PART II - COMPARISON OF LINGERING EXXON VALDEZ OIL WITH OTHER POTENTIAL SOURCES OF CYP1A INDUCERS



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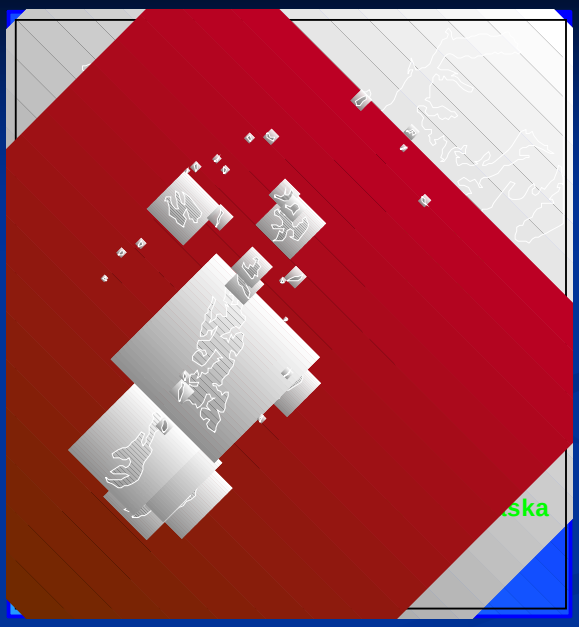
Hello, my name is Kathrine Springman, and thank you for attending this presentation. It concerns the modification of a technology and the applications of this in Prince William Sound.



Path of Released Oil from the Exxon Valdez Oil Spill (EVOS) March 29, 1989

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Other Potential Sources of CYP1A Inducers in Western PWS besides EVO

- Atmospherically-transported PAH, POP
- Regional geologic background sources: oil seeps, coal
- Returning adult salmon
- Salmon hatcheries
- Abandoned industrial sites
- Marinas & boat traffic

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Experimental Design: Sampling Sites

- *Exxon Valdez* Sites –
  9 deployments on 5 beaches
- Regional background sites -
  30 randomly-placed deployments
- Salmon Streams –
  10 deployments, spring and fall
- Salmon Hatcheries –
  5 deployments
- Abandoned Industrial Sites –
  5 deployments
- Controls – 2 marinas, *1 deployment each*

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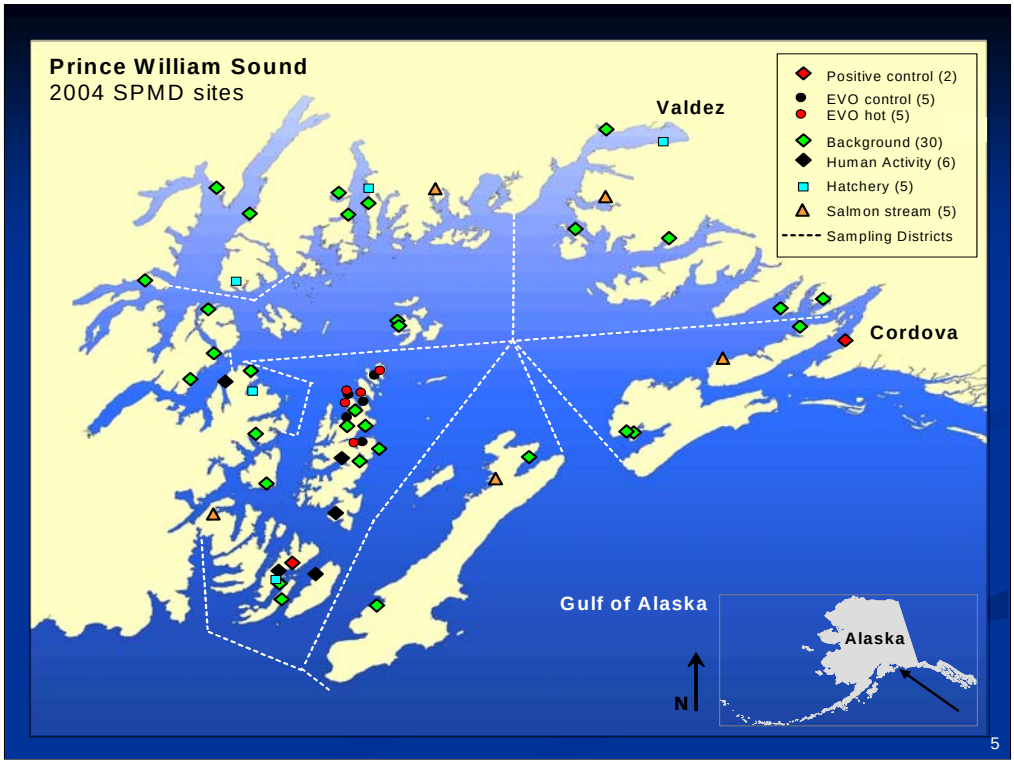

