

Eco-Sponge Cutting Treatment and Bioremediation System



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Project Objectives

- Achieve a more environmentally friendly solution to **stabilization and detoxification** of drill cuttings and other E&P waste streams
- Supply the operators with a **cost effective** alternative to current fly ash applications, open pit treatment and disposal practices
- Create cuttings treatment & management process that **reduces legacy liabilities** for the operators, regulator and landowner
- Eliminate both cuttings and reserve pits (**Pit-less Drilling**) and **eliminates water event issues**
- Immediately stabilize and solidify cuttings in the cutting bin eliminating any risk of seepage or contamination.

Project Outline



- A pilot test was conducted to determine the effectiveness of bio-remediating drill cuttings at the drilling site
- The pilot test involved the surface, intermediate and lateral section of a North Dakota, Bakken Formation oil well.
- The goal of the pilot test was to significantly reduce the total petroleum hydrocarbons (TPH), sodium absorption ratio (SAR) and pH so that the cuttings can be utilized for reclamation material.
- This pilot test was conducted under the authorization of the Oil and Gas Division of the North Dakota Industrial Commission, Bureau of Indian affairs and the BLM.
- On-site remediation of the drill cuttings will help to eliminate or reduce the need for fly-ash treated pits that are currently being buried within the Williston Basin.
- It will also eliminate or reduce the need to transport cuttings to disposal areas, reduce fugitive dust by reducing truck traffic and reducing traffic congestion on the roads.

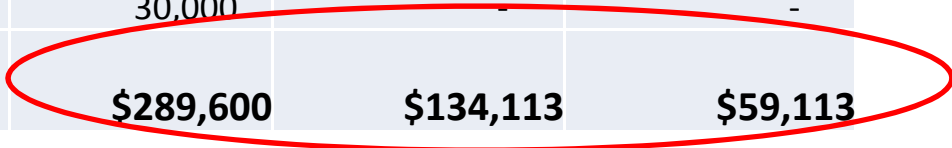


EcoSponge & CE System vs. Conventional Solids Control & Cuttings Process

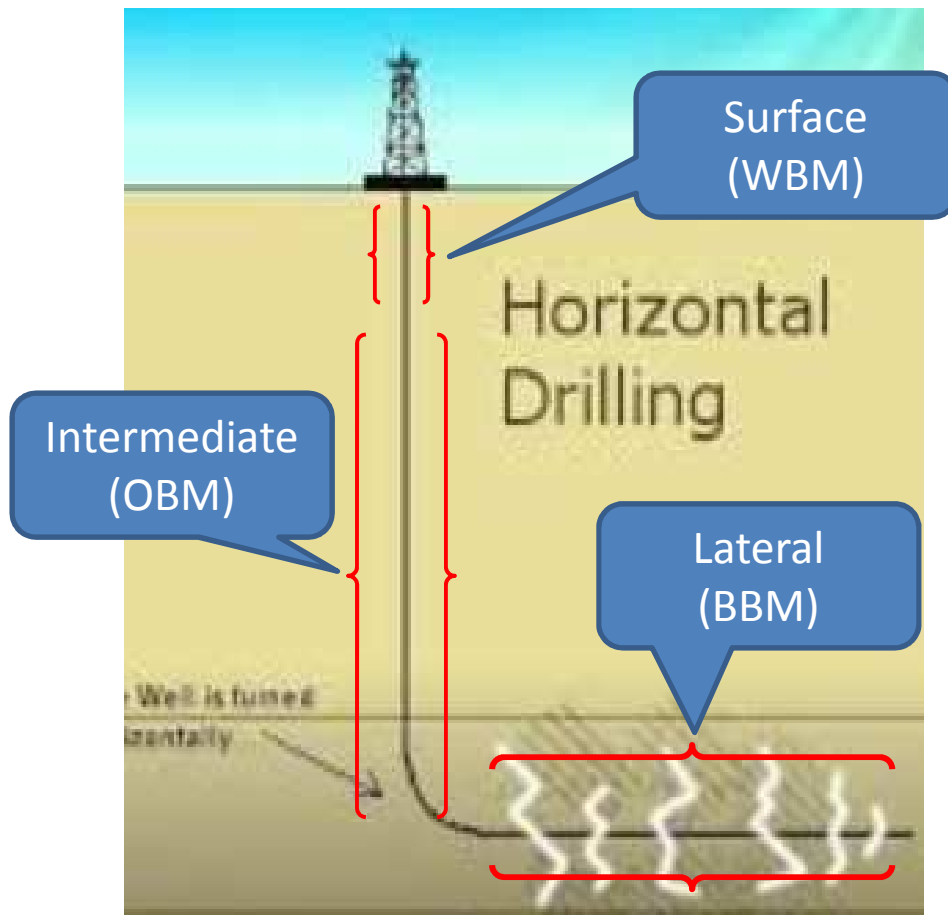
Traditional Solids Control vs. Confluence Energy (4 well average)

Item	Rig 336	Rig B17	Rig 36
Pit or CCA	-	-	2,000
Fly Ash (\$240 per bag)	28,600	-	-
Eco Sponge	-	7,280	7,280
Conventional Solids	90,000	-	-
Confluence Energy System/Well	-	120,833	120,833
Labor Solids Control (2 Hands)	30,000	-	-
Fill Eco Pod	-	-	-
Testing/Monitoring	-	1,000	1,000
OBM Recovery (Average Recovery over 4 wells)	-	(72,000)	(72,000)
Hauling Costs (40% reduction)	111,000	77,000	-
Super Sucker Costs	30,000	-	-
Total Cost	\$289,600	\$134,113	\$59,113

This Rig did NOT use CE system



Well Sections



- Water based drilling fluid is used in Surface
- Oil based fluid is used in the Intermediate
- Saturated brine drilling fluid is used in Lateral

