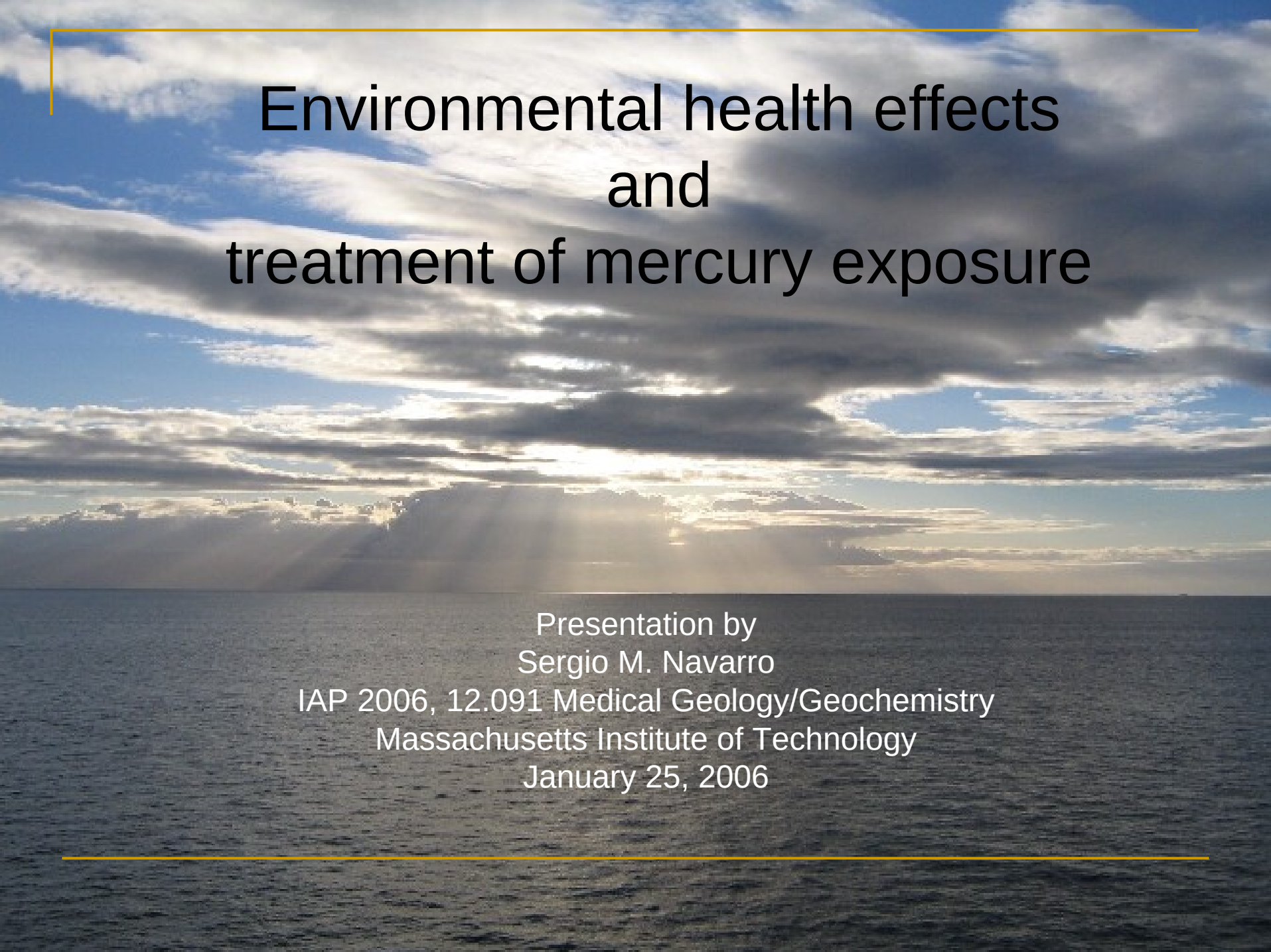


# Environmental health effects and treatment of mercury exposure

Presentation by
Sergio M. Navarro
IAP 2006, 12.091 Medical Geology/Geochemistry
Massachusetts Institute of Technology
January 25, 2006