And here's where they were deployed.

•There were two positive control or hot sites, one of which was cordova harbor with all its boat traffic.

• oiled sites and local controls for those sites

• thirty background sites, although not all were used in induction, but were analyzed. One reason was to track the presence of atmospherically transported contaminants that could induce CYP1A in native biota.

• historic human activity sites such as abandoned canneries to examine their potential for inducing CYP1A in biota of the sound with their effluents

• hatcheries were included for the same reason, and for boat traffic

• and salmon streams, to check for contaminants that may have been deposited in the streams from post-spawning salmon carcasses

•You can see that we covered most of the sound for a good look at what's bioavailable.

SPMD Application: Deployment

- Deployment device anchored to substrate, not buried
- Less biofouling, more representative

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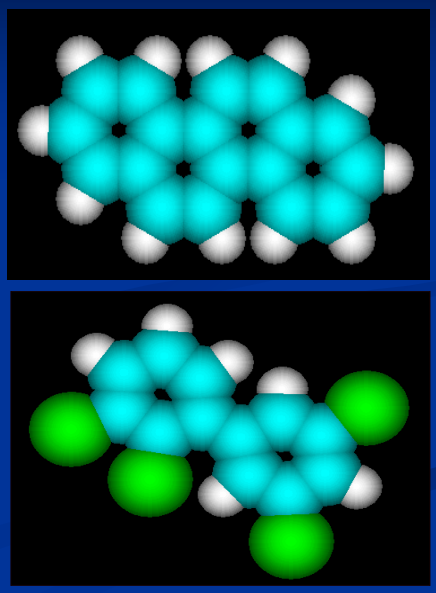
Here you see a deployment device, fully loaded with five SPMDs. These were deployed as you see in the picture here (point) for 28 days.

Experimental Design: Chemical Analysis

- Analyze for 44 PAH, including alkyl-PAH and 62 chlorinated POPs
- Compare chemistry and biochemistry from all sites
- Curve fit results