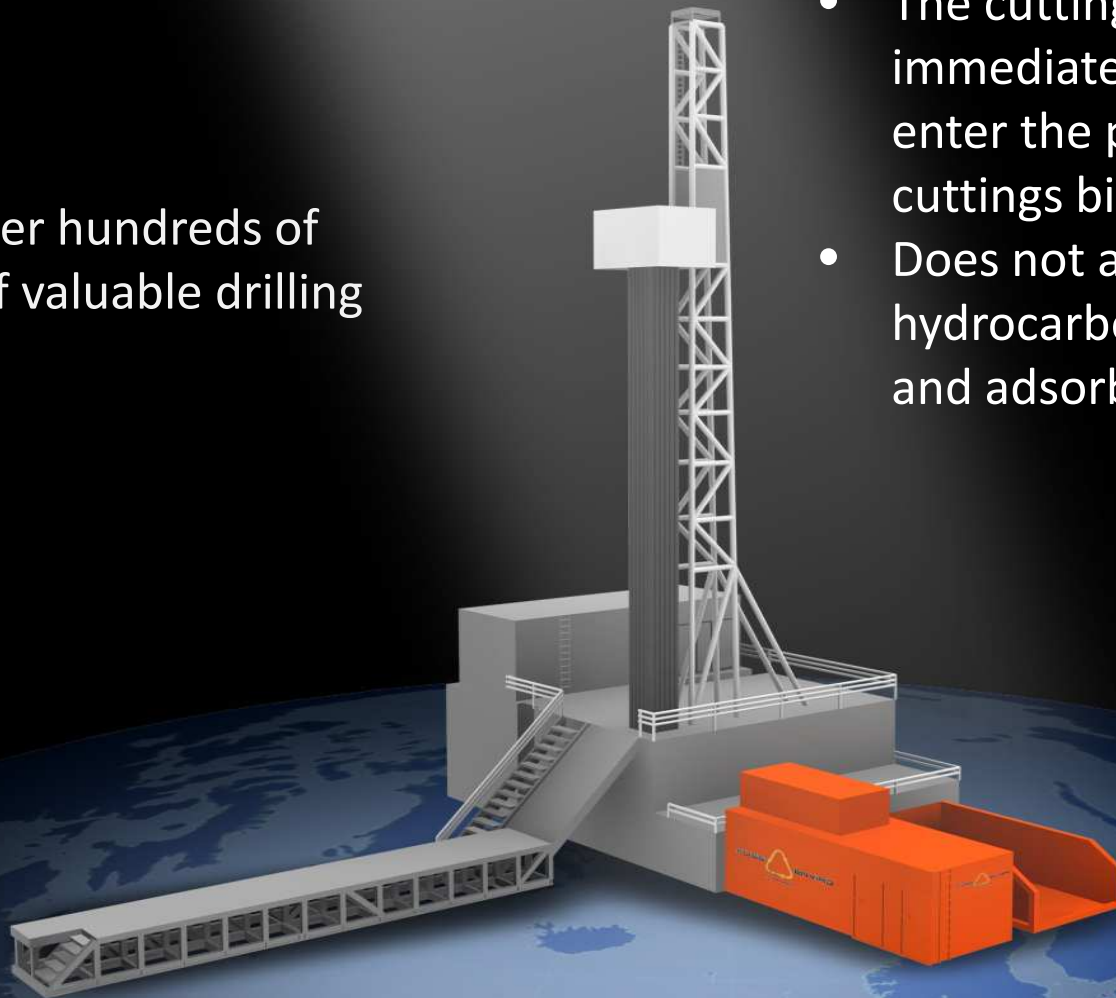


Mechanical Treatment

- Mechanical process of WMB, OBM and brine based drilling fluid is used to reduce hydrocarbon and Chloride concentrations in cuttings
- Immediately treat to reduce adsorption / Absorption
- The lower contamination levels require less bioremediation
- Recovery of valuable drilling fluid is sent back to active system

- Recover hundreds of bbl. of valuable drilling fluids

- The cuttings are treated immediately as they enter the primary cuttings bin
- Does not allow hydrocarbons to saturate and adsorb to minerals



Premium Bioremediation & Absorbent

EcoSpongeTM
FAST-ACTING ABSORBENT



- Fiber based
- Patented cocktail of 1st generation microbes (Bacterial & Fungal)
- Set of micronutrients
- Absorbs and Solidifies



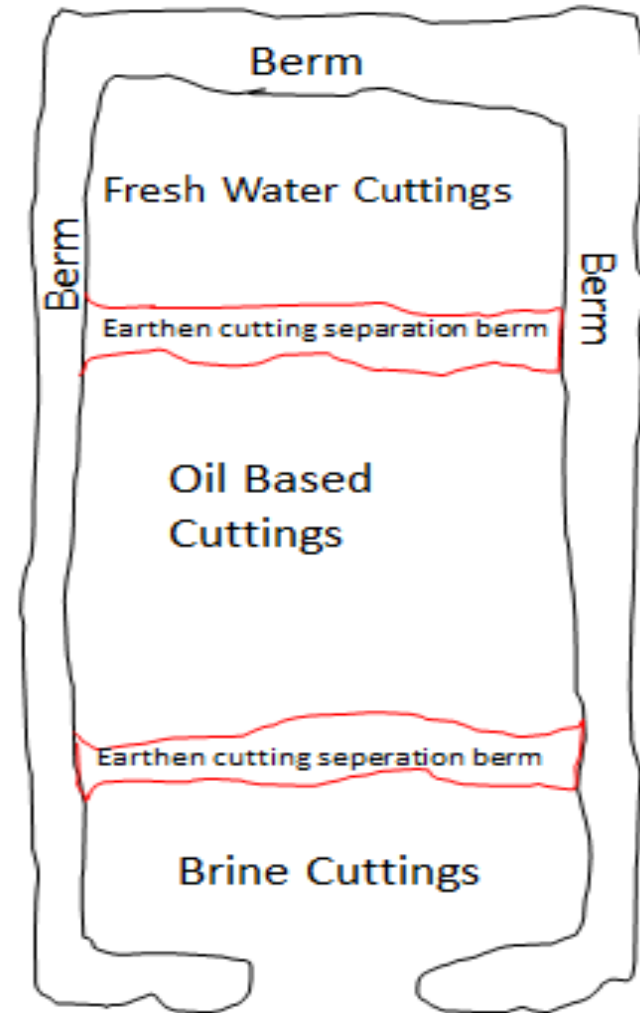
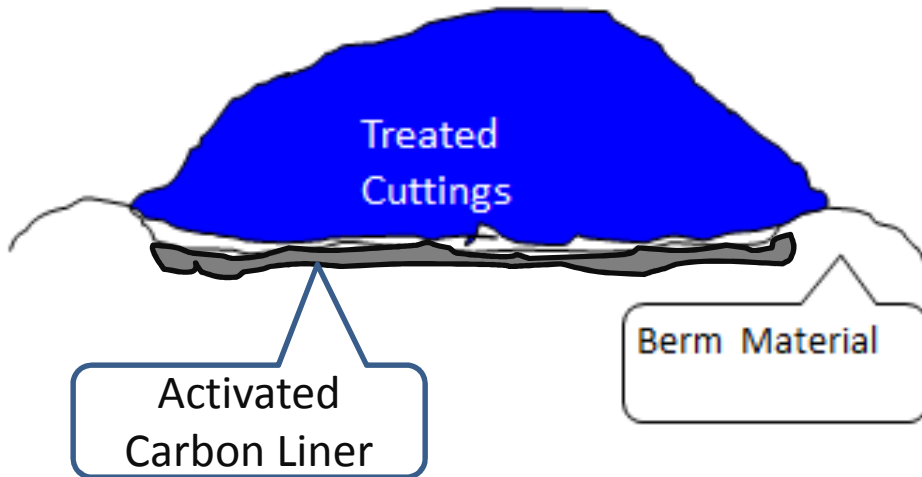
Cuttings are Loaded into a Cuttings Containment Area

Eliminates Plastic Liners

Activated Carbon
Liner Under
Containment area



Cutting Containment Area (CCA)