# Overview

**A. An Introduction to Mercury:**

Mercury and its forms

Mercury cycle

Impact of mercury on the human body

Impact of mercury on ecological system

**B. Exposure:**

Forms of exposure

Symptoms of mercury toxicity

**C. Pollution prevention strategies:**

Areas of containment

Cost and benefit of mercury regulation

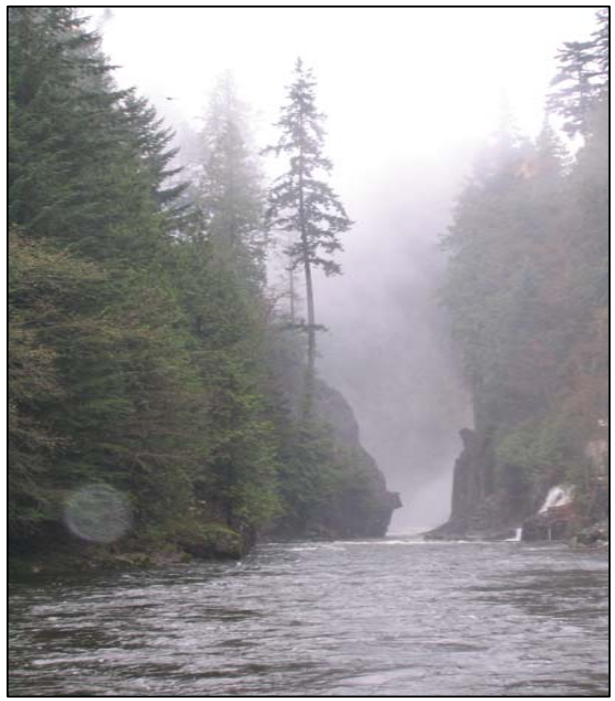
Treatment of individual patients

**D. Summary and Conclusions:**

Personal diet recommendations

Societal environmental conclusions

**E. References:**



# An introduction to mercury and its forms:

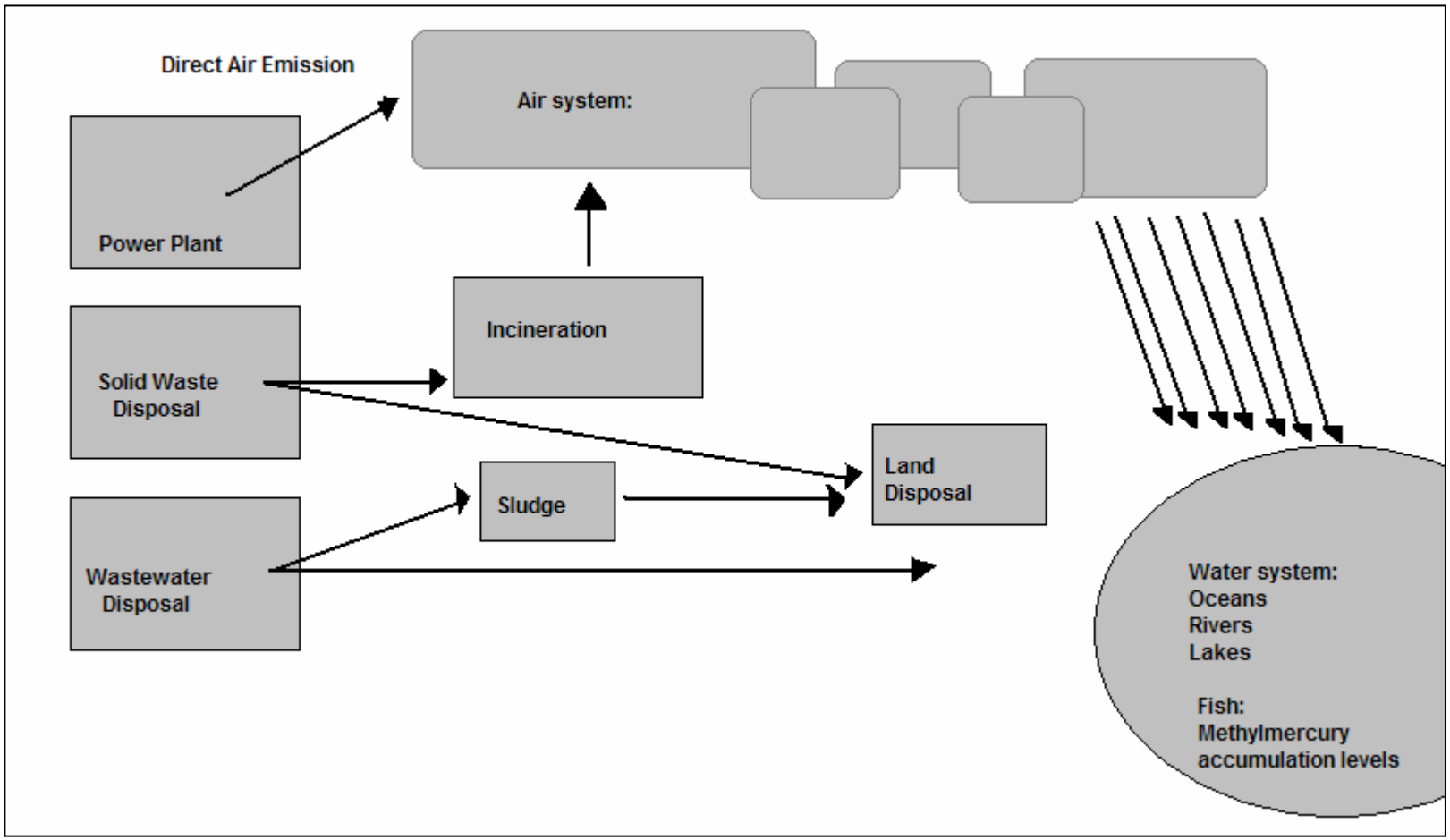
Mercury is the 80th element in the periodic table, one of the five elements in nature found in liquid form at room temperature.