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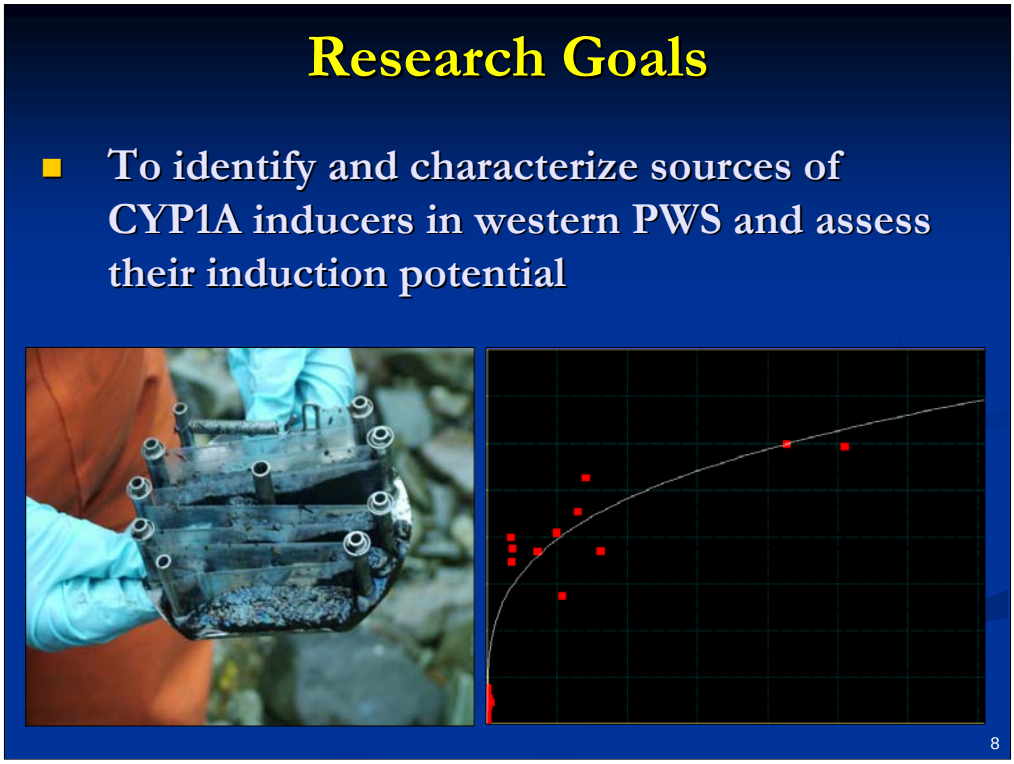
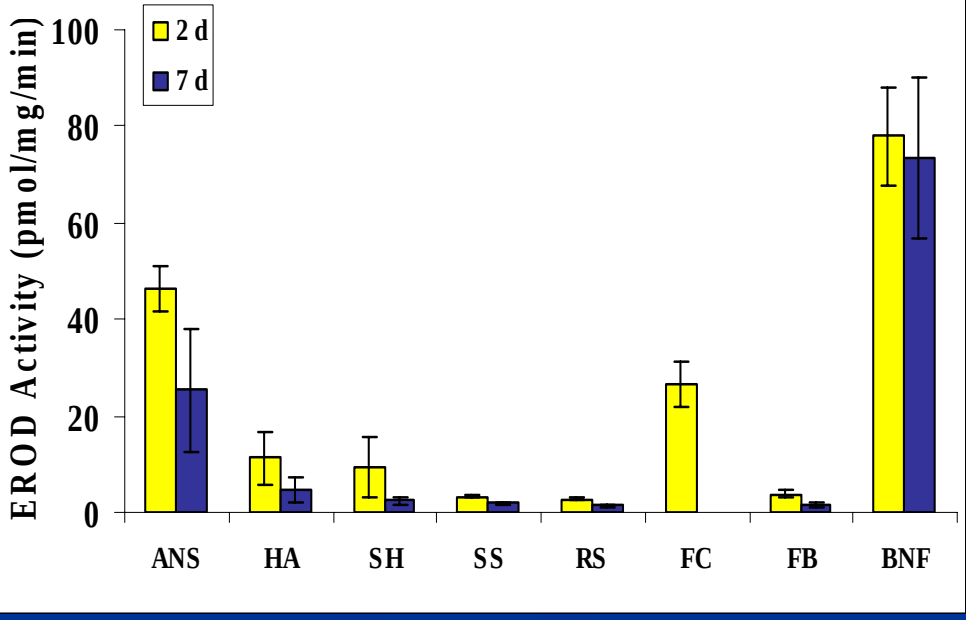


The goals of this research were simple:

• The concept of the SPMD, that of assessing that bioavailable contaminants, was very appealing. With these modifications, the analytical strengths weren't lost or even affected. As the contents of the SPMD are bioavailable, this method allowed us to realistically assessing biotic response to contaminants in a more realistic way, without losing contaminants as we're not testing for them. All this depended, of course, on the consistency of results obtained.

• another goal was to see if any of the residual oil from the Exxon Valdez oil spill in 1989 was bioavailable, and sufficient to induce CYP1A enzyme in rainbow trout fry. This enzyme has been the marker of petroleum exposure in many different animal species.