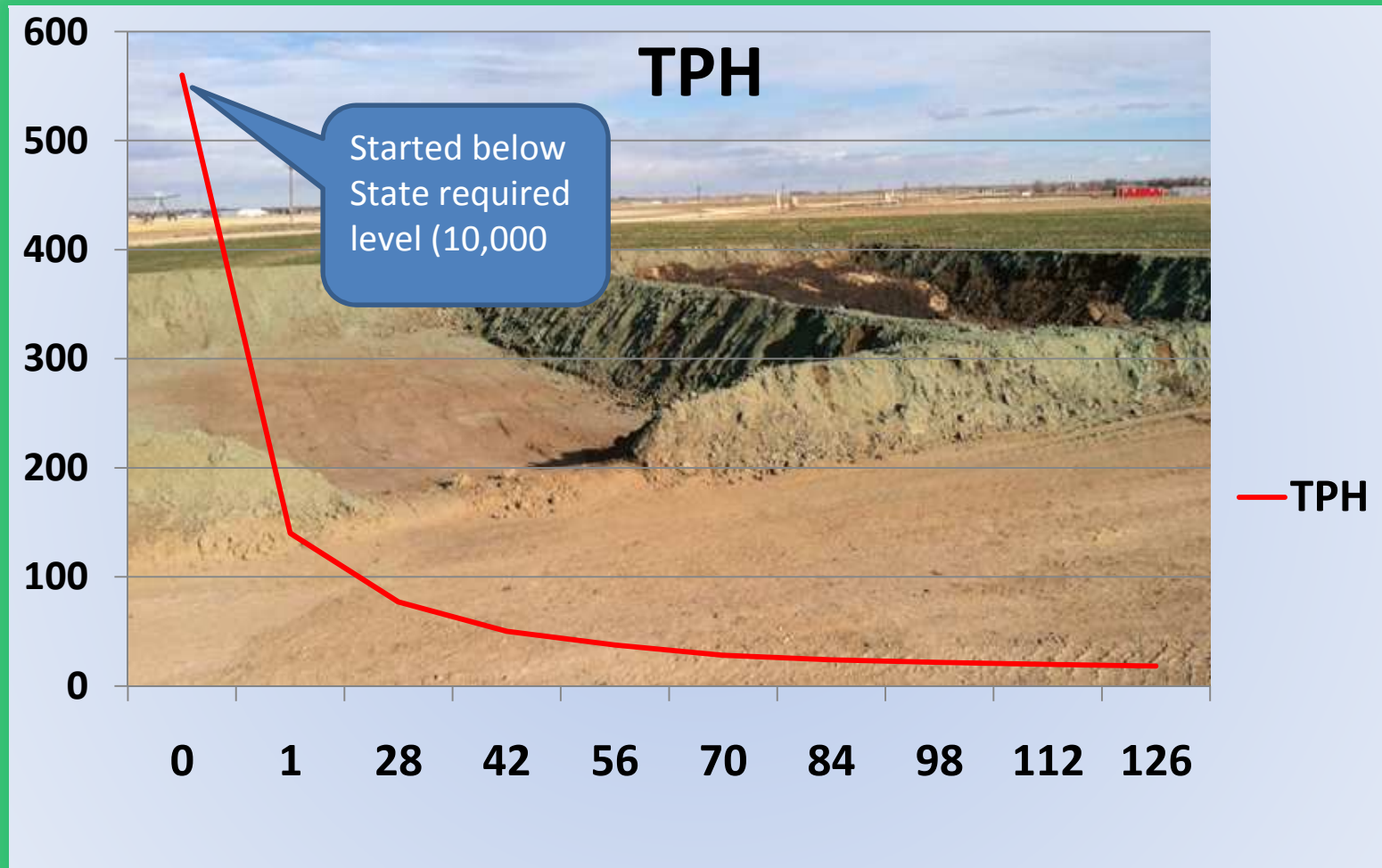




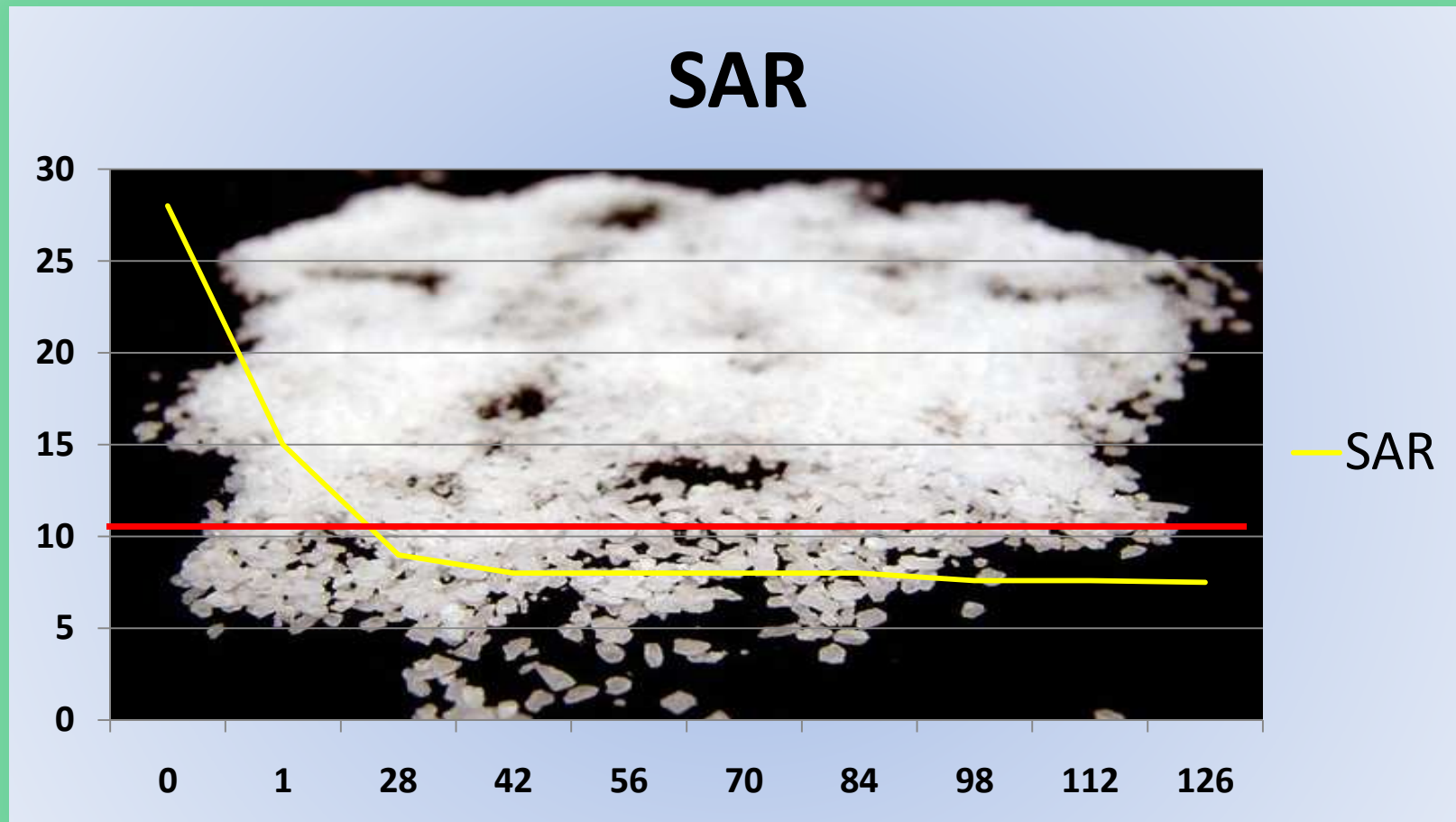
WBM Cutting Issue

- Elevated Chlorides (SAR 18 to 24)
- PH ranges in the 9.5 to 10
- TPH not an issue
- Cutting are typically very soupy

