

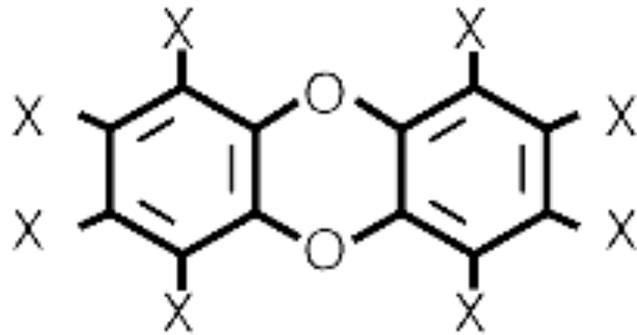
Collaborative research efforts on activated carbon and its potential use for remediation of dioxin-like compounds

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Superfund Research Program

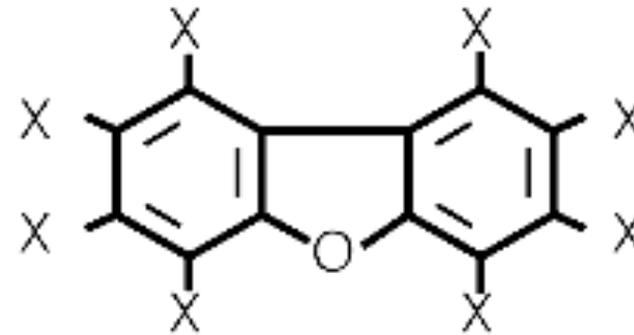


What are dioxins and furans?



Dioxin

X = Chlorine or Hydrogen O =



Furan

X = Chlorine or Hydrogen O =

- Planar (flat) ringed compounds capable of being chlorinated
- Hydrophobic: repelled by water; stick to particles
- Persistent: Remain in the environment for decades

Where Do Dioxins Come From?

Where Are Dioxins Most Commonly Found?

1. Industrial/
Chemical
Processes



2.
Incineration



3. Natural
Formation



Sediment



Soil



Motivation: Soils are complex mixtures. Which soil components most strongly bind dioxins?

- Dioxins/furans in a whole urban soil from Midland were
 - 28% bioavailable to rats
 - 16% bioavailable to young pigs
- This research (Budinsky et al. 2008. *Chemosphere* 70:1774-1786) was performed by Dow. They hypothesized that black carbon in the soil was important in binding dioxin-like compounds
- Goal: Look at separate mineral/organic components of soils and determine bioavailabilities of dioxins/furans in each

We know that both clay and activated carbon sorb dioxins.
But what happens when sorbed dioxin is consumed?