Mercury is often produced by reducing cinnabar ($HgS+O_2 \rightarrow Hg + SO_2$).

Throughout history, mercury has been used for a variety of purposes, from making felt hats, to thermometers and medical equipment, and dental amalagrams.

Mercury can be found in both liquid and vapor forms. Both forms are dangerous and toxic. Mercury commonly comes in two main forms: inorganic (Hg) and as an organic compound.

# Mercury cycle:



# Impact of mercury on the human body:

Organic Forms of Mercury:

- More toxic than inorganic form.
- Causes nervous system and brain damage.
- Developing fetus is at risk.
- Ingestion from fish. Bacteria in water makes organic form of mercury.

Inorganic Forms of Mercury:

- Also toxic.
- Particularly affects the liver.
- Can also act as a neurotoxin.
- Inhalation of mercury vapor or exposure during manufacturing or spill.

# Impact of mercury on ecological systems:

Where does mercury eventually go?

• The answer is simple…up the food chain. It passively accumulates. Big predatory fish like tuna and swordfish are the most common suspects for high mercury concentrations because their gills filter high quantities of water and eat and accumulate Hg from smaller fish throughout their lifetime.

• The water cycle and air cycle have an unexpected effect that despite a lack of heavy industry, a particular region may have low-level contamination of Hg; for instance, a case in the woods of Wisconsin pose one such example.

•Plants can absorb mercury when wet but release mercury into dry air. Coal also contains various concentrations of mercury.

# Symptoms of exposure and toxicity:

- Impairment of the peripheral vision.
- Numbness and loss of feeling, tingling sensations along the limbs.
- Lack of coordination of movement/
- Impairment of speech, hearing, walking.
- Muscle weakness
- Skin rashes
- Dramatic mood swing
- Memory loss
- Mental disturbance

http://www.heartspring.net/mercury_poison_symptoms.html

# Areas of containment:

Three major areas of containment that poses serious risks to human populations:

A.Hospitals and health-care facilities.

Medical equipment

B. Manufacturing and power plants.

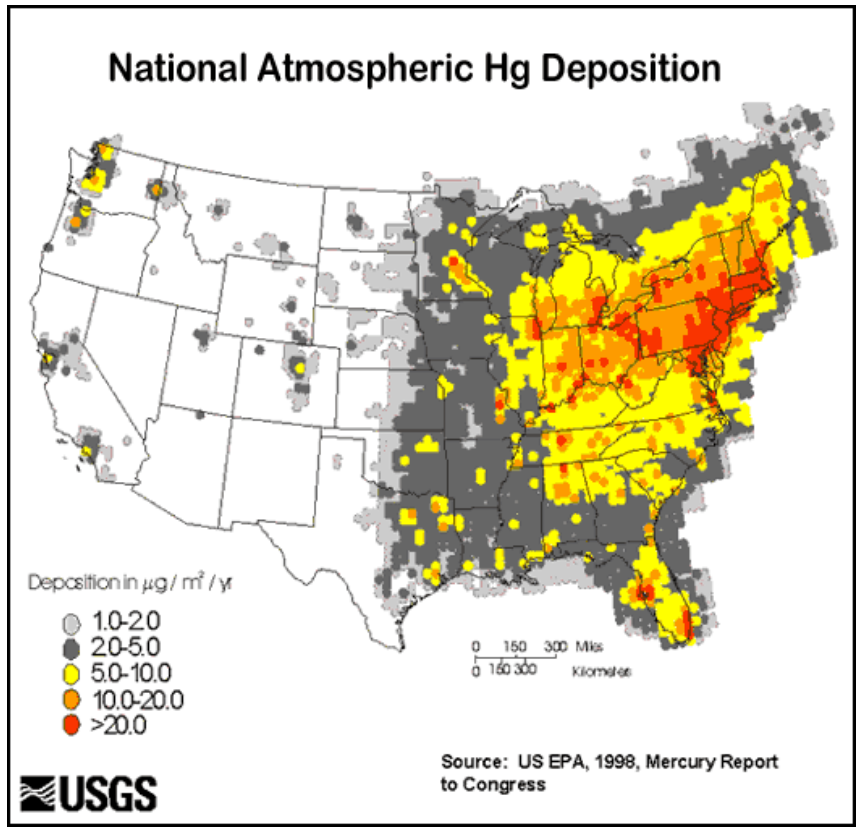
Burning of coal (Direct air emission)