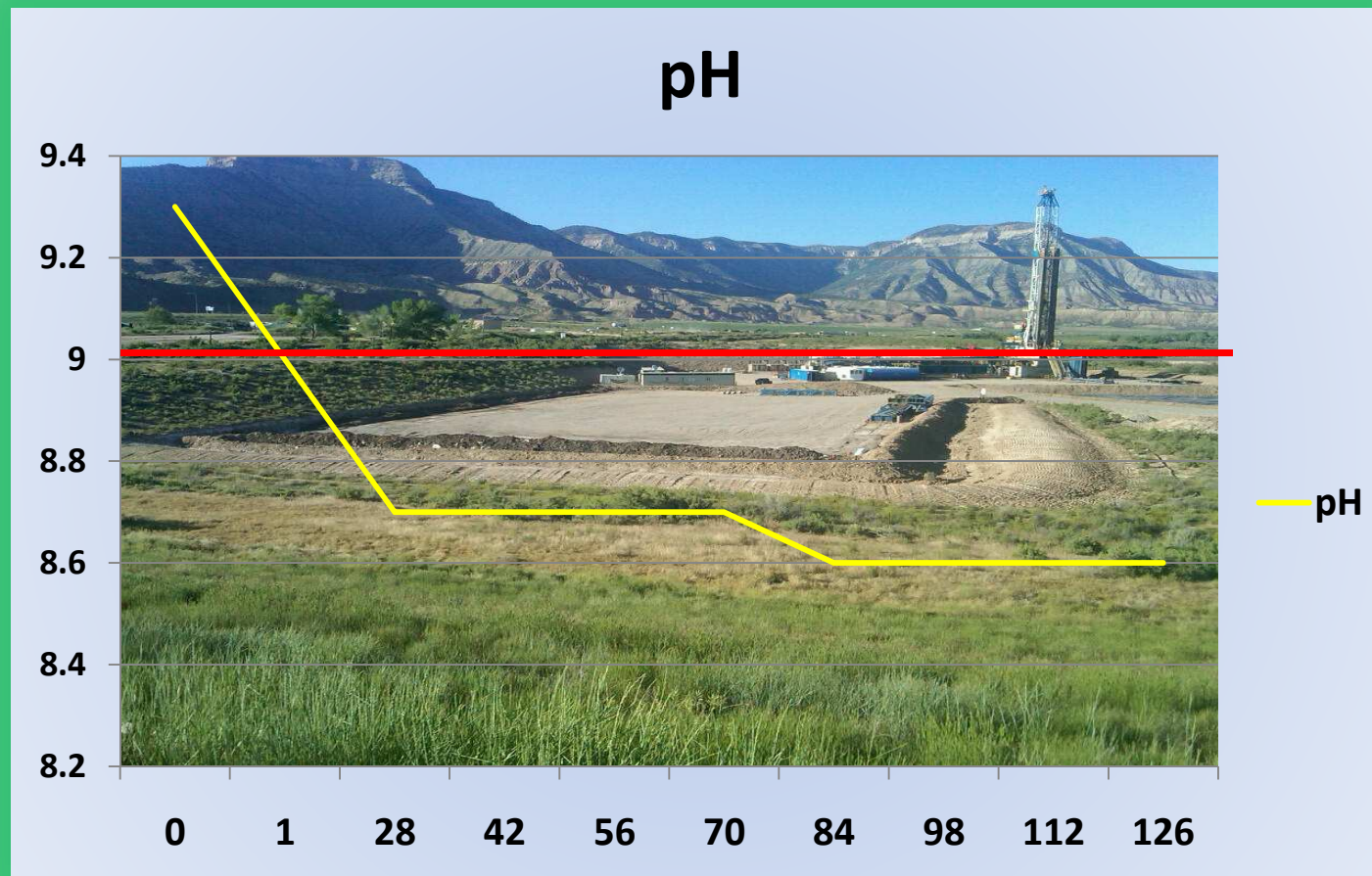
TPH Results (WBM)



SAR Results (WBM)



pH Results (WBM)