Results: All Site Types



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Oiled Sites (EVO)

EL056C – Northwest Bay, Eleanor Island (3)

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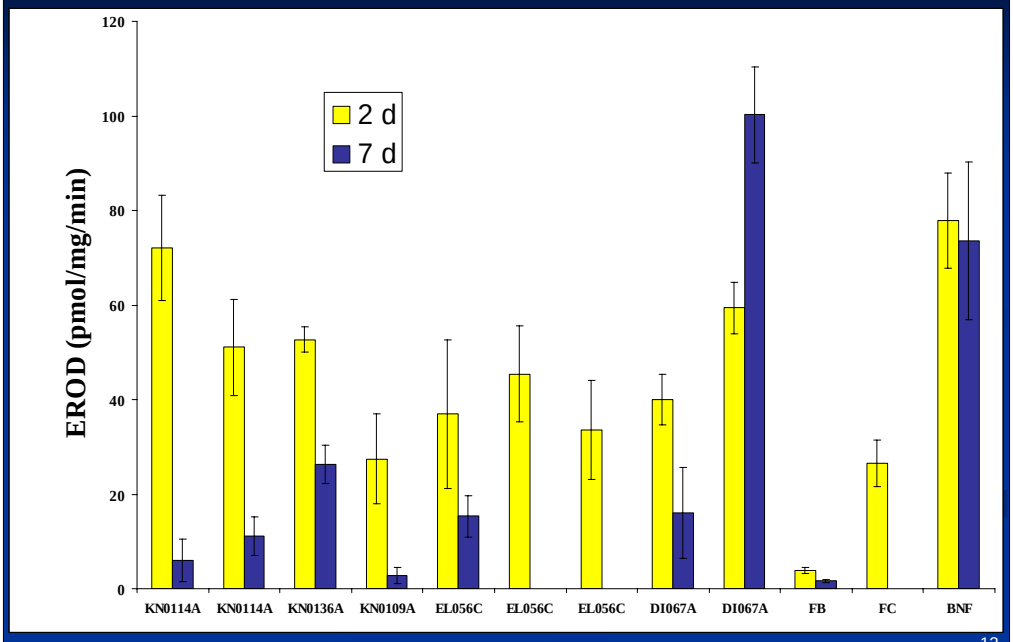
KN0114A – Herring Bay (2)

Disk Island (2)

Oiled Sites



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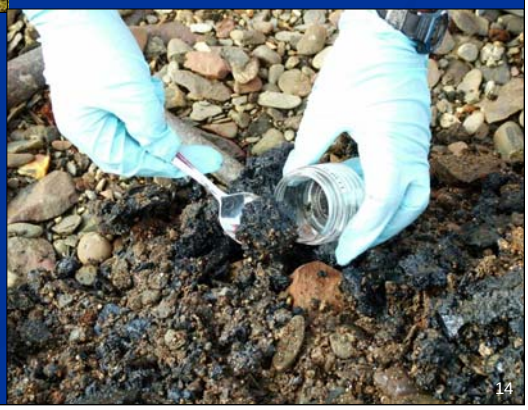
McClure Bay: Monterey Oil from 1964

A template for EVO degradation



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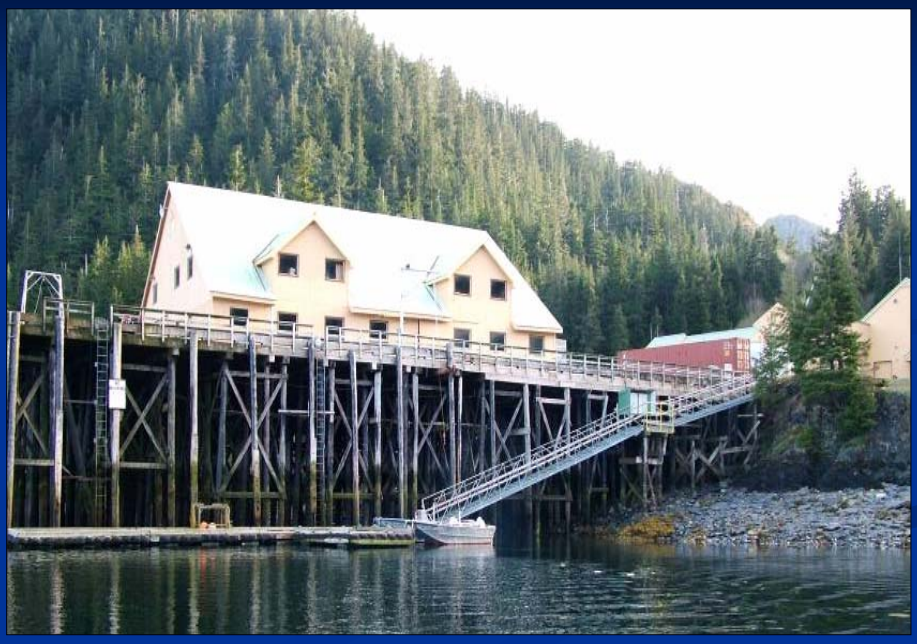
AFK Hatchery and Creosote Pilings



