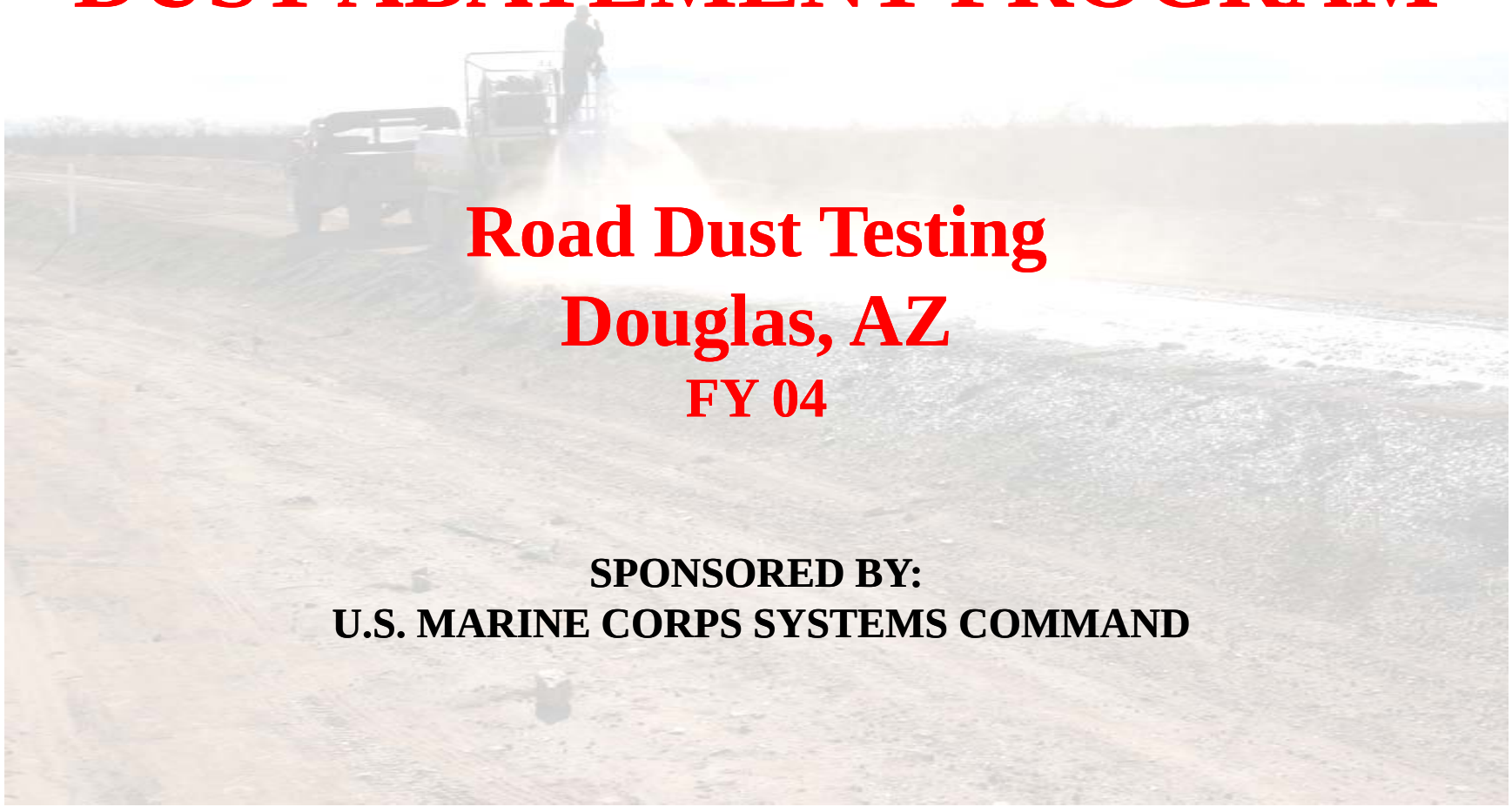
DUST ABATEMENT PROGRAM



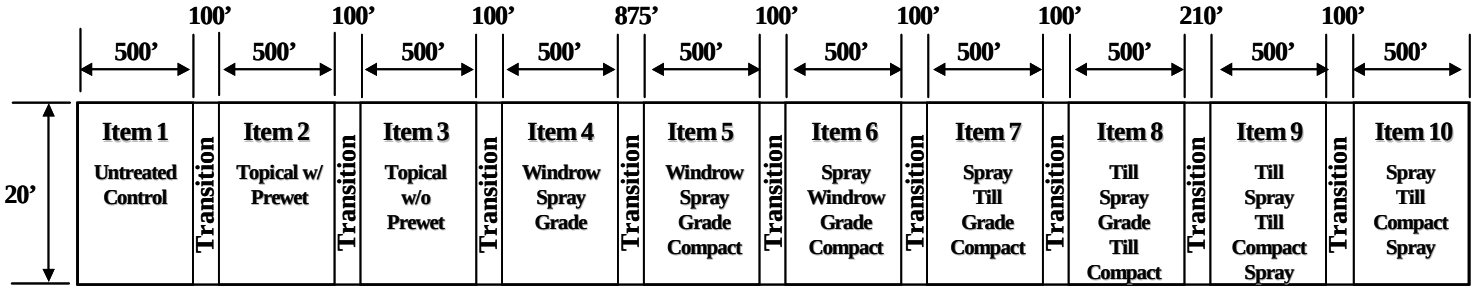
Road Dust Testing
Douglas, AZ
FY 04

SPONSORED BY:
U.S. MARINE CORPS SYSTEMS COMMAND

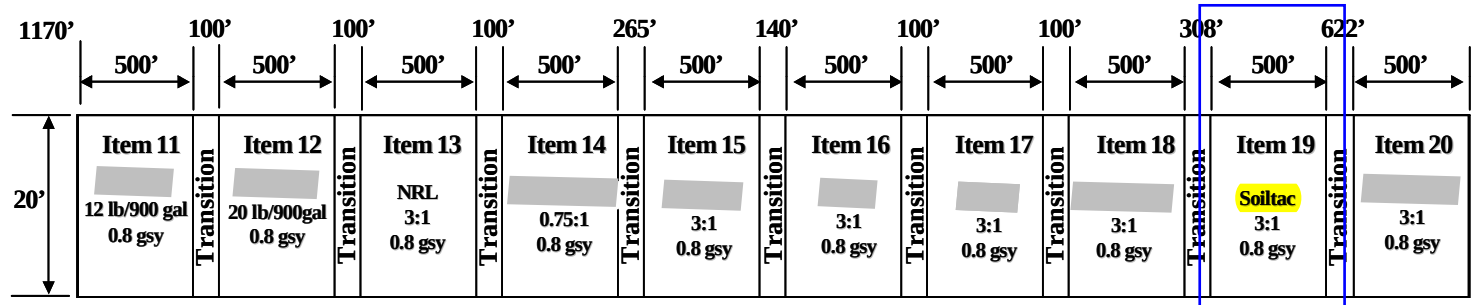
Demonstration of Application Technologies

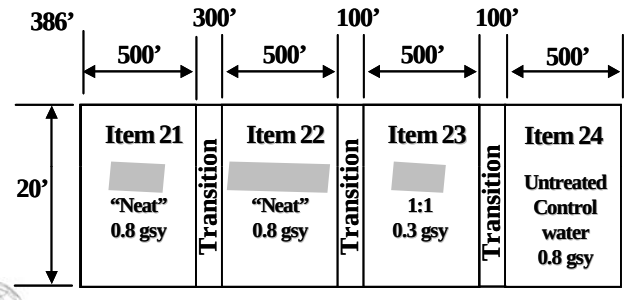
SUSTAINMENT PALLIATIVE DISTRIBUTION SYSTEM

Douglas, AZ, April - 2004



CONSTRUCTION PROCESSES PLAN





PALLIATIVE EVALUATION PLAN

Not To Scale

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General Road Condition

All sections were freshly graded prior to construction and product application

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Site Layout

- 500 ft x 20 ft test sections
- Marked with traffic delineators
- Untreated transition areas separating sections

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Evaluation of Construction Procedures

