Evaluation of Water Quality Impacts from Dust Suppressants

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Project Participants

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Topics of Discussion

- Selection of Suppressants to be tested
- Selection of soil types
- Precautions taken to ensure defensible results
- Development of specific Test Procedures
- Evaluation of Results
- Reporting



Objectives

- Determine the water quality impacts of each dust suppressant in a simulated real world environment
- Focus on products typically used in the desert Southwest
- Focus on construction activity, as opposed to road or pile surface stability



Suppressants Selected for Study

Product	Manufacturer	Туре	Product-to- Water Ratio	Application Rate
Chem Loc 101	Golden West	Surfactant with	1.0 gallon per	4,000 gallons
	Industries, Inc.	ionic and anionic	5,000 gal	per 2 acres
		properties	water	
Enviro RoadMoisture	Envirospecialists,	Surfactant (non-	1.0 gallon per	4,000 gallons
2.5	Inc.	ionic alcohol	2,500 gallons	per 2 acres
		ethoxylate)	of water	
Jet-Dry	Reckitt	Surfactant	1.0 gallon per	4,000 gallons
	Benckiser		2,000 gal	per 2 acres
			water	
Haul Road Dust	Midwest Industrial	Surfactant	1.0 gallon per	4,000 gallons
Control	Supply		2,000 gal	per 2 acres
			water	
Envirokleen	Midwest Industrial	Synthetic Polymer	Product not	1 gal per 40
	Supply		diluted with	sq.ft. & 1 gal
			water	per 250 sq.ft.
Durasoil	Soilworks	Synthetic Organic	NonDiluted	1 gal per 30
				sq.ft.



Soil Selection Criteria

No visible contamination
Native land, no farming/industrial history
Normal soil range of metals

6010 test for metals
7471 test for Mercury



Soils Selected

Clark County AQMD and Maricopa County AQD recommended sample locations

- Based on soil maps of each county
- Maps classify soils by texture and dust-emitting potential
- One-Gallon Samples –5 per county
- Bulk Samples (five cubic yards) 1 per county



Sampling Locations in Clark County



8



Sampling Locations in Maricopa County



Soil Samples

One gallon samples taken by hand

Evaluate sensitivity of select water quality parameters to soil chemistry differences

Bulk samples - taken by excavators

- Pre-tests for metals contamination
- Shipped to SDSU-SERL in super sacks



One Gallon Samples

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Soil Processing

Sizeable rocks and debris removed

Performed sand, silt, and clay analysis

Thorough mixing at laboratory

Chain of custody procedures followed

Test Protocol

- Control Plots Treated with Reverse Osmosis Water Only
- Surface Leaching (Runoff to Surface Waters)
 - Simulated rainfall (0.7, 1.3, and 2.4 inches/hour)
 - Simulated heating
 - Tested for general chemicals of concern
 - Tested for aquatic toxicity (fish, algae, and invertebrates)
- Column Migration (Potential to Reach Groundwater – Subsurface Leaching)
 - Migration rate
 - Tested for general chemicals of concern

Sample Preparation

- One of two reapplication/soil disturbance scenarios
 - A-Soil surface raked daily and product applied each day
 - B-Soil surface raked daily and product applied on days 1, 3, and 5
 - For synthetic products, B scenario was higher initial application and no reapplication
- Duration for both scenarios is consecutive 5-day period following initial application
 - Each of 5-days, soil raked in alternating directions
 - Reapplication rates same as original application

Runoff Collection

Soil Test Tray

Runoff Collection from Test Tray

ARE BL

Preparing Migration Test Cylinders

Rainfall Events

0.7 inches per hour for 150 minutes
1.3 inches per hour for 80 minutes
2.4 inches per hour for 43 minutes

Soil Bed Layout

Tilting Bed SDSU-SERL

Andreada

ALL Y

Products Tested

Product	Abbreviation	Type of Suppressant	Soil Tested
Reverse Osmosis Water	RO	Purified H ₂ O	NV & AZ
Jet Dry	JD	Surfactant	NV
Haul Road Dust Control	HR	Surfactant	NV
Envirokleen	EK	Synthetic Polymer	NV
Chem Loc 101	CL	Surfactant	AZ
Enviro Road Moisture 2.5	ERM	Surfactant	AZ
Durasoil	DS	Synthetic Organic	AZ

Experimental Parameters

Parameter	Surface Leaching	Vertical Migration
Soil Types	2	2
Treatments per Soil Type	3	3
Flow Rates	3	1
Treatment Ages	3	3
Re-App Scenarios	2	2
Exp. Replications	1	2
Total Product Tests	108	72
Water Only Soil Tests	18	8
Total Tests	126	80

Analytical for Runoff and Leachate

- Ph
- Electrical Conductivity
- TSS
- TDS
- DO
- TOC
- Nitrate and Nitrite
- Total Phosphorous
- Aquatic Toxicity (Runoff only)

Qualitative Analysis of Test Results

- Surface Leaching Tests All six products met study DQOs for pH, TDS, TOC, DO, and Nitrate Most significant effect – High TSS in runoff from soils treated with Durasoil and EnviroKleen
 - AZ soil runoff typically had higher conductivity, TDS, TOC, nitrate, nitrite, and phosphate
 - NV soil runoff had higher pH and TSS
 - DO similar for both soils

Qualitative Analysis of Test Results

- Vertical Migration Tests
 - Water migration through a 12-inch column of soil
 - Average results by product for eight of nine parameters meet DQOs
 - TSS results varied but typically not a concern for groundwater quality

Pilot Tests

- Evaluated soil/water/product mixtures
- TDS for Enviro Roadmoisture 2.5 and Durasoil samples significantly higher than control samples – Not observed in runoff tests

Aquatic Toxicity Tests

- Runoff samples for toxicity collected as part of SDSU's surface leaching tests
- Toxicity tests conducted by EPA Region 9 Lab
 - Fish (flathead minnow) acute tests
 - Algae chronic tests
 - Invertebrate (Daphnia Magna) acute tests
- Control samples based on RO-water only

Aquatic Toxicity Testing

- No toxicity to fish observed in any runoff sample
- Algae tests
 - No toxicity to algae observed in any runoff sample
 - Test may underestimate impact due to fine filtration of samples to remove sediments required by test protocol

Aquatic Toxicity Testing

- Invertebrate Tests Daphnia magna
 - For 4 surfactants, majority of samples showed no toxic effect relative to control samples
 - Adverse physical effect on daphnids for Envirokleen and Durasoil samples compared to control (Daphnids trapped on surface not able to re-enter water column).
 - Additional tests with smaller invertebrate (Ceriodaphnia Dubia) conducted on product samples of Envirokleen and Durasoil did not show physical entrapment effect.

Final Report

http://www.epa.gov/region09/air/dust/Dust Suppressants-sept2008.pdf

