

9-30-2004

**SUBJECT: Geobacter**

**RE: Excerpted from Gifted Microbe Transforms Waste into Power, by Robert S. Boyd (Knight Ridder newspapers) July 25, 2004.**

The U.S. Department of Energy, Pentagon, and National Science Foundation are funding research on the properties of the Geobacter class of bacteria:

- turn (highly radioactive) uranium waste into harmless muck
- generate electricity from rust
- generate electricity from garbage
- generate enough electricity to run a toy car
- perform other useful work.

Geobacter (Geo.) was discovered in 1987 in Potomac River mud in Washington DC by biologist Derek Lovely, Head of the Geo. Project based at Univ. of Massachusetts in Amherst.

So far, 20 series of Geo. genus are recognized, plus 30 closely related.

2004 is the third year of DOE testing Geo. removal of uranium waste from groundwater at Rifle, Colorado.

In the test, Geo. moves electrons from atoms in vinegar to highly radioactive species (valence) Uranium-6.

Compounds with Uranium-6 easily dissolve in water, contaminate rivers and underground aquifers, and can kill fish, animals, and people.

Addition of two electrons reduces Uranium-6 to safer Uranium-4, a solid like natural uranium ore.

It sinks to the bottom of water, where it can be extracted or left safely in place. "Geobacter is principally responsible for reduction of U-6 to U-4 and its subsequent removal from groundwater", said Phillip Long, environmental geologist at Pacific NW National Lab at Richland, Washington.

Geo. likes vinegar so Geo. can be fed cheaply to propagate, doubling in 24 hours. Geo. are harmless to the environment--they're already everywhere in almost any soil.

Geo. is also used to turn petroleum byproducts, e.g., benzene (a carcinogen) to carbon dioxide.

Geo. makes electricity from rust. The microbe removes an electron from one type (valence) iron atoms, Fe-2 and converts it to Fe-3, ordinary rust. The electron travels along a wire, from a positive to a negative pole, like a miniature battery.

Such power could be used in less developed countries to charge batteries, run a radio, TV, or PC, or light a small hut.

And Geo. generates electricity from garbage. Although only a tiny amount of electricity in the lab, it is more efficient than burning biomass, e.g., wood, cornstalks, trash.

Lovely claims Geo. can recover 80 to 90% of the energy potential in iron, compared with an average of 30% of the energy stored in biomass by traditional means.

"We're efficient but slow, and trying to get fast."

The Defense Department is interested in using energy in iron-rich mud on the sea bottom to power submarine detectors and other sensors.

—Summary prepared by R. Beatty, CFRI

[Another(?) organism is found in meteors that can withstand millions of times greater exposure to ionizing radiation than can the human body.]

File CFR40930