Section	Palliative	Method	Manpower	Time (min)
1	Water	Spray/Compact	4	60
2		Prewet/Spray/Compact	4	180
3		Spray/Compact	4	105
4		Windrow/Spray/Grade	4	42
5		Windrow/Spray/Grade/Compact	5	48
6		Spray/Windrow/Grade/Compact	5	48
7		Spray/Till/Grade/Compact	6	78
8		Till/Spray/Grade/Till/Compact	6	136
9		Till/Spray/Till/Compact/Spray	5	125
10		Spray/Till/Compact/Spray	5	46
		Range of Values:	**4 to 6**	**42 to 180**

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Topical Applications

- Surface peeling
- High concentration of product on surface
- Product runoff

Windrowing with Motor Grader

- Product does not penetrate core of windrow
- Difficult to achieve uniform distribution
- Final road surface easily disturbed

Tilling with Rotary Mixer

- More even product dispersion
- Unnecessary to till before spraying surface
- Grading can expose untreated areas
- Excess surface moisture can lead to peeling during compaction

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Recommended Construction Process

- Spray half of product onto surface
- Immediately till to a depth of 3 in. with a rotary mixer
- Follow with compactor
- Spray remaining product

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Dust Palliatives

Section	Product	Contact	Company	Dilution Ratio	Application Rate
11				12 lb/900 gal	0.8 gsy
12				20 lb/900gal	0.8 gsy
13	NRL	Dr. James Wynne	NRL	3:1	0.8 gsy
14				0.75:1	0.8 gsy
15				3:1	0.8 gsy
16				3:1	0.8 gsy
17				3:1	0.8 gsy
18				3:1	0.8 gsy
19	SoilTac	Chad Falkenberg	Soilworks, LLC.	3:1	0.8 gsy
20				3:1	0.8 gsy
21				Neat	0.8 gsy
22				Neat	0.8 gsy
23				1:1	0.3 gsy
24	Water			-	0.8 gsy

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- **Powdered polyacrylamide**
- **12 lbs in 900 gal water**
- **Viscosity too high to spray through distribution bar**

- Powdered guar gum
- 20 lbs in 900 gal water
- Product did not completely dissolve
- Small balls clogged spray nozzles during application

- **Acrylic polymer emulsion**
- **Foam began overflowing hydroseeder when tank was approximately half full**
- **Problem may be reduced by adding emulsion last**

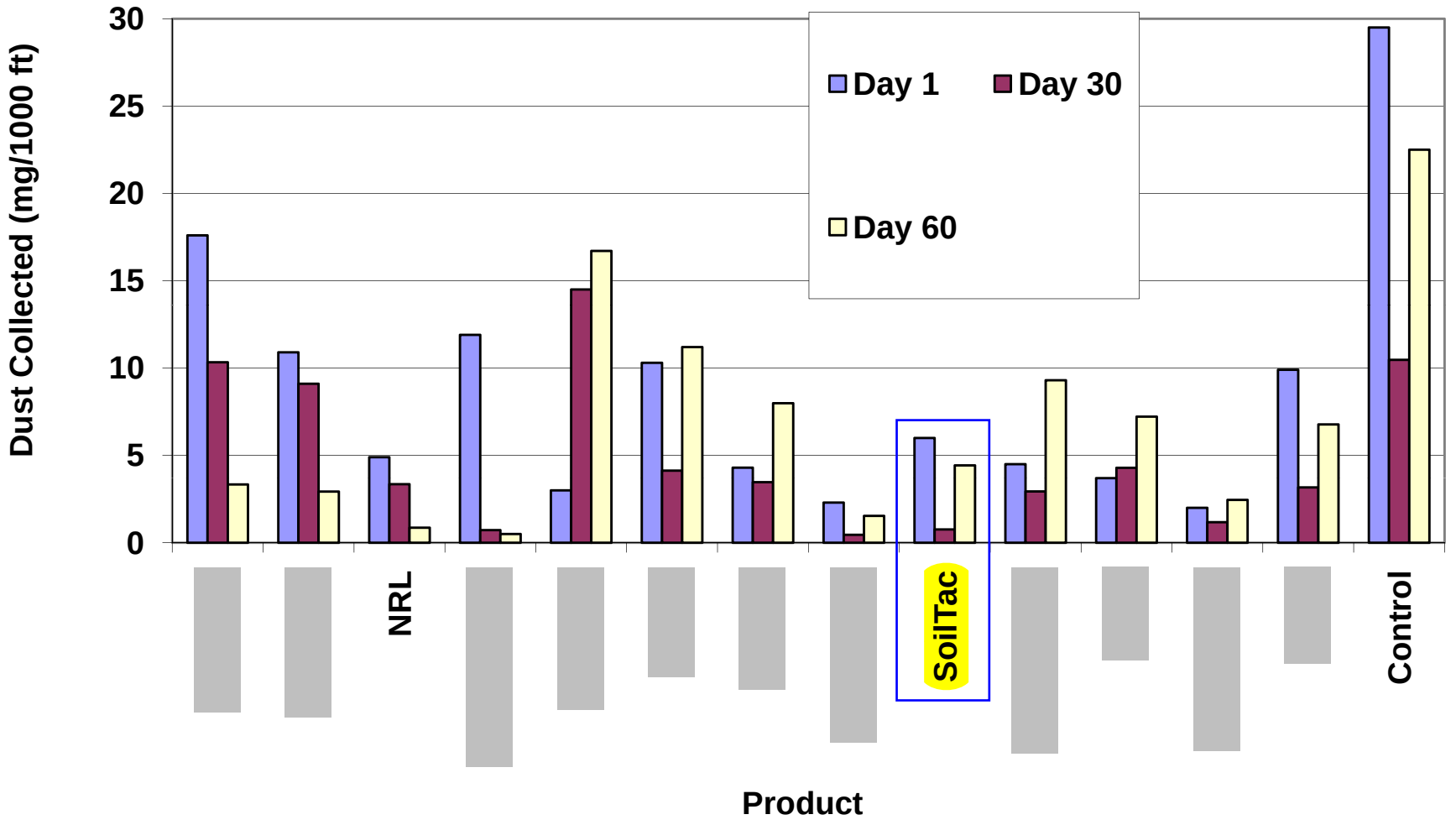
- **Synthetic oil-based product**
- **Viscosity too high to spray with distribution bar**

