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BIOREMEDIATION OF ASBESTOS

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University of Pennsylvania
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Uzbekistan
Kyrgyzstan
urkey
Turkmenistan
China
Syria
Iraq
Iran
Afghanistan
Pakistan
Nepal
Saudi Arabia
India
Myanmar
(Burma)
Oman
Yemen
Thailand
Gulf of Aden
Arabian Sea
Bay of Bengal
Gulf of
Thailand
Ethiopia
Laccadive Sea
Somalia
Kenya


Asbestos roof

Asbestos

- Naturally occurring fibrous minerals

- Industrial use: heat- and abrasion-resistant materials; roof, insulator; wine filtration…

Asbestos Pile, Ambler, PA

http://www.boritcag.org/photo/index.html

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Asbestos

- Exposure to asbestos can cause asbestosis, mesothelioma, and lung cancer.
- In the US, 30 people die each day due to asbestos-related disease.

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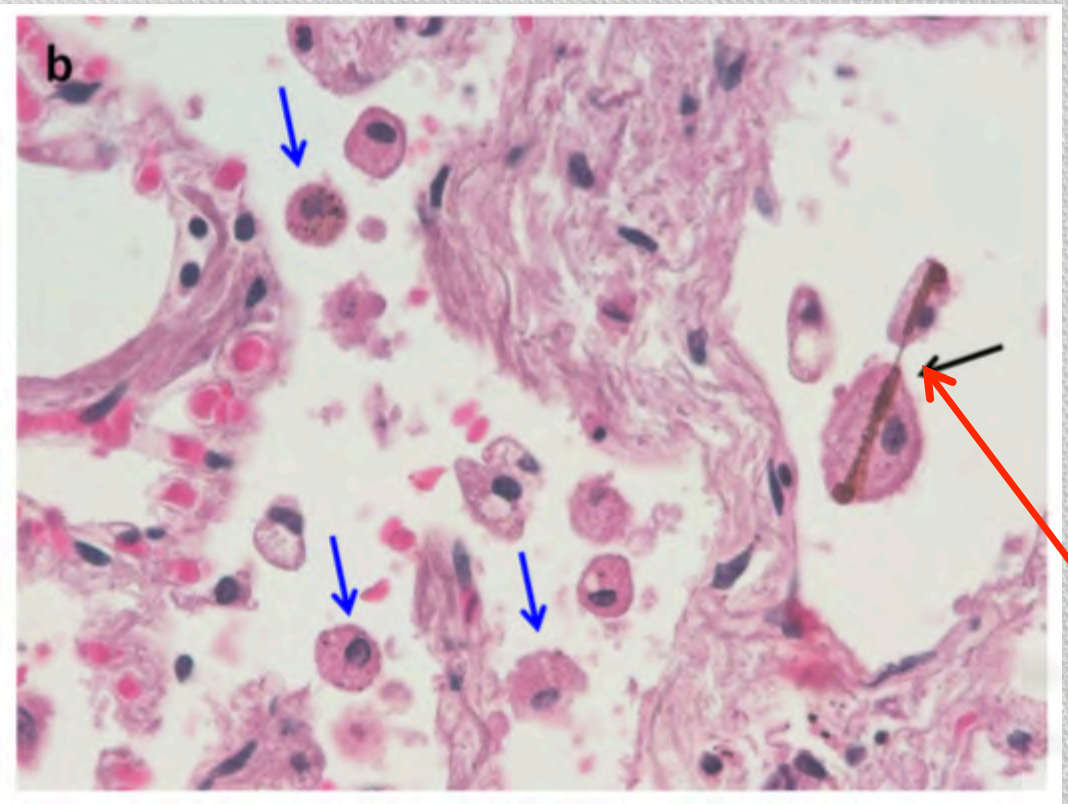
Why is asbestos toxic?