Burning of sludge (Direct air)

Incineration

C. Freshwater and seawater fish.

Accumulation in upper-level predatory fish.




From USGS website

# Cost and benefit of mercury regulation:

Studies on detrimental effects of mercury on human health:

A. Cost of implementation and choice of emission reduction approach (Gayer, Hahn 2005).

B. Lifelong losses income based on loss of IQ in children due to exposure from prenatal methylmercury total to $15.9 billion over a fifteen-year period (Zeller 2005).

C. Relationship between mercury and IQ may be tenuous (P. Grandjean et al. 1997).

# Personal diet recommendations:

Methylmercury builds in the muscle of an animal, not the fat.
Atlantic seawater and east coast fish have shown much higher Hg concentrations over time than Pacific fish.

Limit consumption of freshwater fish to one per week. Mercury in blood does decrease over time.
Expectant mothers must be especially vigilant to regulate fish consumption to reduce risk to fetal development.

Possible supplements to detox:
ProChitosan (increases digestion rate), Garlic (increases S amount), Cilantro,Vitamin C and E (decreases detox side effects).

During EDTA or DMPS, avoid high sugar diet but eat high-protein. Sulfur-side group amino acids facilitate chelation.

# Society environmental considerations:

Use alternatives for mercury in medical equipment.

Reduce emission of mercury at all levels:

•Reduce emission  of power plants

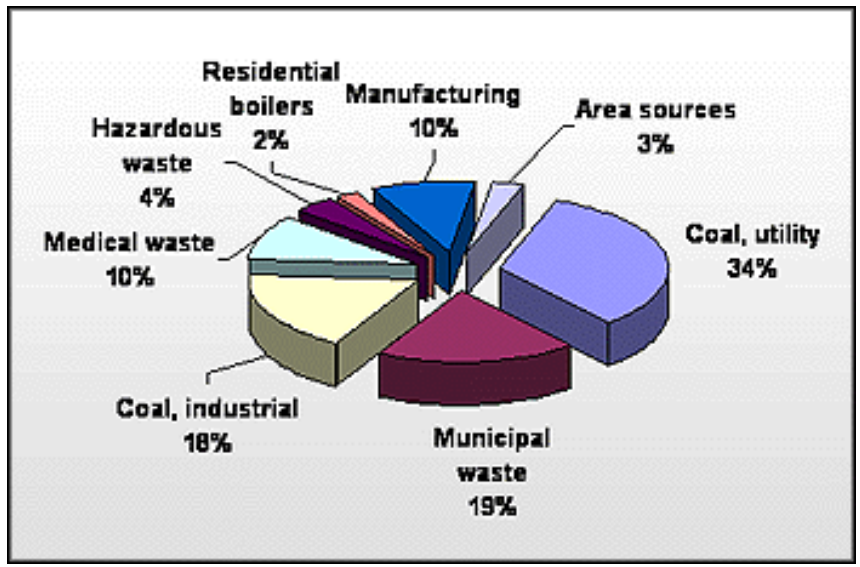
•Reduce mercury depositation

•Reduce methylmercury conc. in freshwater and marine fish, part. U.S. east coast.

•Reduce methylmercury consumption from U.S. fish.

•Increase testing and awareness to U.S. women of childbearing age.

Focus on coal-burning: 86% of mercury emissions in the U.S.




From EPA website

# References:


Krahalil B., et. al. Examination of urinary mercury levels in dentists in Turkey. Hum Exp Toxicology. 2005 Aug;24(8):383-8.

Boguszewska A., Pasternak K. Mercury influence on biochemical processes of the human organism. Ann Univ Mariae Curie Sklodowska. 2004; 59(2):524-7.

Dorea, J., Donangelo, C. Early (in uterus and infant) exposure to mercury and lead. Clinical Nutrition. 22 Nov. 2005.

Zeller D. Costs and benefits of regulating mercury. Science 4 Nov. 2005. 310(5749):777-9.

P. Granjean et al., Neurotixicology. Teratol. 1997. 19, 417.