Corn Oil

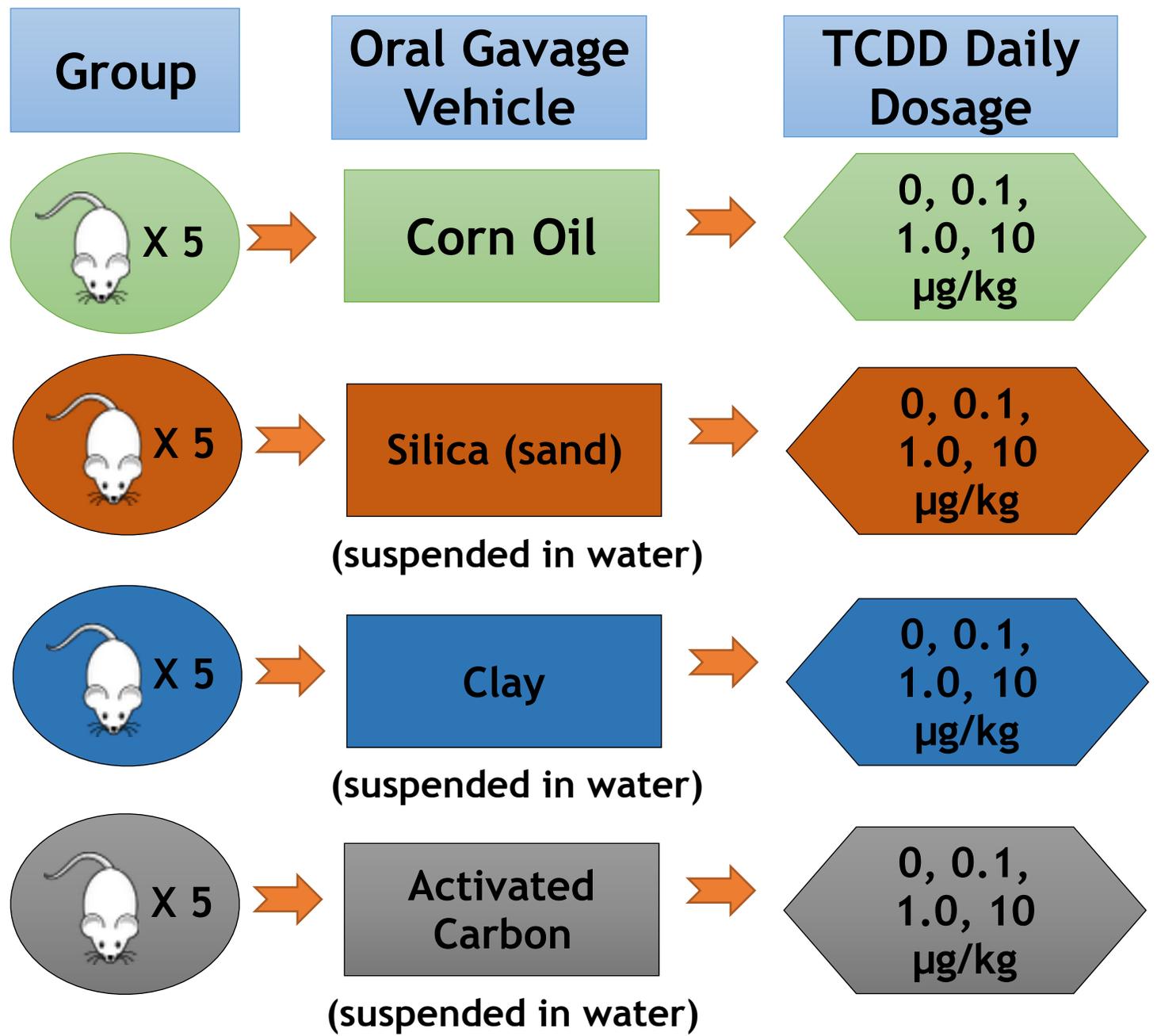


Clay

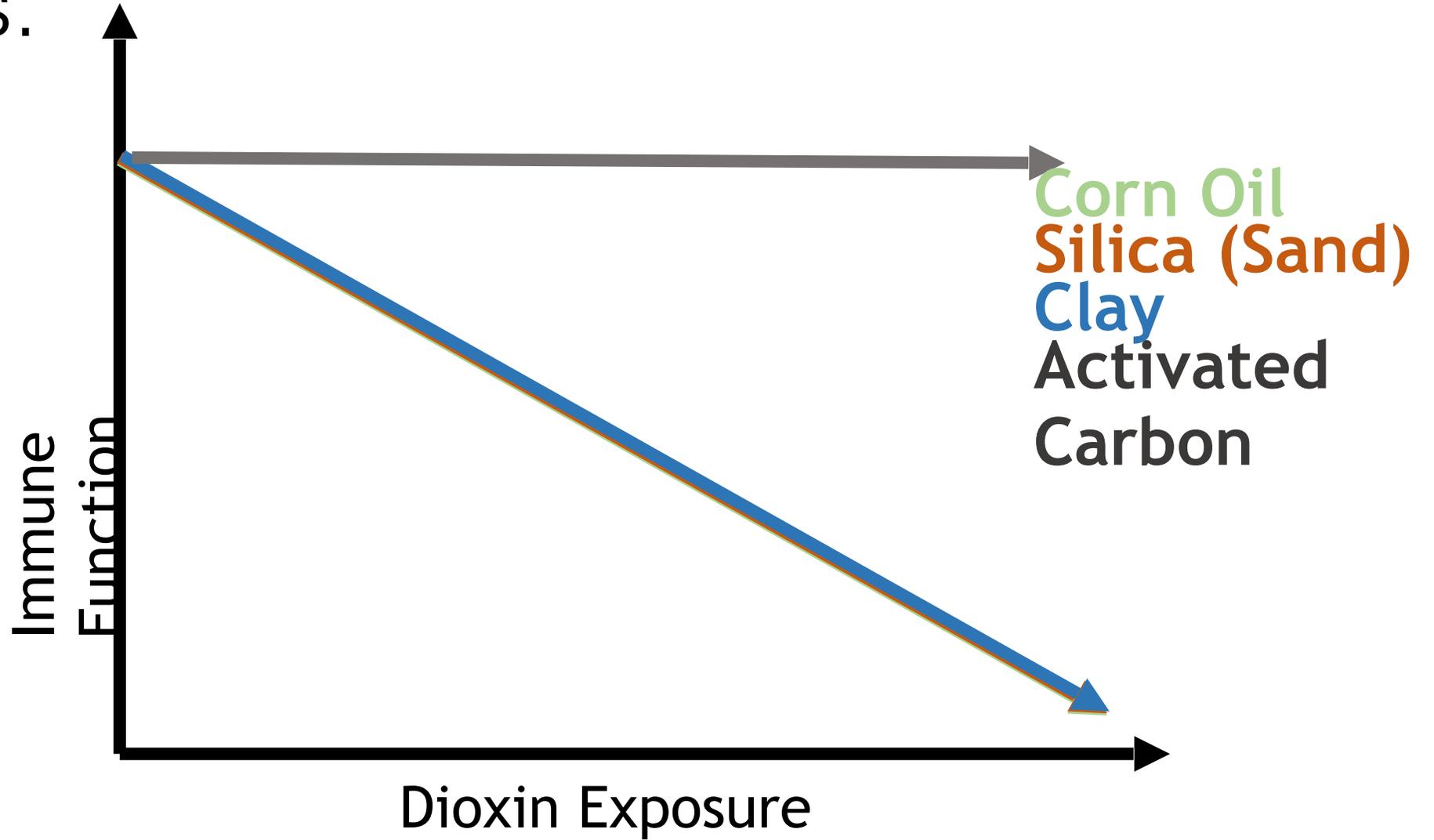


Activated Carbon

To answer this question, we conducted experiments to see how bioavailability differed between different sorbent materials.