Histological examination of human lung tissue with asbestos bodies. (Pascolo et al. 2013 Scientific Report)

Physical structure

- Rigidity
- Long fiber

Chemical properties

- Iron enhances asbestos toxicity

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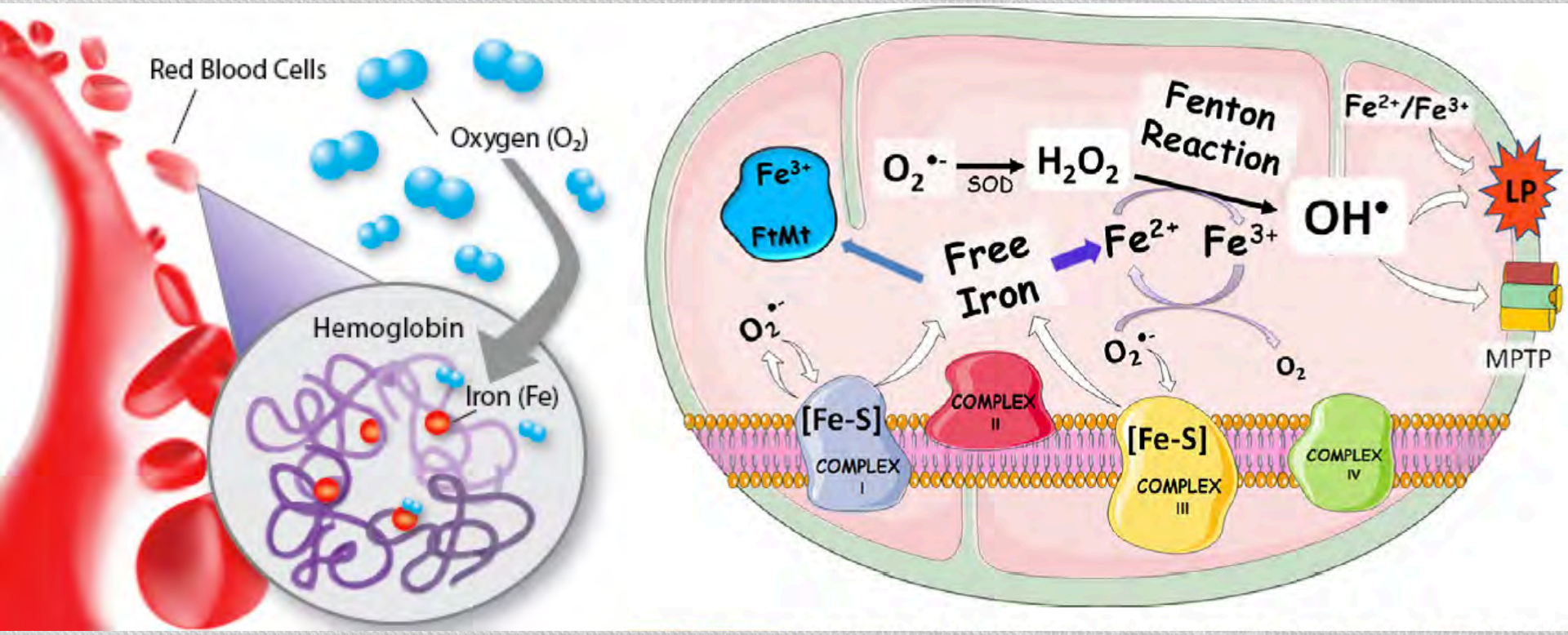
Why is (free) iron toxic?



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Goal

To lower asbestos exposure potential to community by treating the asbestos fibers underground.