- Slow setting cationic asphalt emulsion
- Section pre-wet prior to application
- Product delivered in heated tanker and applied with distribution bar
- No compaction performed on section

Midwest Research Institute Data Collection

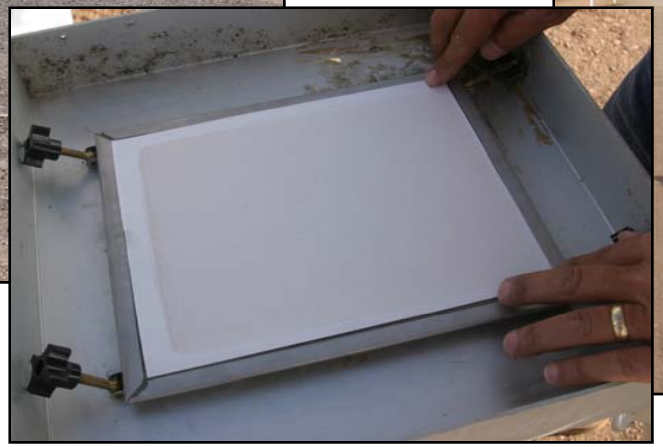
- State of the art dust collection system
- Remote controlled
- 25 mph travel speed
- Universal mounting system

MRI Dust Collection Results



ERDC Data Collection

- Stationary dust collectors positioned on the downwind side of test section
- Ten passes with test vehicle traveling at 30 mph
- In-situ soil property measurements



