Potential Environmental Problems with Oil Shales

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Dr. Tom Barton

Western Research Institute, Laramie, WY 82070

Goal: Compare potential environmental issues with oil shale development with those of processing Wyoming coal. Focus is on mercury and arsenic.

Background

- Oil shale as a mineral has all the potential environmental issues with processing as other minerals.
- Mercury and other environmental contaminants in coal have become very pressing topics in recent years.
- How do the potential environmental issues with oil shale compare to those of coal?

Objectives

- Measure content of mercury and arsenic in oil shale.
- Determine how those contaminants may be exposed to the environment during thermal processing.
- Compare the results to similar data for coal.

Experimental Procedure

- A 250 kg amount of oil shale was obtained from the Green River Basin, Wyoming.
- A portion of oil shale was ball milled to sub 40 mesh size.
- Individual 50 g samples were placed into ceramic dishes and heated in air to temperatures between 100ºC and 400ºC for 24 hours.
- A single experiment was run at 400ºC under nitrogen for 24 hours.
- Content of the oil shale was measured by an independent laboratory before and after heating.

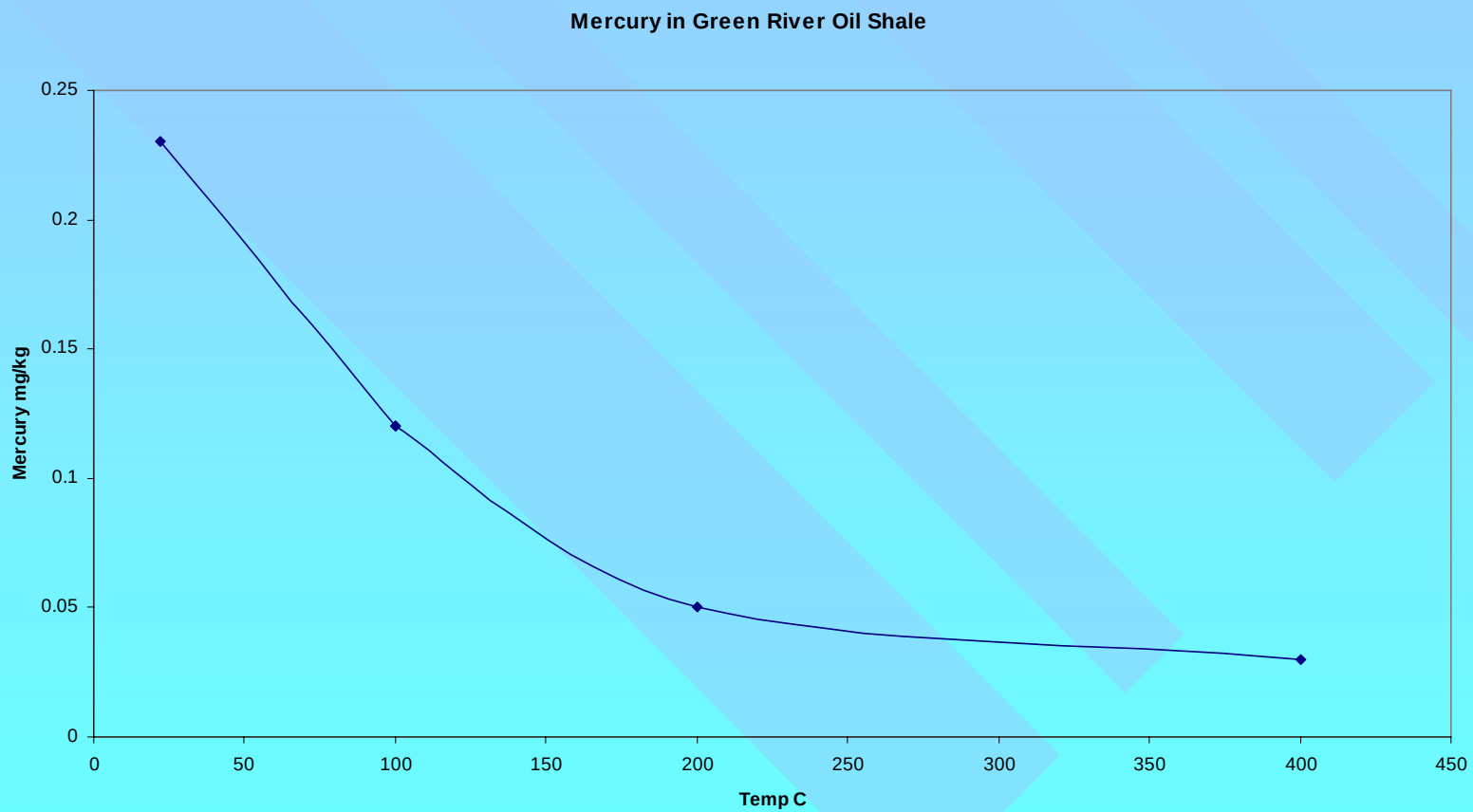
Composition of the Oil Shale

- Proximate analysis: 67% ash, 33% volatile
- Mercury by weight: 0.23 mg/kg
- Mercury per energy value: 70 mg/million BTU
- Arsenic per weight: 11.6 mg/kg (bp=600ºC)

Composition of Wyodak Coal

- Proximate: 6% ash, 44% volatile, 50% fixed carbon
- Mercury per energy value: 6 mg/million BTU
- Arsenic per weight (mean): 3 mg/kg

Mercury Concentration vs. Temperature



Results

- After 24 hours at 100ºC, 1% shale weight lost, but 50% of mercury lost to environment.
- After 24 hours at 200ºC, 6% shale weight lost, and 80% of mercury lost to environment.
- After 24 hours at 400ºC, 15% shale weight lost, and 87% of mercury lost to environment.

Conclusions

Although this was a limited study and based on simplistic tests, the results are clear:

- On a weight per BTU basis, oil shale can contain over 10 times the mercury found in a typical Wyoming coal.
- A significant amount of the mercury in oil shale is lost to the environment at temperatures associated with drying, 100 to 200ºC.

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