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Sonar[®] Aquatic Herbicide Non-target effects, trials & monitoring

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Sonar[®] Aquatic Herbicide Non-target effects, trials & monitoring

- SePRO Corporation Introduction
- Sonar[®] Herbicide Family
 - How it works
 - Water use precautions
 - Use rates and formulations
 - Efficacy
 - Whole-lake vs. partial-lake treatments
 - FasTEST[®] analysis

<u>Solutions</u> to Preserve our most Precious Natural Resource...Water



- Aquatic Weeds
- Algae & Cyanobacteria
- Water Quality
- Lab & Prescription Services
- Data Management and Mapping Services
- Research and Development







Aquatic Plant Management



Aquatics Research







Laboratory Analysis Services





Sonar: How it Works



• Active Ingredient: Fluridone



- Sonar is a <u>systemic herbicide</u> for the control of aquatic plants and was registered by the Environmental Protection Agency for use in 1986.
- As a <u>systemic herbicide</u>, Sonar is absorbed through the roots and shoots of plants and then translocates to the shoot tissues.
- Sonar inhibits the <u>plant</u> enzyme phytoene desaturase (PDS Inhibitor)

Sonar: How it Works

- Sonar inhibits the synthesis carotenoid pigments allowing ultraviolet light to destroy essential <u>chlorophyll</u> pigments.
- Without <u>chlorophyll</u>, the plant is unable to photosynthesize, shoot tips turn pink or white, and the plant slowly starves and dies.



Typical plant response to Sonar Aquatic Herbicide three weeks post-treatment.



Sonar Aquatic Herbicide

- As determined by the U.S. EPA and the State of Alaska Sonar Aquatic Herbicide poses a negligible risk to human health and the environment when used according to label instructions.
- <u>No</u> Swimming Restrictions
- No Potable Water Restrictions (drinking)
 - 2000x Safety Margin
- <u>No</u> Fishing Restrictions
- <u>Minimum</u> Irrigation Precautions with treatment protocols planned for Kenai Lakes

Sonar Aquatic Herbicide

- As determined by the U.S. EPA and the State of Alaska Sonar Aquatic Herbicide poses a negligible risk to human health and the environment when used according to label instructions.
- Minimum Irrigation Precautions with treatment protocols planned for Kenai Lakes
 - ≤ 10 ppb no precautions other than sensitive crops (i.e. tomatoes, bell peppers, Solanaceae Family)
 - ≤ 5 ppb no precautions other than hydroponic and greenhouse production

Sonar Aquatic Herbicide

- •Herbicide sorption-distribution coefficient (Kd): 3-16
- •Organic carbon partition coefficient (K_{oc}): 350-1100

 Indicates a strong affinity to bind with soil particles and thus a decreased risk of soil leaching and offsite movement.

- •DT₅₀ aquatic environments (anaerobic): ±9 months
- •DT₅₀ hydrosoil ±90 days
- Gradual desorbtion and breakdown through photolysis is primary degradation pathway in hydrosoil.

SonarOne* Aquatic Herbicide

- A unique, temporal release profile that results in a quick initial target dose of Sonar followed by a sustained dose.
- Peak ppb's achieved faster
- Maximum concentrations sustained longer
- One-Step Sonar Solution







Sonar Genesis* Aquatic Herbicide









Consider the following:

What is this "Part-per-billion" (PPB)?



1 ppb

*"*1 5/8 inches"On the equator24,901.55 miles



Perspective







Sonar Efficacy



Sonar Efficacy

- Sonar is very efficacious on *Elodea* spp.
- Sustained levels ≤ 5 ppb will control *Elodea* spp.
- Eradication is the goal and drives the plan to treat for 2-3 consecutive years





Biochemical Assay



TABLE 2. AQUATIC PLANT FREQUENCY OF OCCURRENCE DATA CHI-SQUARE ANALYSIS RESULTS FOR COMMON SPECIES. NUMBERS ARE THE PERCENT OF SAM-PLES WHERE THE PLANT WAS FOUND IN LOOMIS LAKE, WA, JUNE 2002 TO 2005.

