



Project title: **BioPreferred Road Product Study**

Project cooperators: US Forest Service

Project purpose: To establish baseline aquatic toxicity data for dust suppressant products in USDA's BioPreferred catalog

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Data generation: Samples of dust suppressant products for testing were requested from vendors. Vendors choosing to participate (Table 1) shipped samples to the Columbia Environmental Research Center (CERC) in Columbia, MO. After appropriate test concentration ranges were identified in preliminary tests, products were tested in 96-hour acute toxicity tests with juvenile rainbow trout (*Oncorhynchus mykiss*). Tests were conducted under standard conditions (Table 2) and followed general guidelines described in ASTM E 729—Standard guide for conducting acute toxicity tests with fishes, macroinvertebrates, and amphibians (ASTM 2014). Non-water-soluble products were tested as water-accommodated fractions (WAFs), mixed according to Singer et al. 2000. Results (Tables 3 and 4) are presented as median lethal concentrations (LC50s), calculated using the surface response model in Risk Assessment Tools software (Mayer et al. 2009).

References:

ASTM. 2014. ASTM Guide E 729 – 96 (2007), Standard guide for conducting acute toxicity tests with fishes, macroinvertebrates, and amphibians. ASTM International, West Conshohocken, PA.

Mayer, F.L., M.R. Ellersieck, and A. Asfaw. 2009. Risk Assessment Tools Software and User's Guide. Society for Environmental Toxicology and Chemistry.

Singer, M.M., D. Aurand, G.E. Bragin, J.R. Clark, G.M. Coelho, M.L. Sowby, and R.S. Tjeerdema. 2000. Standardization of the preparation and quantitation of water-accommodated fractions of petroleum for toxicity testing. Marine Pollution Bulletin 40:1007-1016.

Table 1. Status of dust control product samples from the USDA BioPreferred list requested for testing

List status	Product Name	Vendor	Sample status
On BioPreferred list at project initiation, 9/2011	DeDust	BioSpan Technologies	Sample provided
	Encapsulate	BioSpan Technologies	Sample provided
	ArenaPro	Dustkill LLC	Sample provided
	BioRain	Dustkill LLC	Sample provided
	Dustknocker	Dustkill LLC	Sample provided
	RoadKill	Dustkill LLC	Sample provided
	Envirologic 500	Terresolve	Sample provided
	DustLock	Environmental Dust Control	Sample provided
	ELM Dust Suppressant	Environmental Lubricants Manufacturing, Inc.	Sample provided
	SC-Dust Down	Safe Care	Sample provided
	Soy Solv DS	Soy Solv	Sample provided
	IceClear AF	Orison Marketing, LLC	Sample not provided
	IceClear PGX	Orison Marketing, LLC	Sample not provided
	ArenaTech	The Amber Group	Product discontinued ^a
	BioTag	The Amber Group	Product discontinued ^a
UltraTAG	The Amber Group	Product discontinued ^a	
Added to BioPreferred list ^b	Green Sweep	Clean Sweep Products	Sample not provided
	Dust Stop powder	Eco-Infrastructure Solutions, LLC	Sample provided
	Dust Sentinel	NanoQuantics	Sample provided ^c

^anotification by D. Delamore, The Amber Group, 9/2013

^bnotification by V. Barandino, 7/2013

^csample provided labeled "Soil Sentinel--Dust"

Table 2. Conditions of acute toxicity tests with juvenile rainbow trout in accordance with standard methods (ASTM E 729 (2008))

Test species	<i>Oncorhynchus mykiss</i>
Test type	Static
Test material	1) Water soluble products added directly to water, or 2) Non-water soluble products tested as water-accommodated fractions (WAFs; prepared according to Singer et al. 2000)
Test duration	96 hours
Temperature	12°C
Light	Ambient laboratory light, 200 lux, 16L:8D
Water volume	2 L
Water renewal	None
Age of test organisms	~30 days post-swim-up
# organisms/chamber	4-6, depending on test (loading rate <1 g fish/L)
# replicate chambers	4
Feeding	None
Chamber cleaning	None
Control water	Well water (hardness about 300mg/L as CaCO ₃)
Test concentration	<p>Appropriate dilution series identified by preliminary tests--at least three treatment levels per product plus controls</p> <p>Water-soluble products</p> <p>ELM: 1800, 1080, 648, 389 and 233 mg/L</p> <p>Arena Pro: 6000, 3600, 2160, 1296 and 778 mg/L</p> <p>Dust Down: 6000, 3600, 2160, 1296 and 778 mg/L</p> <p>BioRain: 4000, 2400, 1440, 864, 518 and 311 mg/L</p> <p>DeDust: 60, 30, 15, 7.5 and 3.8 mg/L</p> <p>Soil Sentinel: 10000, 5000, 2500, 1250 and 625 mg/L</p> <p>Non-water-soluble products</p> <p>Dust Lock: 100% WAF</p> <p>Terresolve: 100, 75, and 56.25% WAF</p> <p>RoadKill: 100% WAF</p> <p>SoySolv: 50, 30, 18 and 10.8% WAF</p> <p>Encapsulate: 5, 2.5, 1 and 0.1% WAF</p>
Water quality	Dissolved oxygen and temperature measured daily; dissolved oxygen, conductivity, pH, hardness, alkalinity, and ammonia measured on Day 0 and Day 4
Endpoint	Survival
Test acceptability	≥90% control survival

Table 3. Results of 96-hour toxicity tests with juvenile rainbow trout (*Oncorhynchus mykiss*) and water-soluble products from the USDA BioPreferred list. Reported values are median lethal concentrations (LC50s) with 95% confidence intervals in parentheses.

Product Name	Vendor	LC50 (mg/L)
ArenaPro	Dustkill LLC	>6000
BioRain	Dustkill LLC	>4000
DeDust	BioSpan Technologies	38 (31-44)
Dust Stop powder	Eco-Infrastructure Solutions, LLC	>5000
Dustknocker	Dustkill LLC	17 (16-19)
ELM Dust Suppressant	Environmental Lubricants Manufacturing, Inc.	853 (706-1000)
SC-Dust Down	Safe Care	>6000
Soil Sentinel--Dust	NanoQuantics	>5000

Table 4. Results of 96-hour toxicity tests with juvenile rainbow trout (*Oncorhynchus mykiss*) and non-water-soluble products from the USDA BioPreferred list, tested as water-accommodated fractions^a (WAFs). Reported values are median lethal concentrations (LC50s) with 95% confidence intervals in parentheses.

Product Name	Vendor	LC50 (%WAF)
DustLock	Environmental Dust Control	>100
Encapsulate	BioSpan Technologies	5-10
Envirologic 500	Terresolve	>100
RoadKill	Dustkill LLC	>100
Soy Solv DS	Soy Solv	31 (26-35)

^aprepared according to Singer et al. 2000 (original concentration of 10 g product/L well water, mixed with no vortex for ~24 hours then water siphoned to create WAF). Water-accommodated fraction was diluted as appropriate with well water to create treatments. If exposure to 100% WAF in preliminary tests resulted in no mortality, only the 100% concentration was run in definitive tests.