- ✓ Decrease fiber toxicity
- ✓ Breakdown fiber

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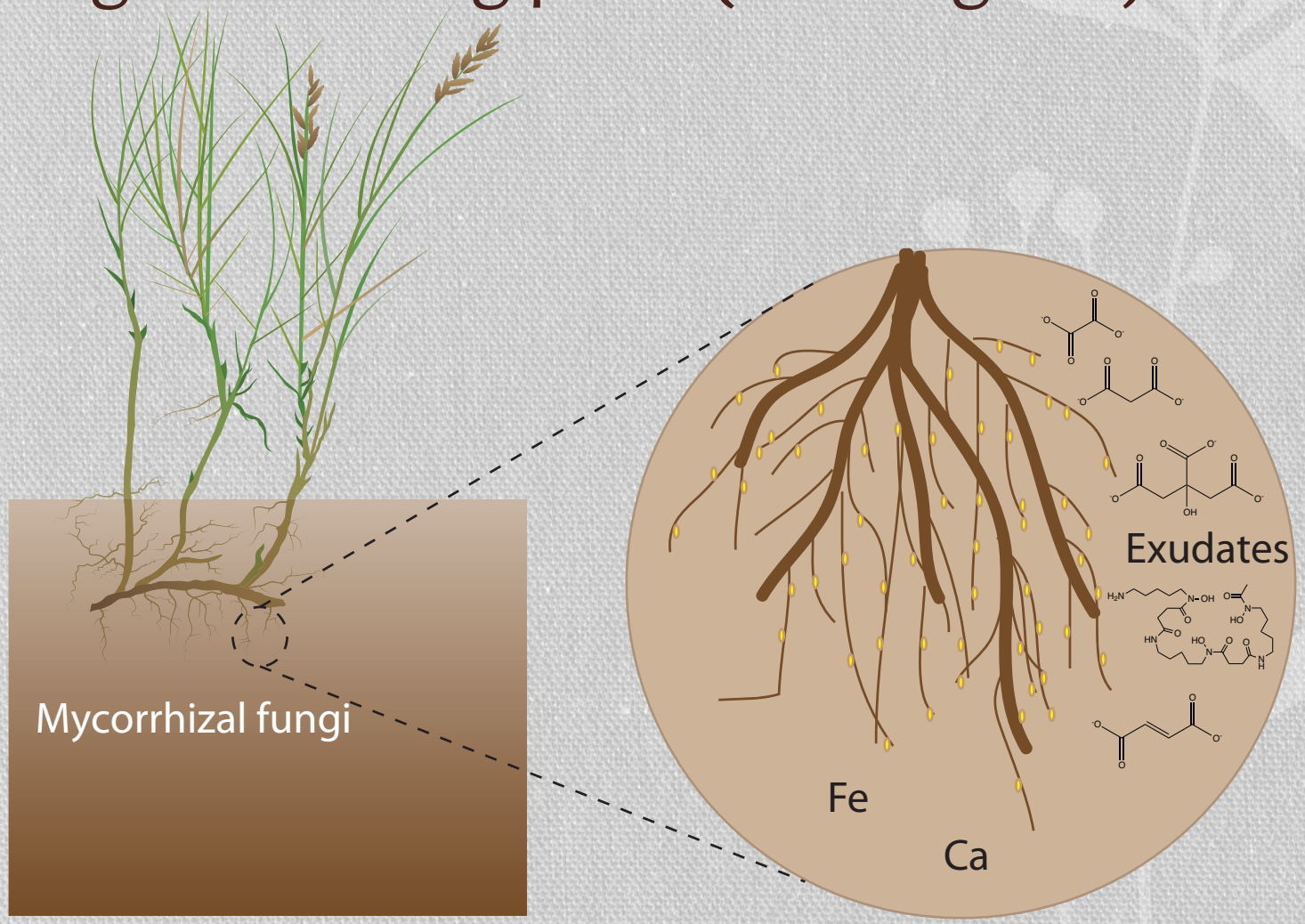
Best Remediation Plan: Capping

April 2015

Vegetative cover

GE-Pittsfield/Housatonic River Site

Can we remove iron and breakdown asbestos underground using plant (native grass)?