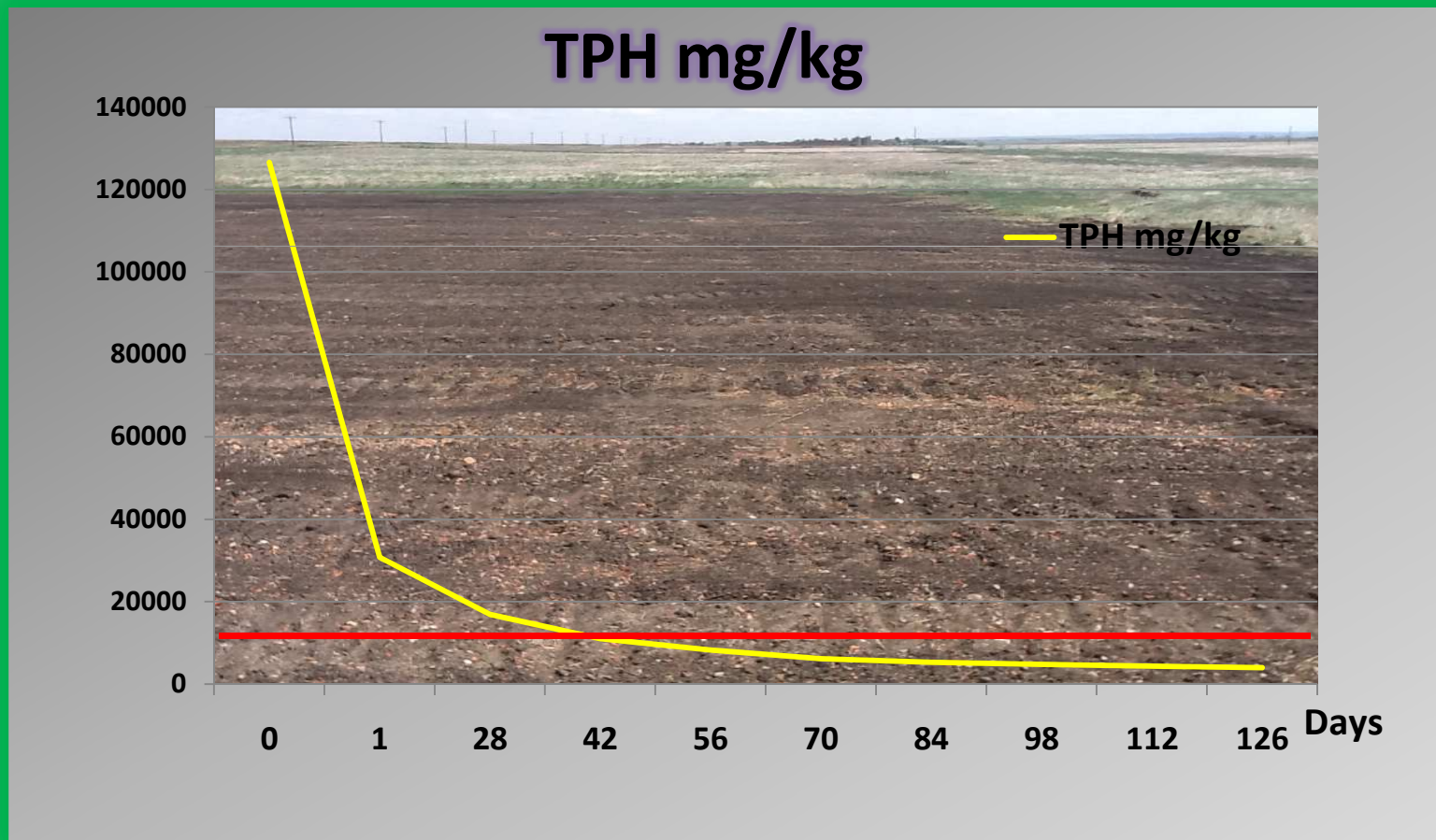


Issues With Invert Cuttings

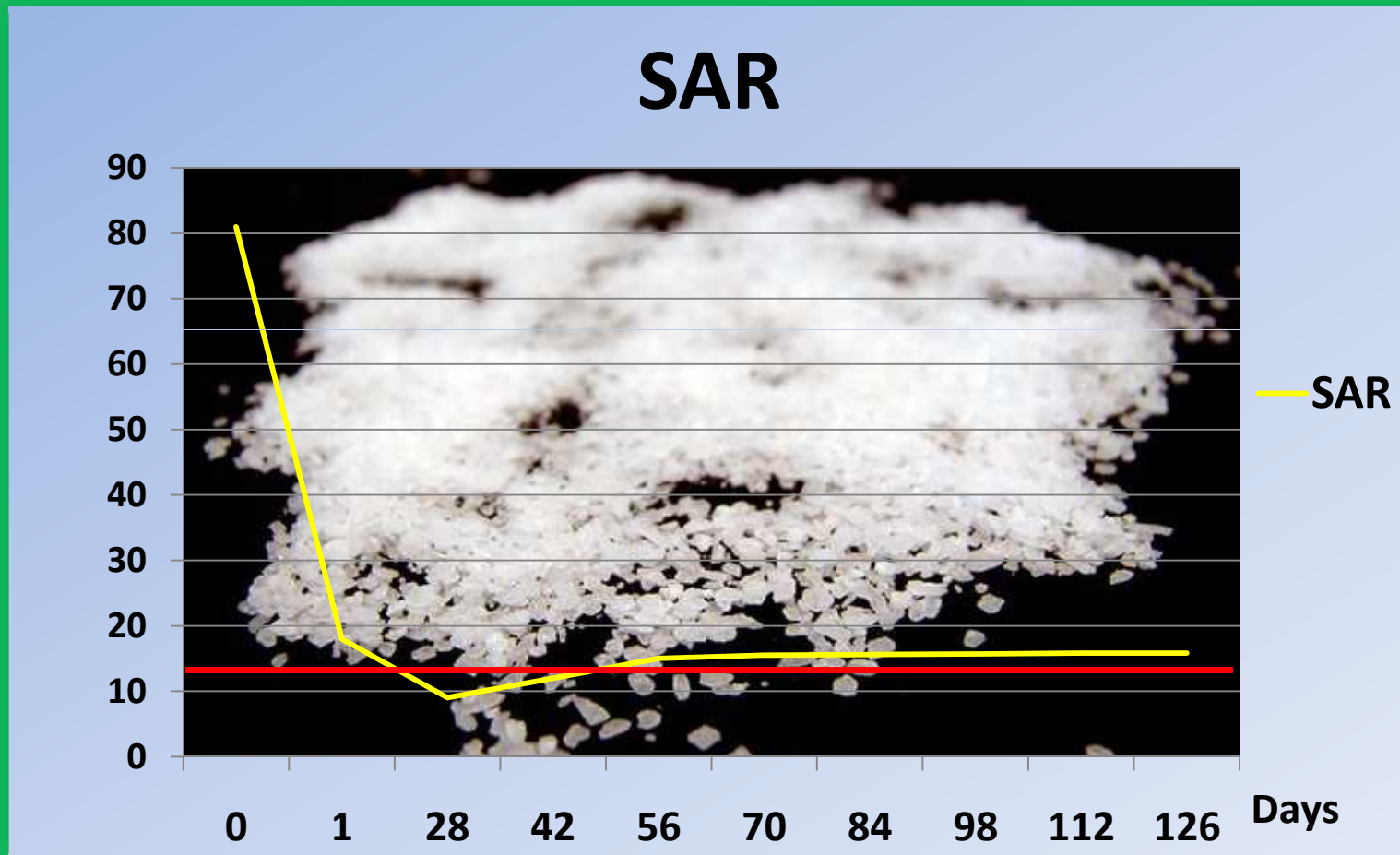


- Elevated Hydrocarbons. Most of it in the DRO range (90,000+ PPM TPH) off the rig shakers
- High SAR (25 to 40)
- pH in the 9.5 to 10.2 range