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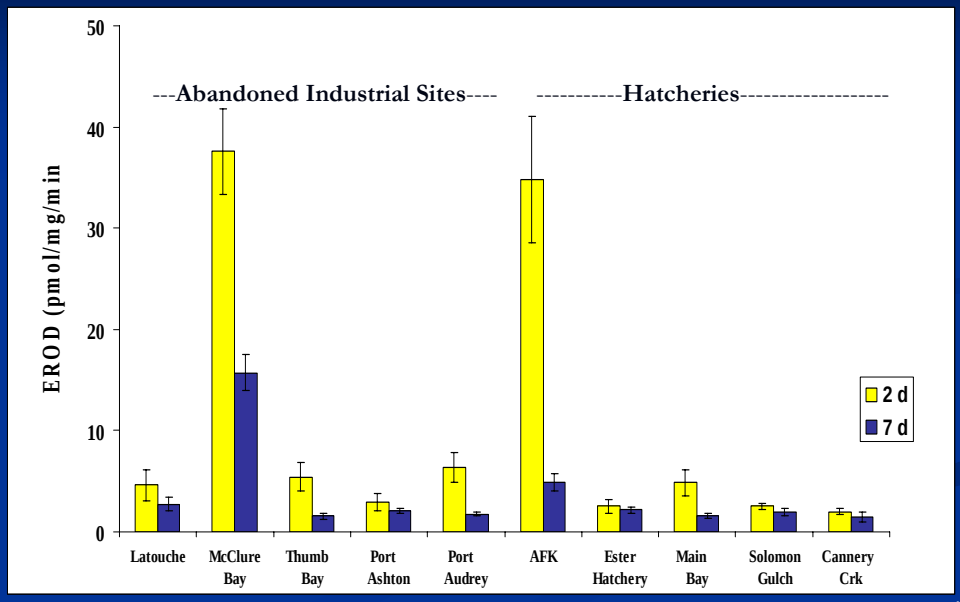
Here are the site types:

•Salmon streams, with the deployment device in the middle of the stream bed surrounded by salmon carcasses.

• hatcheries

•And there is an example of historic human use. An old cannery.

Hatcheries, Ex-Industrial Sites



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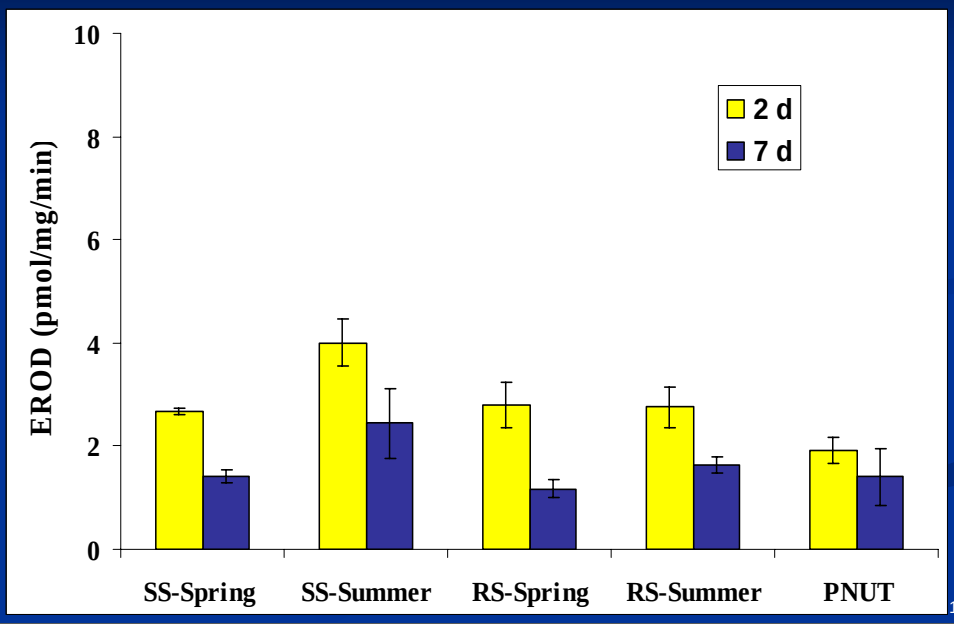
Temporal Effects: SS, RS