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Plants need fungi to get nutrients locked in minerals or rocks.

http://creating-a-new-earth.blogspot.com/2014_12_01_archive.html

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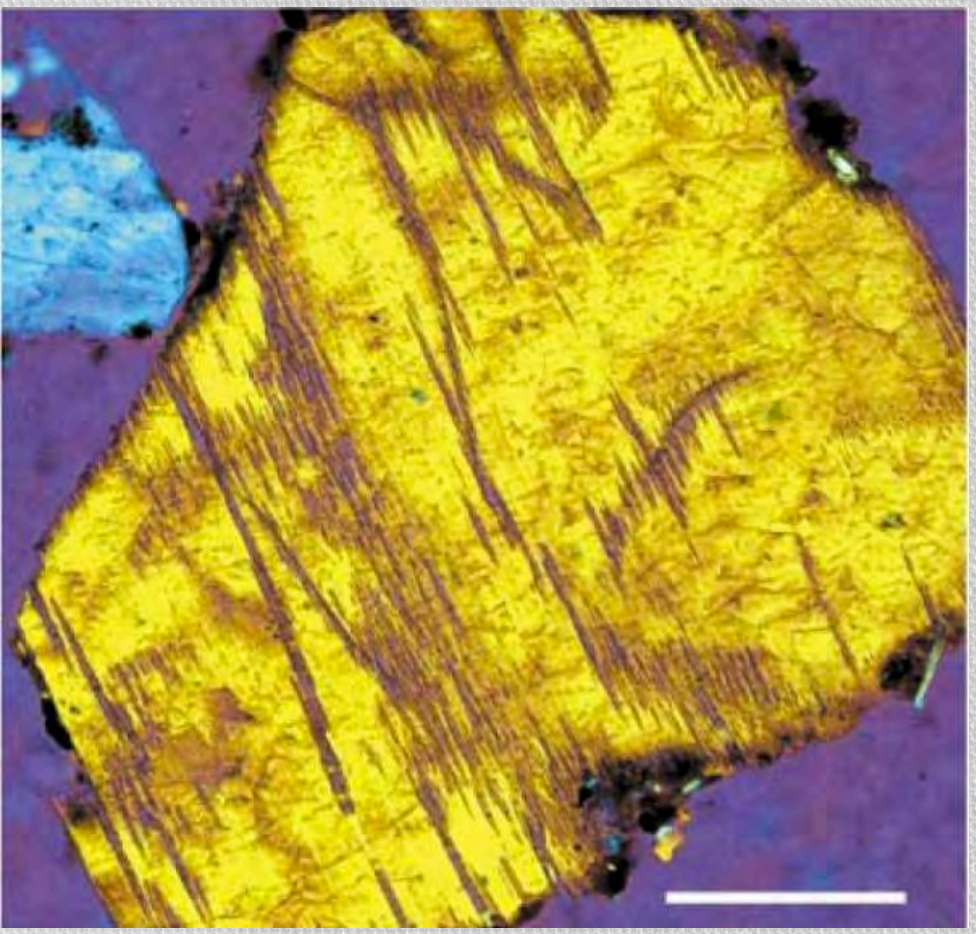
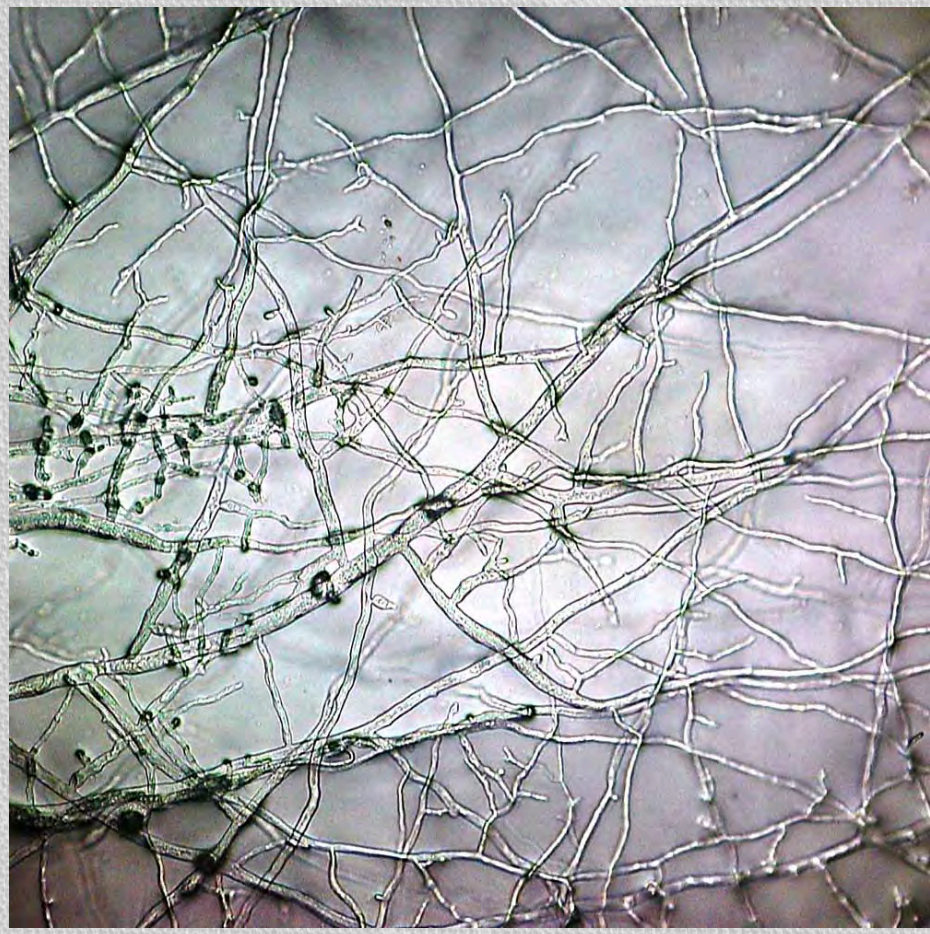
“The World's Largest Mining Operation Is Run by Fungi”