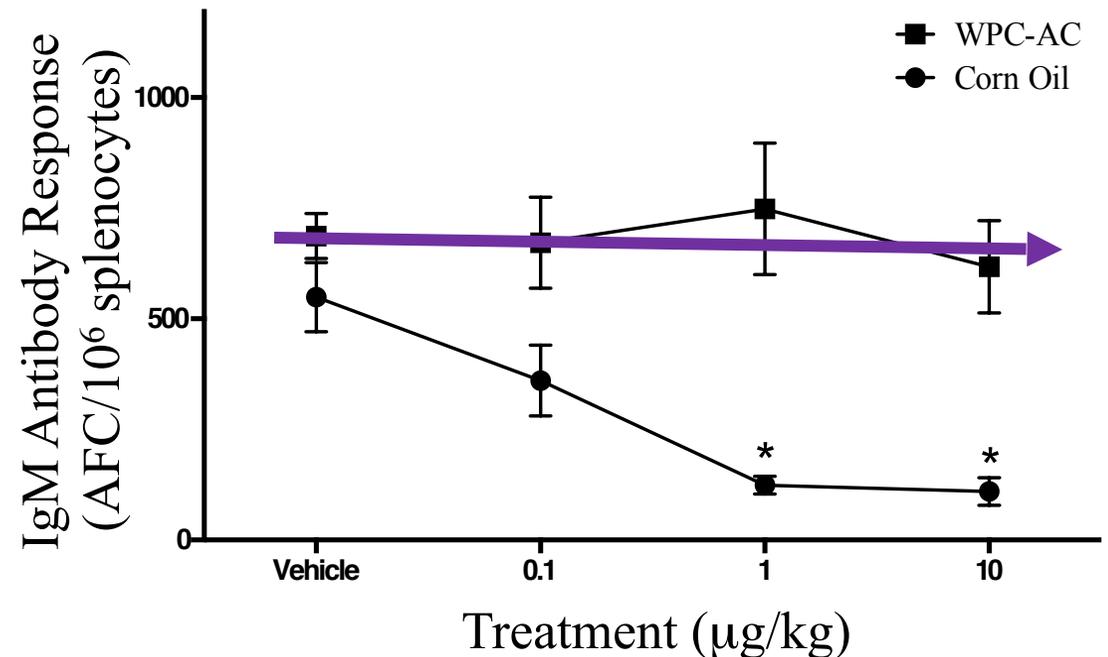
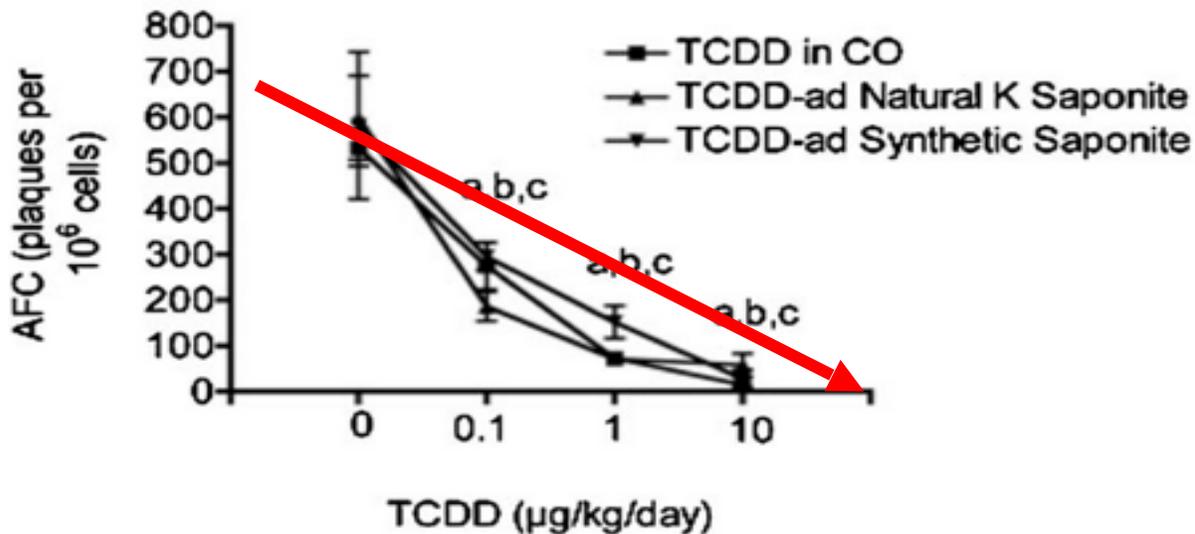


Results:



Summary

- Sorption does not equate to loss of bioavailability to mammals, demonstrated by clay and silica studies. TCDD was just as available as in corn oil
- However, sorption to **Activated Carbon** eliminates bioavailability of dioxins to the mammals (mice)



