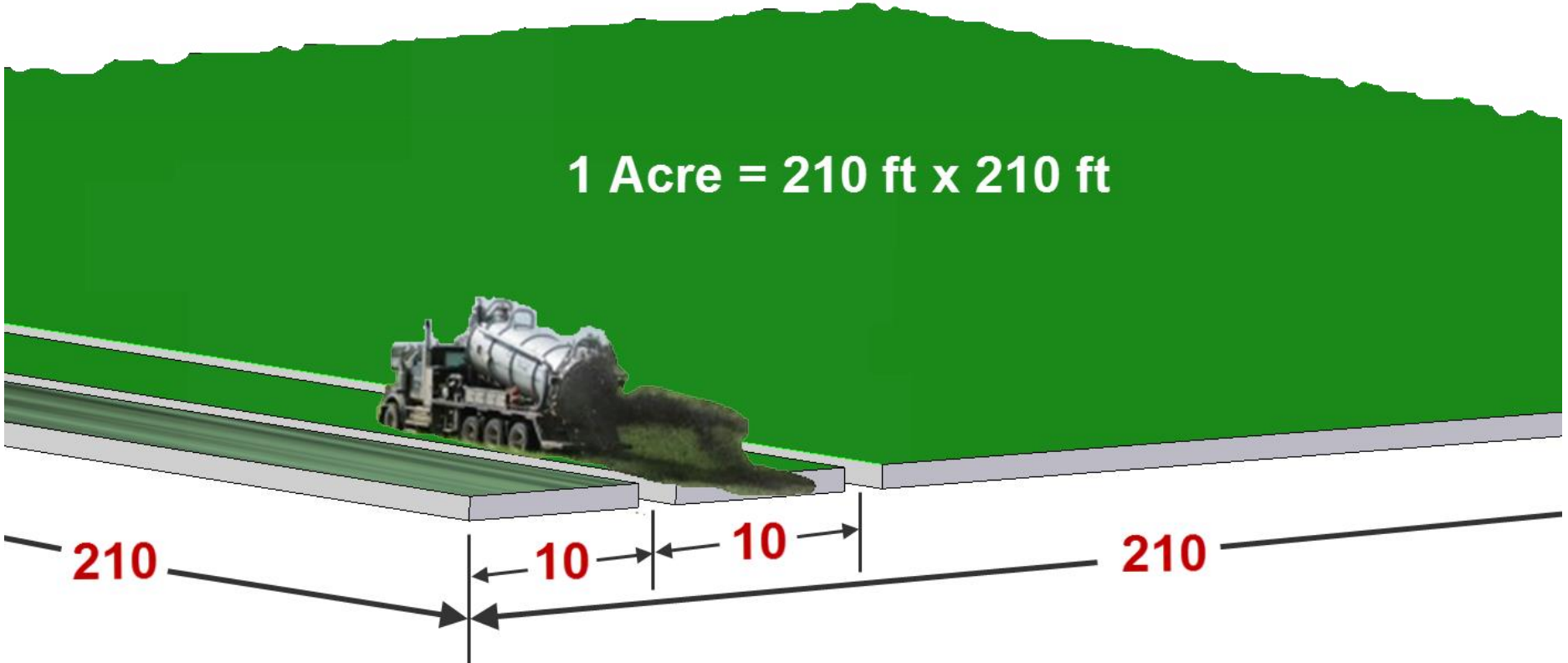
"Prescription" for Land Application



Application Rate Per Pass

- 210 ft ÷ 10 ft $(App\ Width)$ = 21 Rows

- 12,520 $\frac{Gal}{Ac}$ ÷ 21 Rows $= 596\ \frac{Gal}{Row}$



HDD Drilling Mud: How the people in the industry see it…

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QUESTIONS?