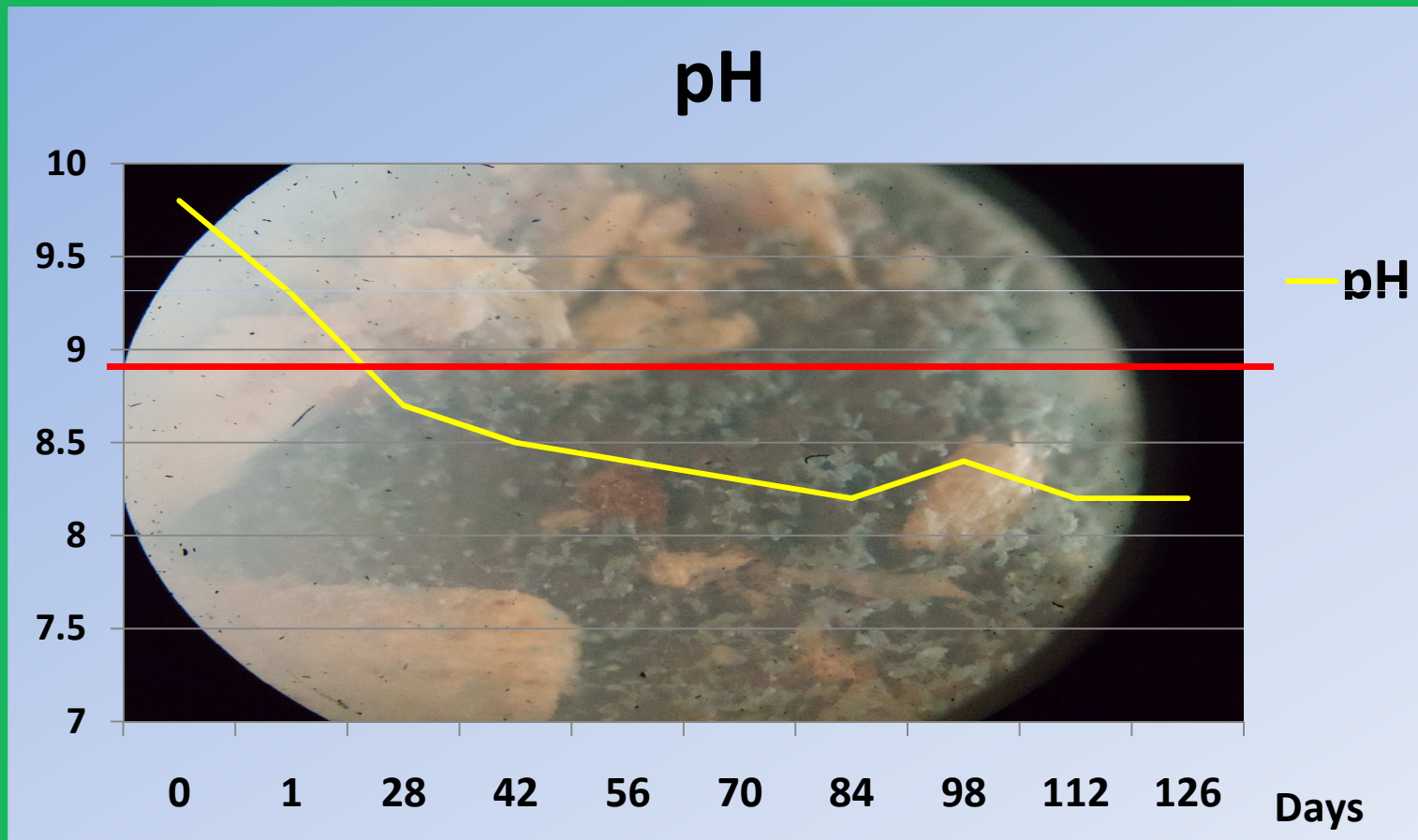
Invert Cuttings Results



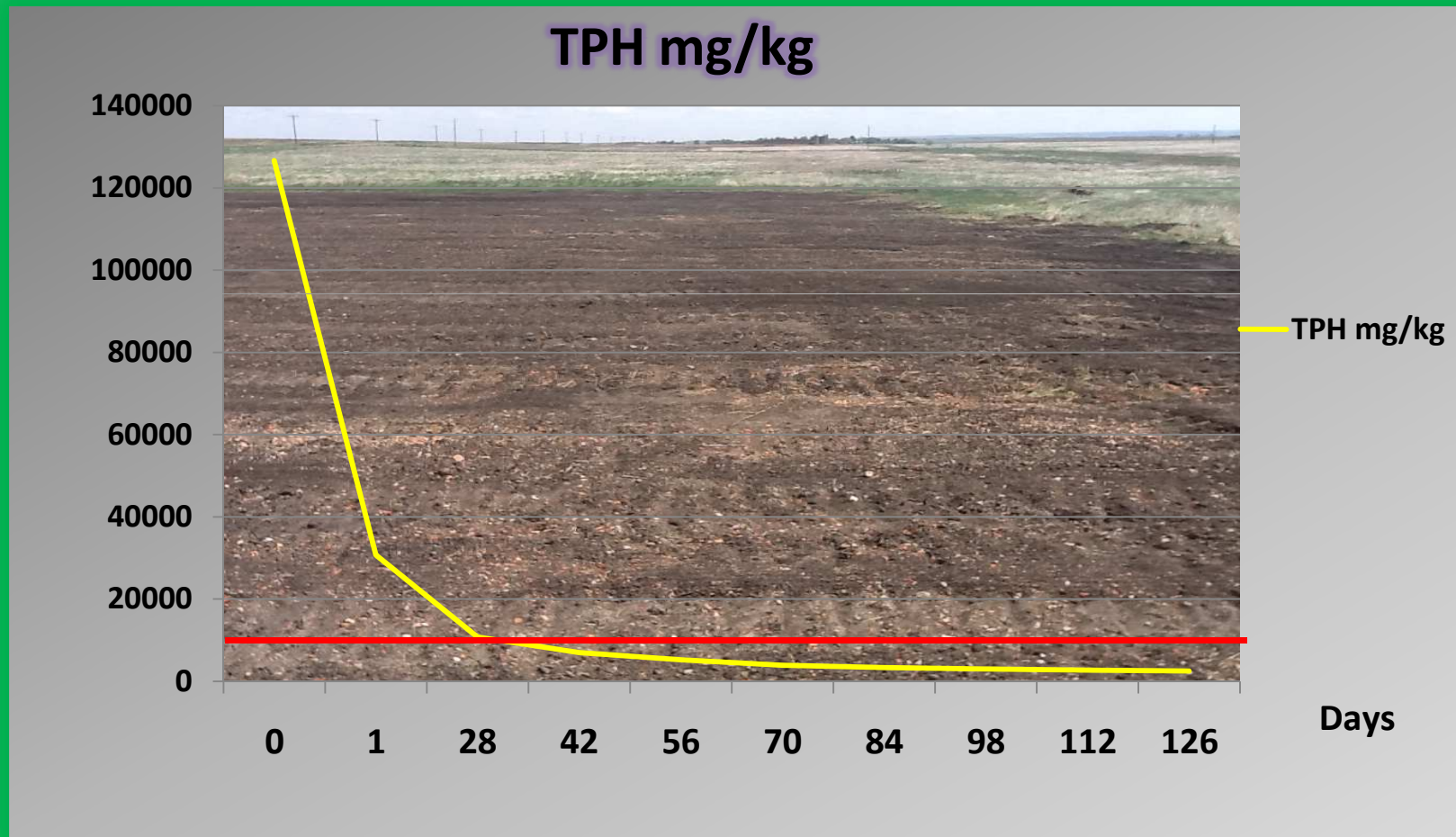
SAR Results



pH Balance



TPH Result (OBM Bench Test W/Surfactant)