	% present						
Plant	June '02	June '03	June '04	June '05			
Egeria	59	16*	0.4*	8*			
Eurasian watermilfoil	82	0*	0*	13*			
Coontail	16	0*	0*	5*			
eelgrass pondweed	56	2*	3*	20*			
Elodea	33	0*	0*	0.4*			
water-naiad	0.8	0	18*	32*			
macroalgae	2	0	47*	52°			
No Plants	3	75*	42*	30*			

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*significantly different from pretreatment frequency of occurrence (June 2002). Significance level corrected for multiple comparisons is p < 0.017.

Environmental Concentration

VS.

No Observable Effect Levels (NOEL)



No Observable Effect Levels (NOEL)

"Early Life Stage Toxicity of Fluridone to the Chinook Salmon, Oncorhynchus tshawytscha, Under Flow Through Conditions"

– Madsen, T.J. 2002-03', Study #47895, ABC Laboratories, Columbia MO.

• 61-Day post-hatch exposure, NOEC for egg hatchability and fry survival was

1.71 mg/L

- Noted absence of both significant mortality and sub-lethal effects.
- No significant effect on time-to-hatch or swim up
- No notable histo-/ pathology for brain, gills, liver from any fish in the

treatment group

- •NOEC (liver) 0.848mg ai/Kg
- •LOEC (liver) 1.71mg ai/Kg



Alaskan *Elodea canadensis* x *nuttallii* Hybrid Control Project Fluridone Information





Alaskan *Elodea canadensis* x *nuttallii* Hybrid Control Project Fluridone Information





8 ppb versus 150 ppb





8 ppb versus 5000 ppb







Aquatic Plant Management

Beck Lake

- Whole-lake Sonar Treatment Program
- Sonar Genesis
 - 2014
- Sonar ONE
 - 2014
 - 2015
 - 2016
 - Pellet placement to known infestations



Daniels Lake

- Partial-lake Sonar Treatment Program
- Sonar ONE
 - 2014
 - 2015
 - 2016





Daniels Lake

- Partial-lake Sonar
 Treatment Program
- Sonar ONE
 - 2014
 - 2015
 - 2016





FasTEST[®] Analysis

GC-MS Quantitation [fluridone]



Daniels Lake - FasTEST



		15-Jun	1-Jul	1-Aug	1-Sep	1-Oct
Lake	FasTEST Site	2 WAT	4 WAT	8 WAT	12 WAT	16 WAT
Daniels Lake	1	Х	Х	Х	Х	Х
Daniels Lake	2	Х	Х			
Daniels Lake	3	Х	Х	Х	Х	Х
Daniels Lake	4	Х	Х			
Daniels Lake	5	Х	Х			
Daniels Lake	6	Х	Х	Х	Х	Х
Daniels Lake	7	Х	Х			
Daniels Lake	8	Х	Х			
Daniels Lake	9	Х	Х	Х	Х	Х
Daniels Lake	10	Х	Х			
Daniels Lake	11	Х	Х			
Daniels Lake	12	Х	Х	Х	Х	Х
Daniels Lake	13	Х	Х			
Daniels Lake	14	Х	Х			
Daniels Lake	15	Х	Х	Х	Х	Х
Daniels Lake	16	Х	Х			
Daniels Lake	17	Х	Х	Х	Х	Х
Daniels Lake	18	Х	Х			
Daniels Lake	19	Х	Х			
Beck Lake	1	Х	Х	Х	Х	Х
Beck Lake	2	Х	Х			
Beck Lake	3	Х	Х	Х	Х	Х
Beck Lake	4	Х	Х			
Beck Lake	5	Х	Х			
Beck Lake	6	Х	Х	Х	Х	Х
Stormy Lake	1	Х	Х			
Stormy Lake	2	Х	Х	Х	Х	Х
Stormy Lake	3	Х	Х			
Stormy Lake	4	Х	Х	х	Х	х
Stormy Lake	5	Х	Х			
Stormy Lake	6	Х	Х	х	Х	Х
	Total Samples	31	31	13	13	13
	Grand Total	101		-	-	

Sepro























Aquatic Plant Management

SCPR

Summary / Questions

- Sonar poses negligible risk to human health & the environment
- Sonar is very effective on Elodea
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