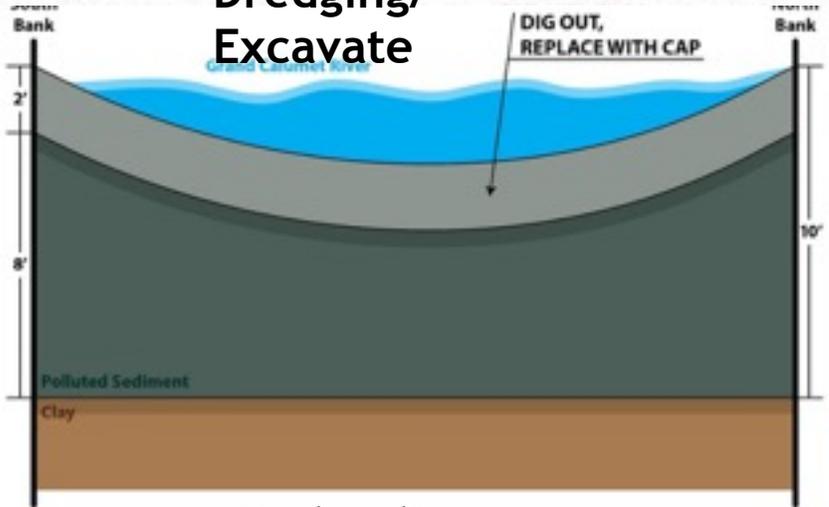
Specific Relevance to this CAG

- **Dioxin-like compounds bind to soils and sediments, but only the soil black-carbon fraction seems to bind the compounds tightly enough to make them unavailable to mammals (to completely eliminate the immune-system compromise effects)**
- **It's not how much TCDD is present; in what form is it present?**
- **Potential for use in the Tittabawassee/Saginaw cleanup**

How is dioxin contamination traditionally handled?



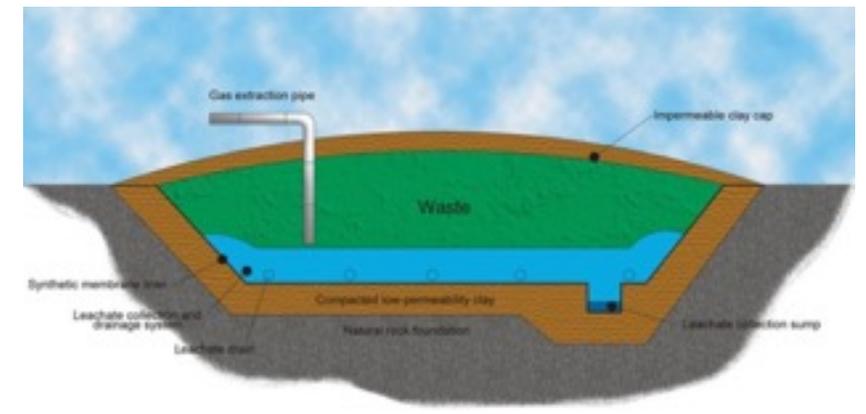
Dredging/
Excavate



Hydraulic



Transporting



Landfilling

- ✓ High cost
- ✓ Destructive to Habitats
- ✓ Mixed effectiveness

Activated Carbon: An Emerging Remediation Technology

- An emerging remediation technique that is gaining rapid acceptance involves the use of activated carbon (AC).
- AC is applied to contaminated soils and sediments and over time traps dioxin contaminants within its porous structure.

Why Use Activated Carbon?



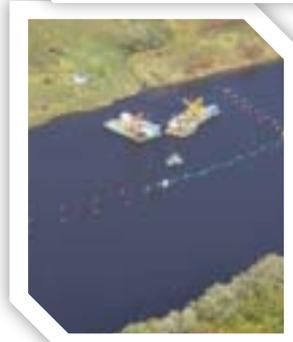
- Highly sorptive
- Similar materials occur naturally in soils and sediments
- Relatively cheap and easy to produce
- Potential to be made from agricultural waste