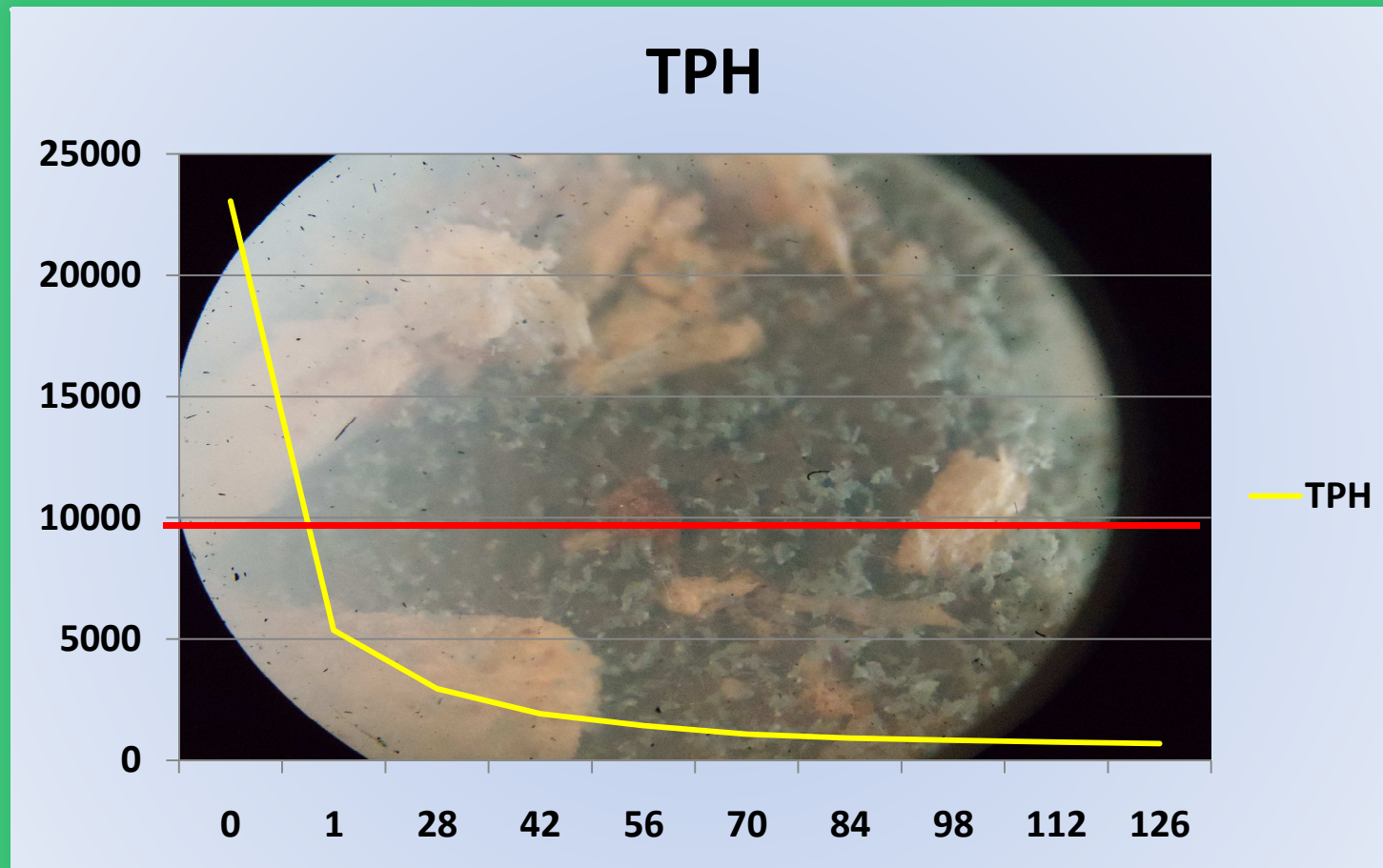




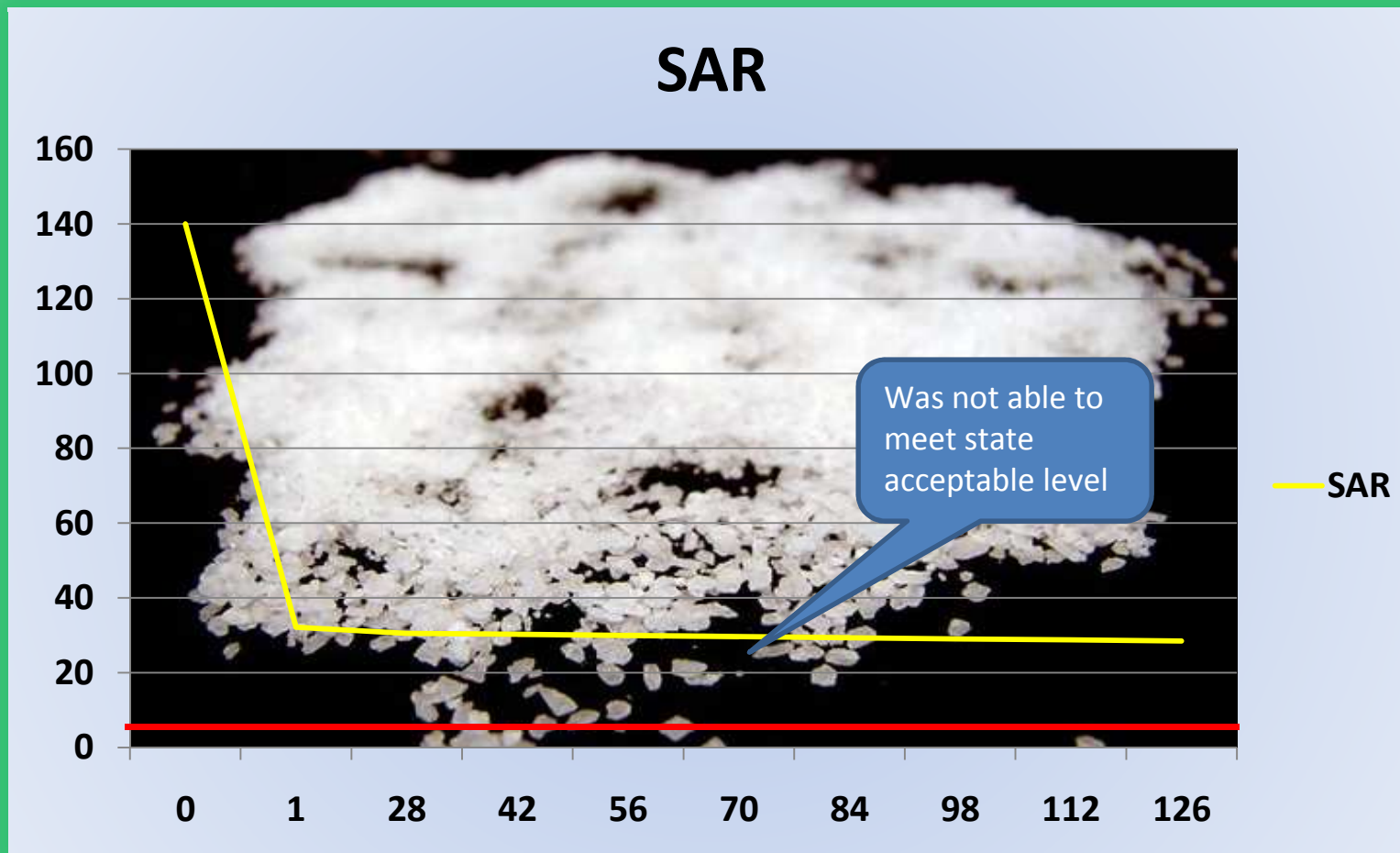
Brine Based Drilling Fluid Issues

- Elevated Hydrocarbons. Most of it in the crude range (15,000 to 30,000 PPM TPH)
- Extremely High SAR (70 to 140+)
- PH in the 9.3 to 9.9 range

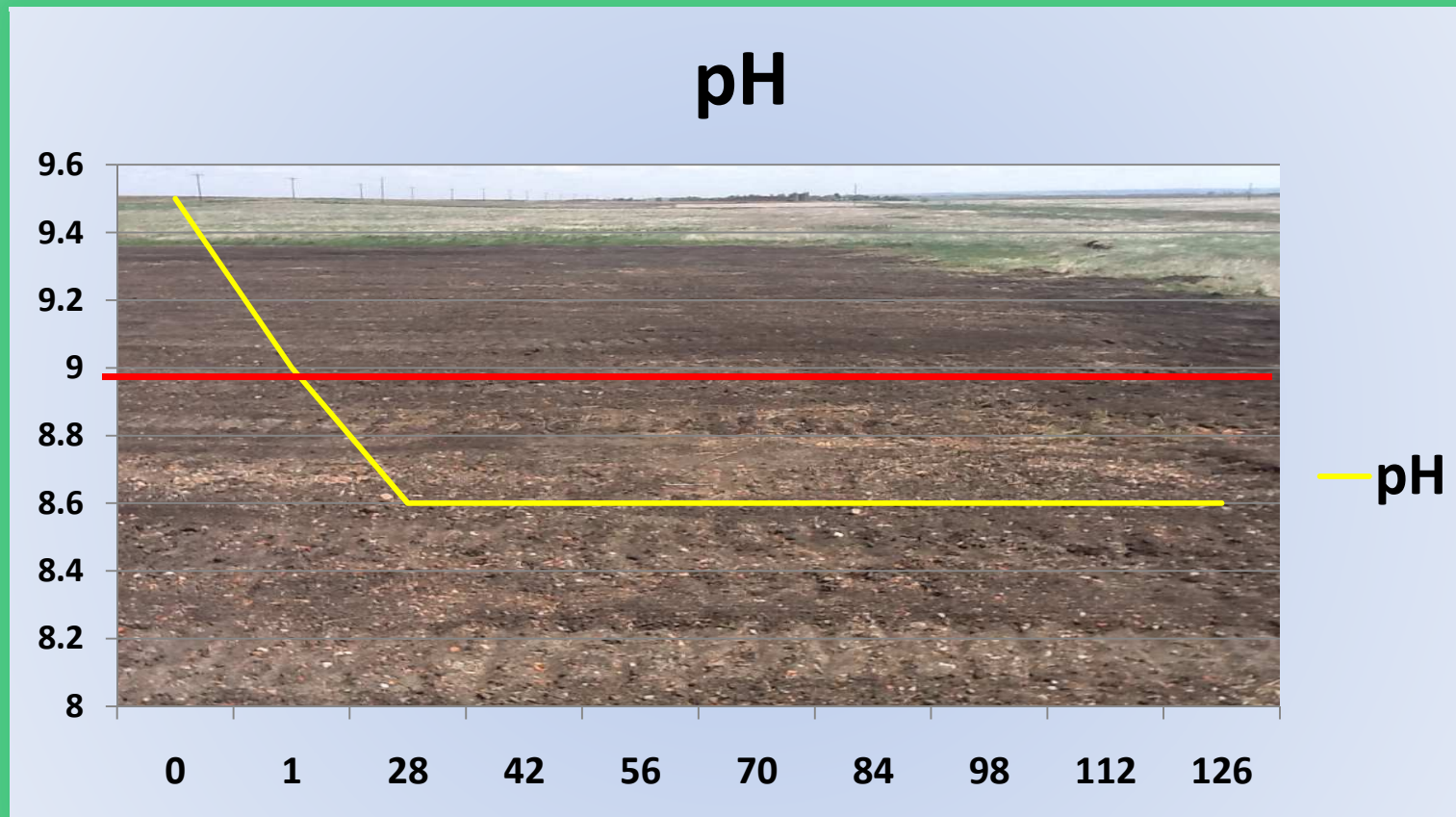
TPH Result (BBM)