http://blogs.scientificamerican.com/artful-amoeba/the-world-s-largest-mining-operation-is-run-by-fungi/

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Where do we typically use fungi?

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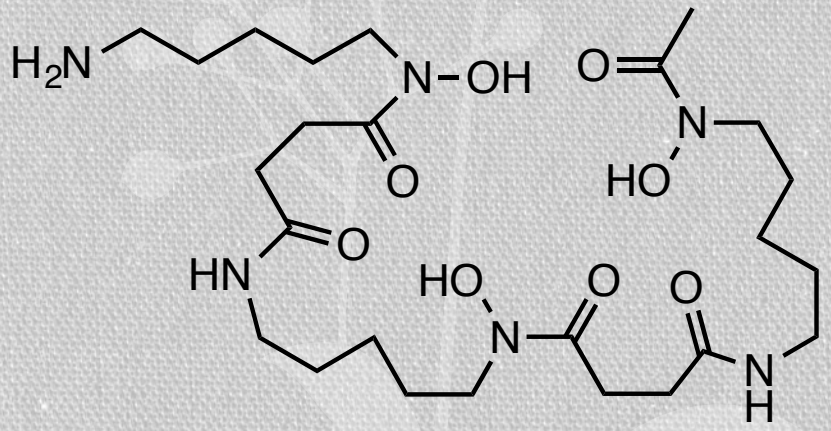
Materials

- Asbestos Fiber (Chrysotile)

Chrysotile ore (Globe, Arizona)