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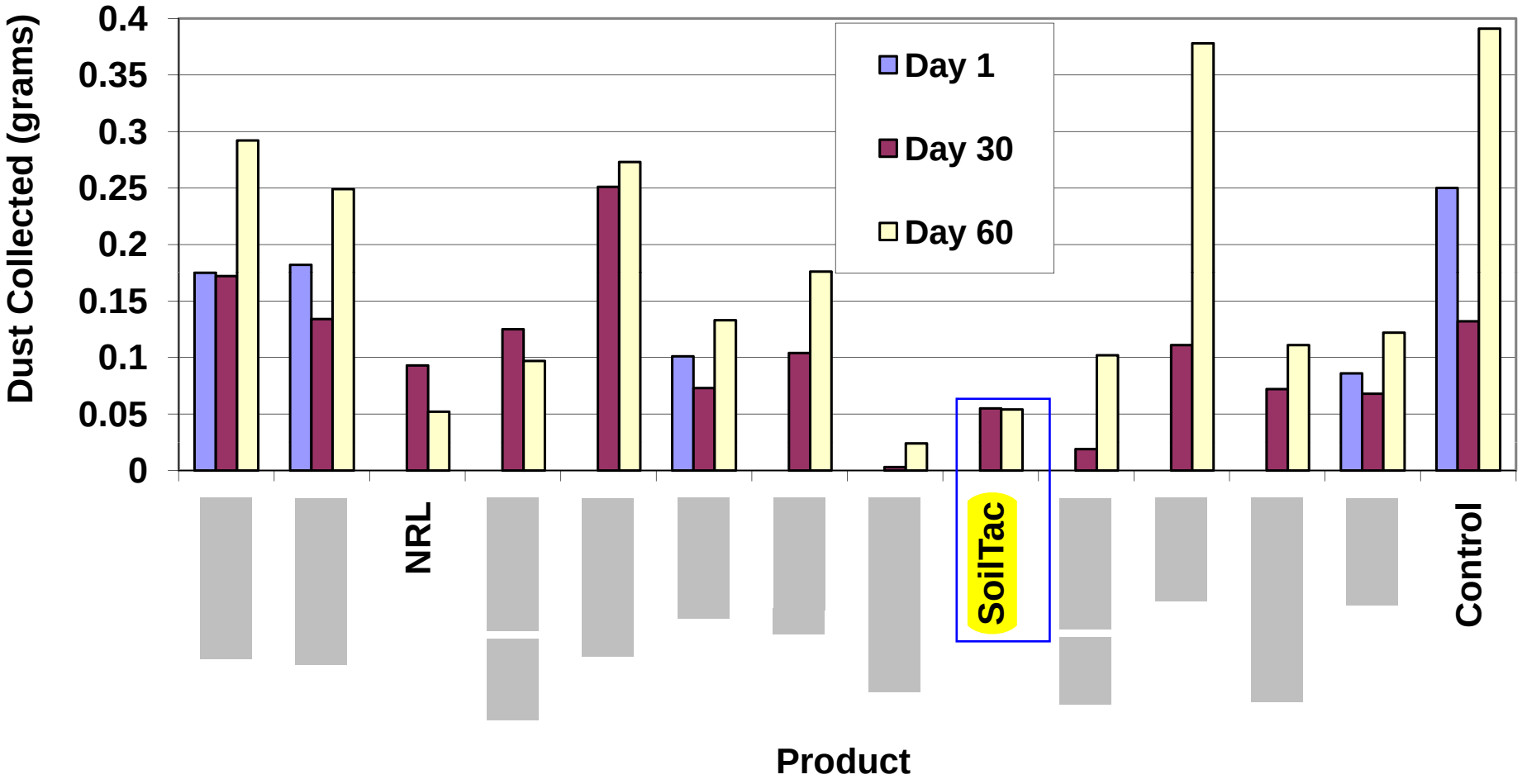
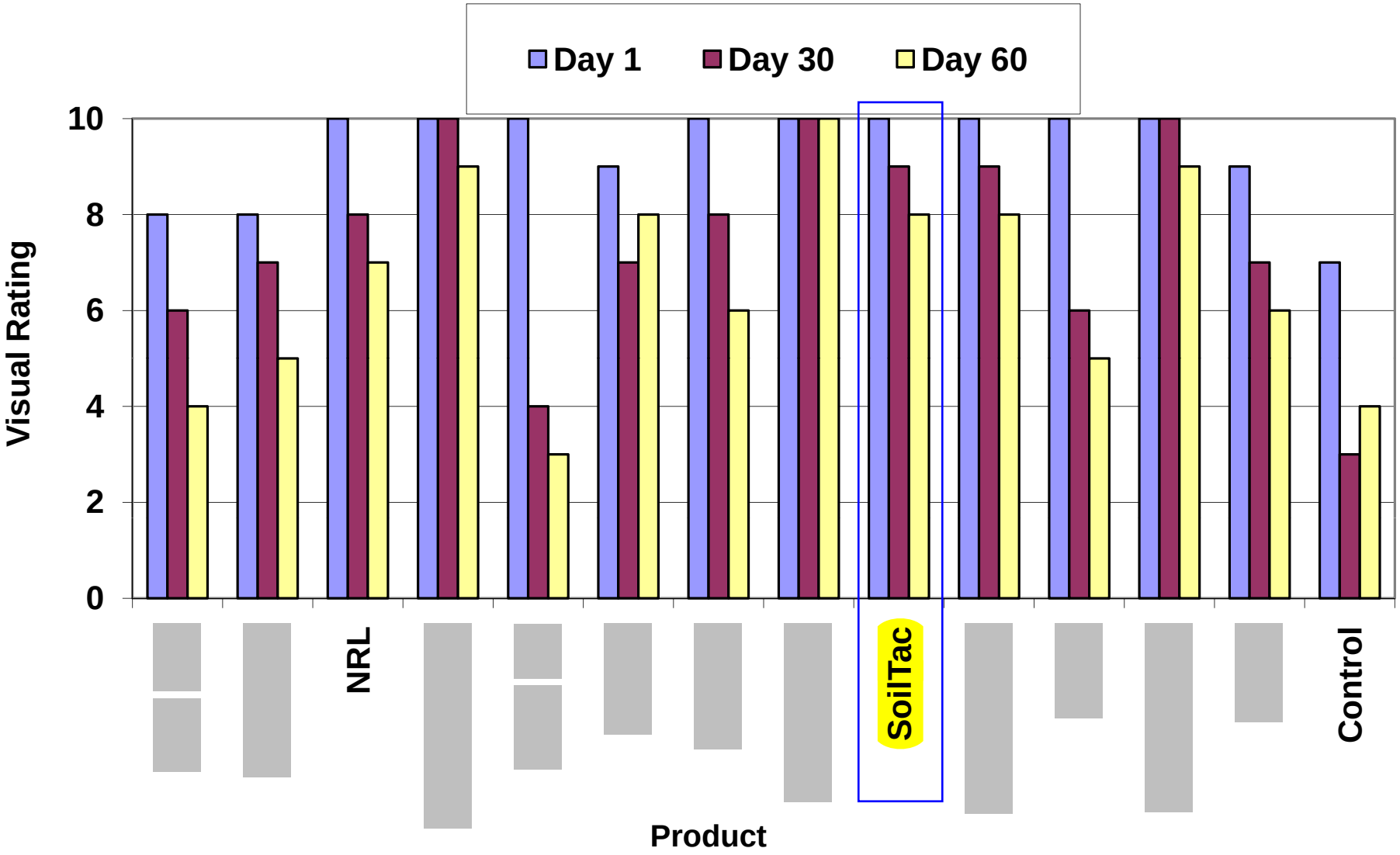
ERDC Dust Collection Results