SAR Result (BBM)



pH Results (BBM)





Interim Reclamation

- Cuttings will be mixed with spoils pile
- Spread across the face of the pad site under the top soil
- Site is seeded with native grasses
- Hydro seeding or top cover applied



Good and the Bad (Takeaways)



Good

- 80% of the cutting meet state acceptable level to allow operator to leave the cutting on site with no burial or hauling
- Significant cost saving to the operator
- Easier to execute than a pit burial or haul and dispose

Bad

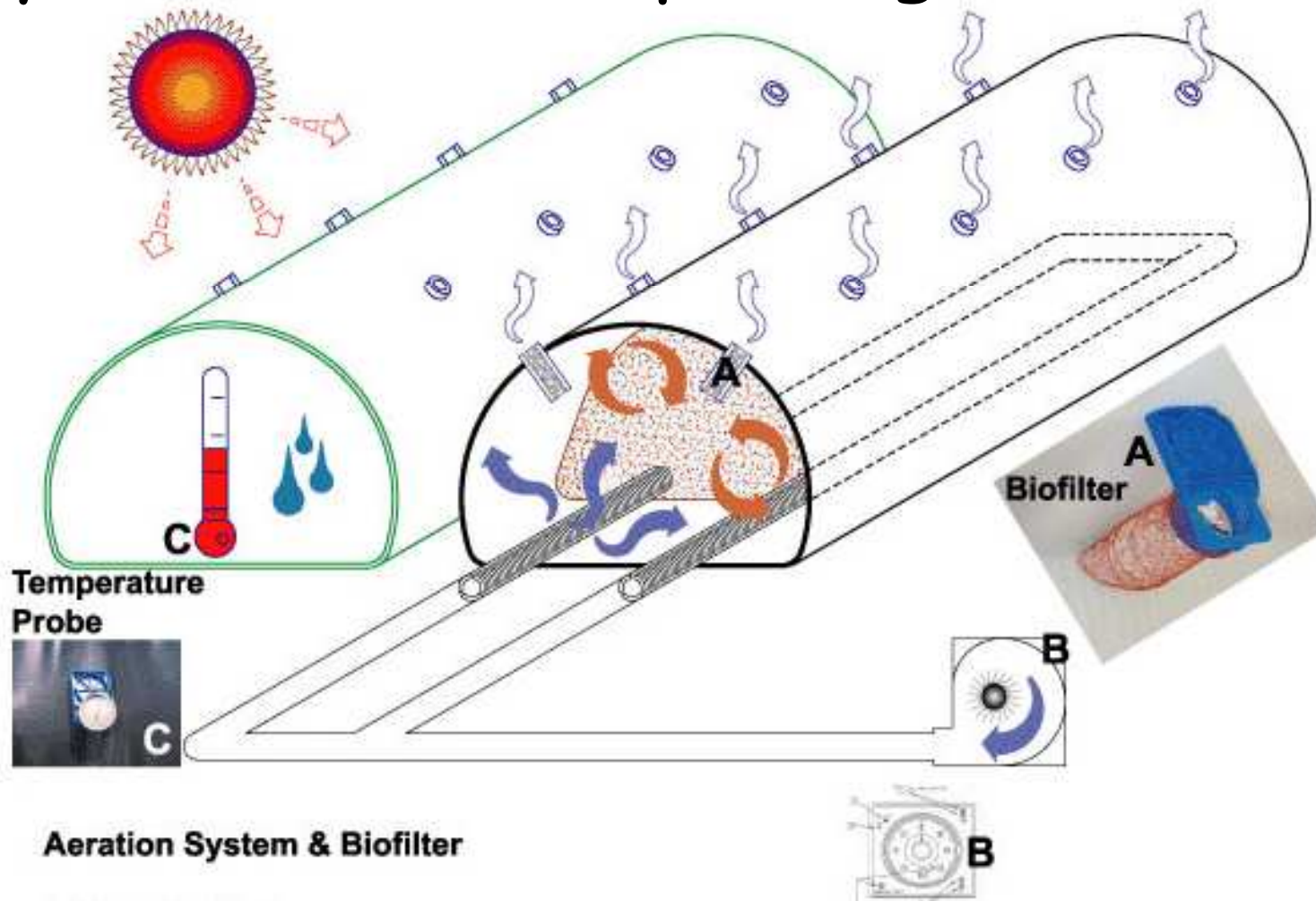
- The BBM did not meet state requirements for SAR and had to be hauled to disposal
- Rules changed and the DOH vs. the NDIC are now the regulatory oversight regarding onsite treatment.
- First 2 pilots completed in ND showed significant reductions in TPH, SAR and pH but did not meet state requirements within 60 days

Elevated Hydrocarbon / Moisture Control Issues

**Extreme
Situations**



Mechanical Aeration and Hydrocarbon Composting





Hopper Mixer





Ancillary Benefits of on Site Treatment

- The reduced product requirements (stuff hauled in) and reduction or elimination of cuttings that need to be hauled will:
 - **Reducing truck traffic congestion**
 - **Reduce fugitive dust**
 - **Reduce CO emissions**
- **The application of fly ash is a very dusty process.** The small particle size leads to much of the product getting airborne during application, creating incremental fugitive dust which is:
 - **A health hazard**
 - **Environmental hazard**

EcoChar Water Treatment System



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Treating Brine Drilling Fluids

Issues:

- Operators currently dispose of brine drilling fluids after each well drilled
- Disposal can be expensive (\$35 to \$55 per bbl.)
- New batch drilling can create need to re-use brine fluid
- Can be up to 5% organics
- Environmental issues created with the disposal of the drilling fluids

Affordable Carbon (GAC) Treatment



- Simple Liquid phase vessel
- 2 cubic yards
- Utilizes 2 x 3 inch on-site pump
- Treats 1200 bbls. of brine drilling fluid
- Disposal of 2 yards of solids @ \$140 vs. \$35k+ per well





Treatment of Brine Drilling Fluids

- Utilize simple low cost A/C filter cartridge to clean the TSS, organics and some TDS from the fluids (removes lubricants)
- Creates ability to utilize same brine fluid several times before disposal
- Cost is about \$.75 per bbl. vs. \$35+ bbl. to dispose and replace
- Simple and easy to utilize

Thank

You



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