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POP Results

- *Highest* ΣPCB < 200 ng/SPMD (Median = 12 ng/SPMD; *N* = 76)
- Other POPs near MDLs
- POPs, EROD *Uncorrelated*

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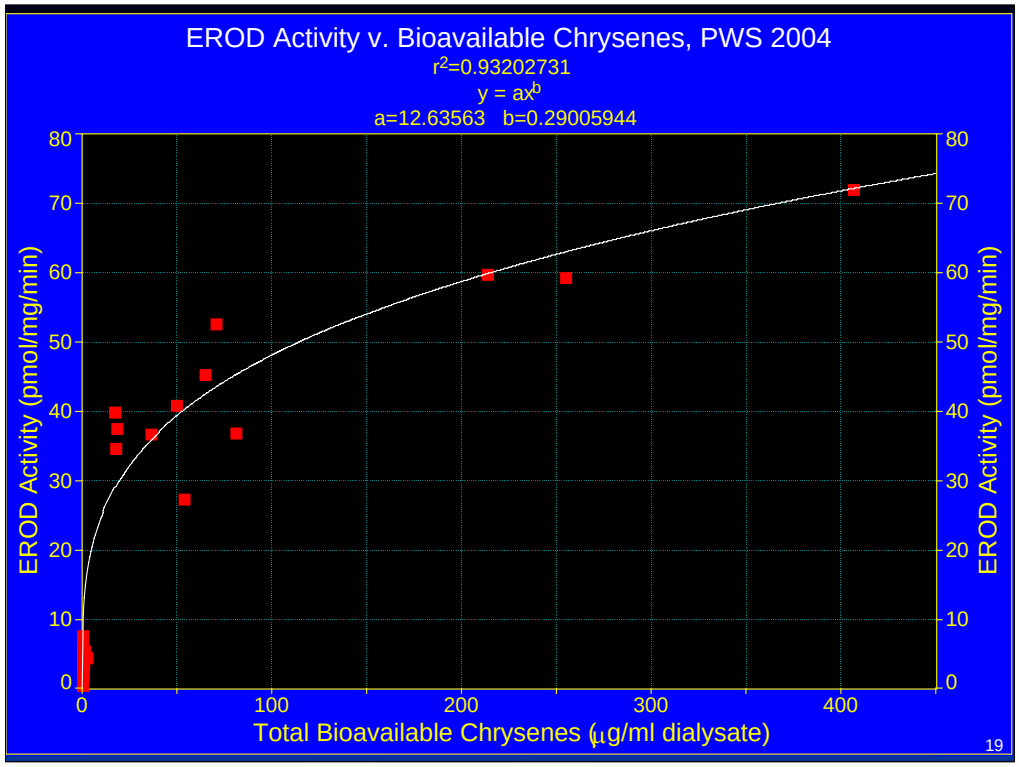
EROD Activity v. Bioavailable Chrysenes, PWS 2004
r2=0.93202731
y = axb
a=12.63563 b=0.29005944
EROD Activity (pmol/mg/min)
Total Bioavailable Chrysenes (µg/ml dialysate)
0
10
20
30
40
50
60
70
80
100
200
300
400
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Conclusions

- This is a sensitive method for linking the bioavailable contaminants to biochemical effects
- Exxon Valdez oil remains a potent CYP1A inducer
- Most human activity sites are not
- Areawide sources clearly are not

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The results showed that the modifications used in this research are useful as the consistency was striking. The method is sensitive and within the tolerance range of the test animal. Residual bioavailable Exxon Valdez oil induces CYP1A in trout fry at much higher levels than any other putative vector or contaminant source. Basically, it's not the only one there, but by far and away shows the most biological impact.

Remember the earlier picture of the SPMD on the spider? That was the before. On the bottom is the after picture.

Contact Information

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