- Plant and Fungal Exudates



Desferrioxamine B (DFO-B)
siderophore

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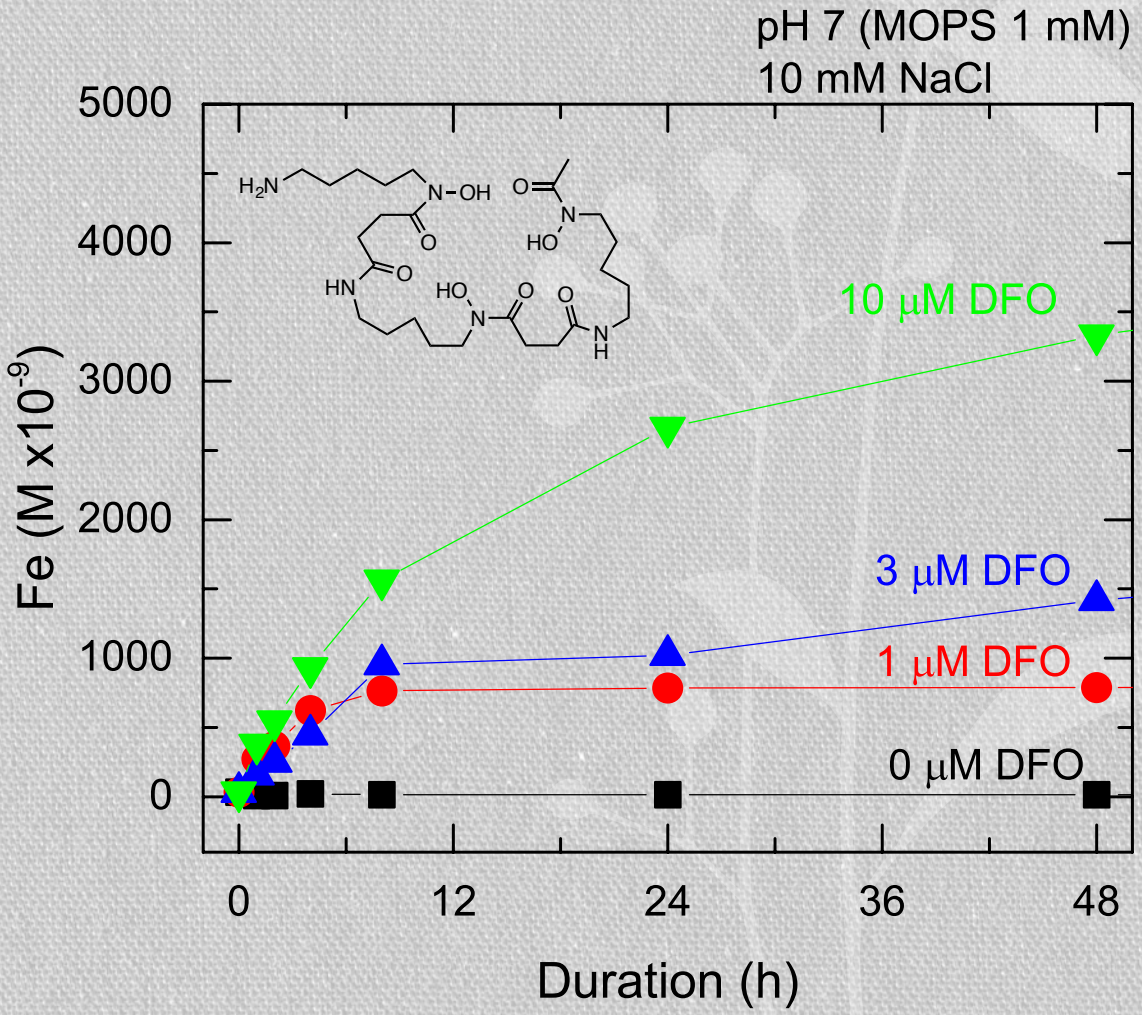
Plant and fungal exudates can remove iron from asbestos fibers

A sustainable remediation design!