United States

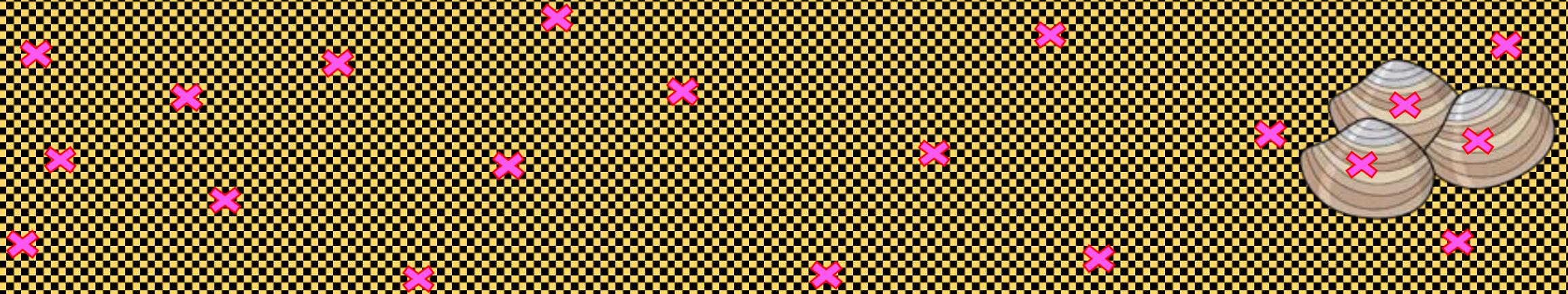
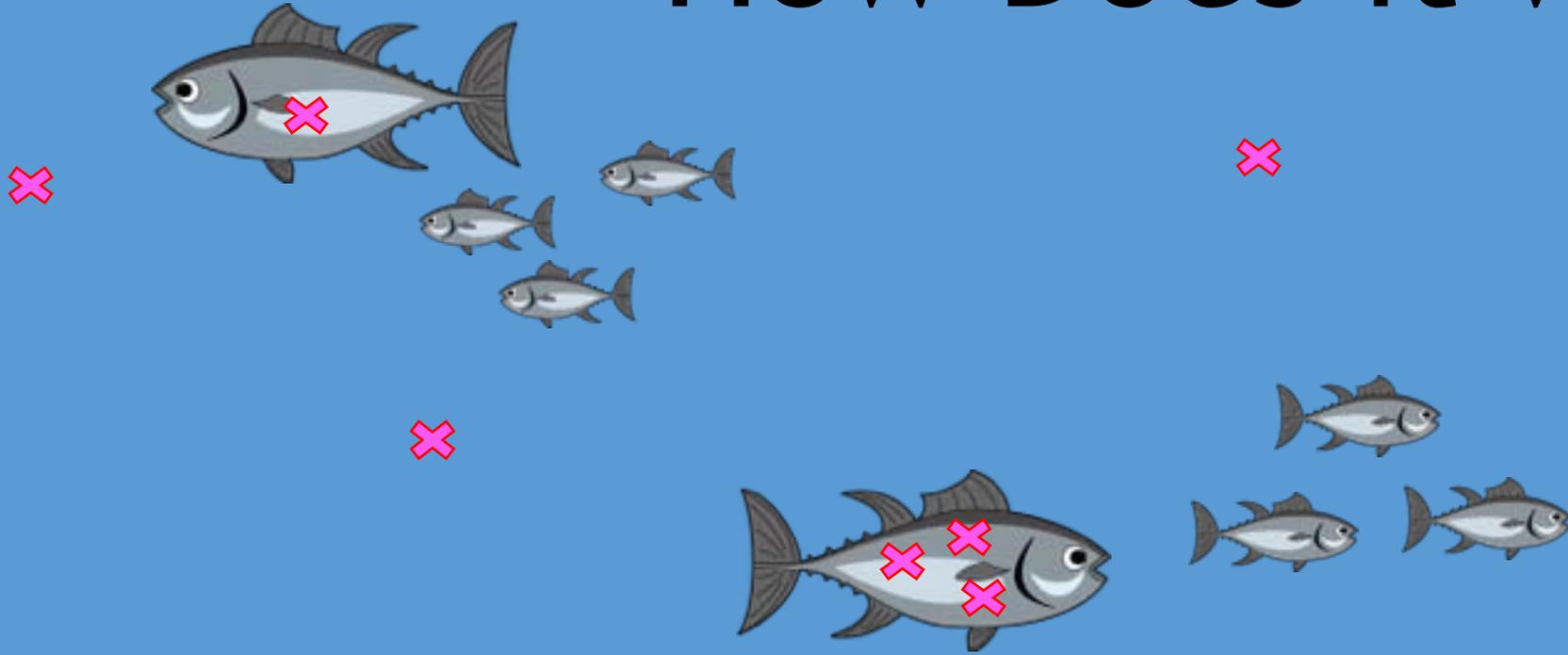


