

**The Lands Council Proposal for Phase 2 Funding:
Using Fungi to Break Down PCB's and other Contaminants
October 31, 2017**

We are seeking funding to continue our work to break down PCB contaminated solids with fungi. The original pilot study was designed to answer the following questions:

- Can certain types of fungi survive and grow in the presence of vector waste?
- Can these fungi break down PCBs (polychlorinated biphenyls) in vector waste?

Results Key Points:

- All eight species of fungi grew in 2% sterilized vector waste agar media. No difference in growth was observed between the vector waste spiked media and the non-spiked media.
- Some fungi grew better in the vector waste than others. *P. ostreatus brat*, *P. ostreatus columbinus*, and *P. wild CA creek* exhibited the most robust growth overall.
- There was a statically significant decrease in some PCB congeners (16, 45, 46, 50, 133, 175, 191, 201, 202, 206) while other congeners (1-7, 11, 115, 20, 22, 25, 26, 36, 37, 60, 61, 66, 114) showed a statistically significant increase. Some observations in the congeners that were reduced:
 - There may be a pattern associated with congeners containing “ortho-chlorines”.
 - Most were higher molecular weight congeners.
 - The PCB degradation pattern is different from that seen in animal metabolism (ex. river fish).
 - Six out of ten PCB congeners that showed degradation are in the “Least Biodegradable” category according to the Boon Group numbering system
- It was not possible to draw any specific correlations between the reduction in total PCBs and the fungi species or quantity of fungi.

We are proposing to continue the project.

We would like to run the study for longer time periods to determine if degradation continues. Specifically, this would address the issue of whether larger PCB congeners are being degraded to smaller ones, and if fungi are able to further degrade smaller congener PCBs to non-harmful breakdown products. It is possible that any smaller congener PCBs that were accumulated were beyond the ability of the fungi to degrade. It is equally possible, however, that further

breakdown of smaller congener PCBs would have occurred if the study were of a longer duration. Further studies are clearly needed to distinguish between these two possibilities.

Since higher molecular weight PCB congeners were significantly decreased in this study, future studies spiking fungi with these high molecular weight congeners in large doses would be informative. If the fungi are able to degrade elevated amounts of high molecular weight PCB congeners, studying the byproducts of degradation would be facilitated because they would be present in larger amounts. This would allow for more precise measurement of the breakdown products. Breakdown products could also be introduced to a new round of fungi to determine if they can be degraded further by the same organism.

A potential confounding factor in this study is the sawdust media the fungi were grown on. Since many of these fungi digest wood, it is possible that, with sawdust as a food source, they preferentially digested the sawdust before the PCBs. It would be interesting to observe the behavior of the fungi when they are partially "starved" of their preferred food source. Additionally, this would allow for testing the ability of fungi to degrade PCBs in other contaminated sources, such as soil or sediment from Kaiser's PCB cleanup ponds.

New Partnership

We are starting a new partnership with North Central High School, who will be providing in-kind contributions of time and expertise, as well as the best high school laboratory in the state. We also have a retired bioremediation expert, Les Stephens, who is volunteering to work with North Central High School students.

To gain a better understanding of the steps the fungi take in breaking down PCB's we will test for hydrocarbons during the study period. North Central students will do an initial lab test to determine the total petroleum hydrocarbon levels which include the PCBs.

We will continue to use the space at Ash Street Training Center at 1925 N. Ash Street, Spokane, WA, and will also utilize the laboratory at North Central High School.

Testing of the soil in the lab will be carried out before treatment, and at intervals after the mycelium is applied. Since the levels of PCB's should be detectable with the lower cost test we hope that either the City or North Central High School can conduct PCB testing.

Three students from North Central High School are eager to carry out this project, along with their advisor Dan Shay, and would like to continue it to June 2019. They have created a work plan that includes growing the fungi on soil in pans (vs the petri dishes in Phase 1), and doing a total petroleum hydrocarbon assay using the gas chromatography equipment in their lab.

The Lands Council will assist with obtaining samples and will maintain the Ash Street laboratory during the 14 month project period.

Outcomes

We hope that this project will show that fungi can be used to mitigate contaminated soil and reduce PCB, hydrocarbons and other contaminants. We will work with the Spokane River Toxics Task Force to have positive media outcomes, and share our findings with Washington Department of Ecology, the US Environmental Protection Agency, and other interested parties.

Success will be measured on how PCB's, hydrocarbons and other contaminants are reduced through the treatment on contaminated soil. Applications from this research could be seen in storm gardens, known contaminated sites, vector waste and biosolids.

We will produce a report of the Phase 2 results by the end of the project period.

FUNDING REQUEST

Phase 2 Mycoremediation Project	Nov 1 2017 - Dec 31 2018
Task	Amount
Ash Street Rent, utilities and insurance	\$6,000
North Central summer student interns (2018)	\$3,000
Project Coordination - Lands Council	\$3,000
North Central test materials	\$1,000
Summary Report and presentations	\$2,000
Total Amount	\$15,000

Contact information:

Mike Petersen, Executive Director
The Lands Council
25 W. Main Ave, Suite 222
509-209-2406
mpetersen@landscouncil.org