ERDC Visual Observation Rating



Preliminary Conclusions

- **Distribution bar - limited to 10gpm nozzles. Applied at idle speed, low range. Increased size will improve operation. Uniform application rate obtained.**
- **Product build-up on hydroseeder engine due to over-spray/misting during application.**
- **Adequate mixing could not be achieved using motor grader.**
- **Compaction was necessary for optimum performance but caused problems with wet surfaces.**
- **Rotary tiller provided means to incorporate product to desired depth.**
- **Final surface application after compaction provided sealed wearing surface.**

Preliminary Conclusions

- Water soluble polymers are limited to low concentrations due to large viscosity increase.
- Starch/sugar and chloride salt based products are performing good.
- Lignosulfonate products provided little soil cohesion and are performing good to fair for dust abatement.
- Oil based products provided little soil cohesion however are performing well in preventing dust.
- Polymer emulsions show increased strength of surface and are performing from excellent to good for dust abatement.

Evaluation of HMMWV Distribution System

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Evaluation of HMMWV Distribution System

- Excellent system for use in military operations
- System provided uniform distribution of material from a compact, user-friendly machine
- Recommendations were made to the manufacturer for changes that would enhance the performance for needed applications
- Some changes include:
  - Noise control
  - Throttle adjustment
  - Pressure control
  - Increased flow rate
  - Larger fuel tank
  - Recirculation/agitation in tank
  - Anchor points to HMMWV
  - Detailed operators manual