Field Trials are being conducted all over the world

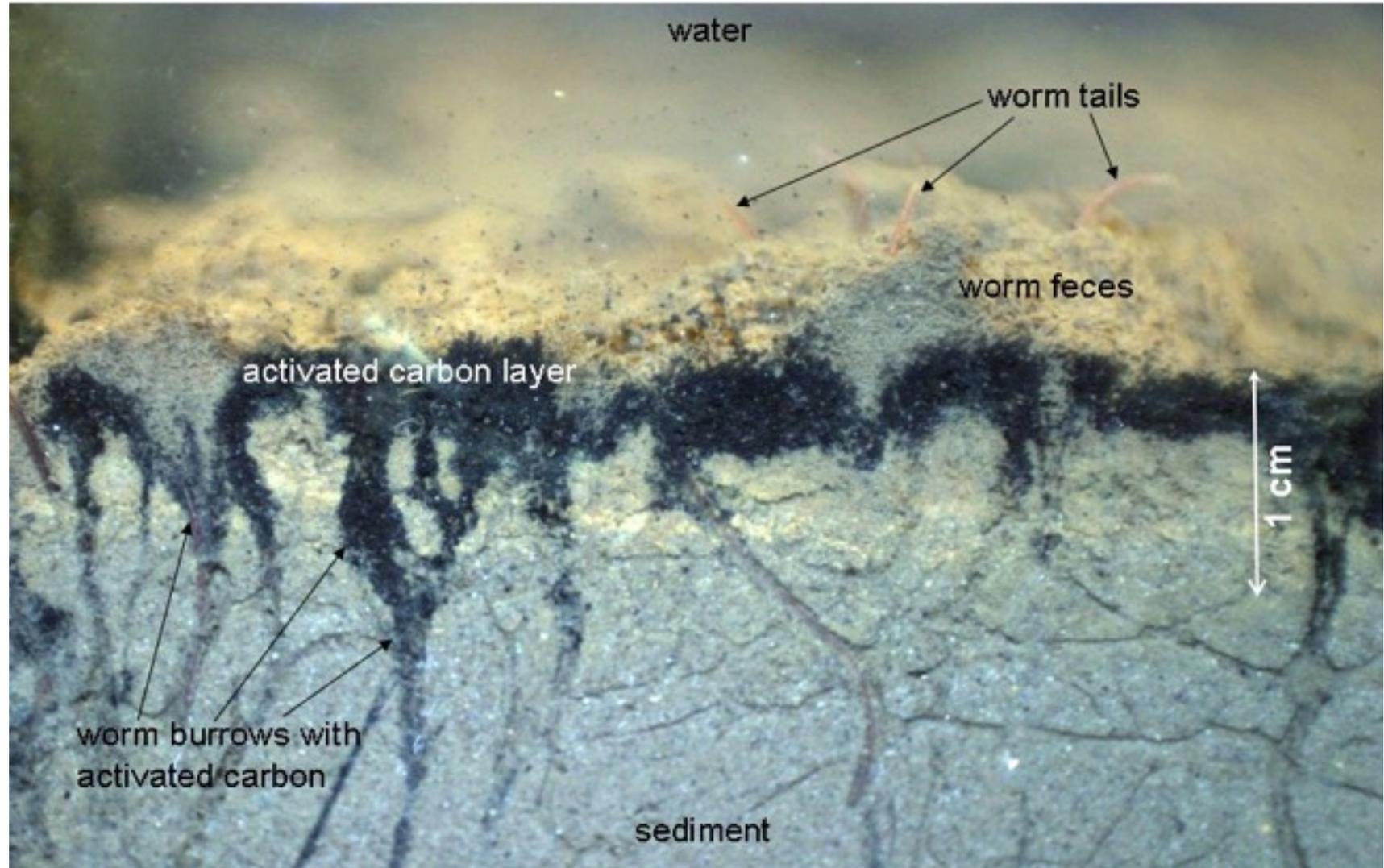
Europe



How Does it work?



Over time, the AC is naturally mixed with sediment increasing the contact with contaminants such as dioxins and furans



Any Questions or Comments?

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