Mohanty et al.(2016 b) *In Preparation*

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Ongoing work

- Great start, but we have a long-way to go
- Phytoremediation using native grass
- Possible field experiment at a different site

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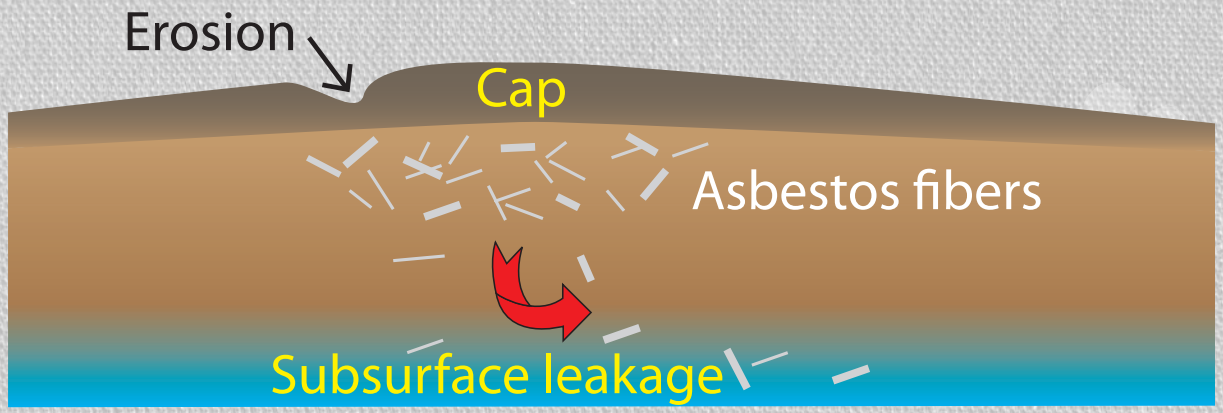
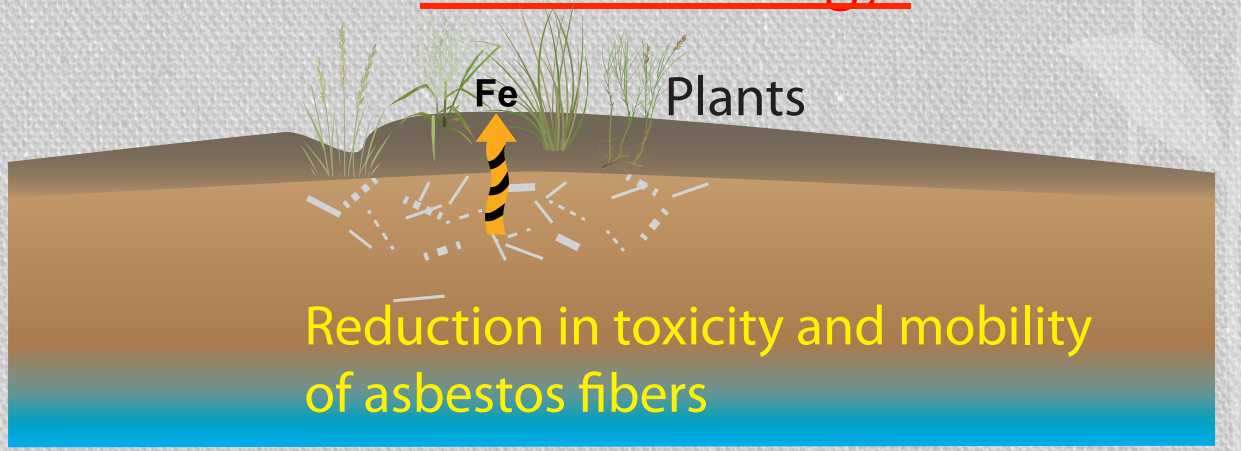
Remediation of asbestos-contaminated site

Current Remediation Plan



A Better Strategy?



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Community Asbestos Exposure