



**Minamata Mercury Convention  
&  
Restorative Dentistry**

**2014 National Oral Health Conference  
ASTDD & AAPHD  
April 29, 2014**

**Peter Orris, MD, MPH, FACP, FACOEM**  
Professor and Chief  
Occupational and Environmental Medicine  
University of Illinois Hospital and Health Sciences System  
UIC School of Public Health  
A WHO Collaborating Center

# Disclosures:



**Born 1945:**

**Many Teeth Restored with Amalgam & Gold**

**Perspective:**

**35 Year Internal Medicine Practice At Cook  
County Hospital**

**Public Health/Occupational Health**

**Financial:**

**No Conflicts** (unfortunately)

# NEUROBEHAVIORAL EFFECTS OF DENTAL AMALGAM IN CHILDREN: A RANDOMIZED CLINICAL TRIAL

TIMOTHY A. DEROUEN, PHD ET. AL.

## Conclusions:

children who received dental restorative treatment with amalgam did not, on average, have statistically significant differences in neurobehavioral assessments or in nerve conduction velocity



# DENTAL AMALGAM AND PSYCHOSOCIAL STATUS: THE NEW ENGLAND CHILDREN'S AMALGAM TRIAL.

Bellinger DC et. al.

Harvard Medical School, Harvard School of Public Health, Children's Hospital, Boston, MA, USA.

Randomized trial involving 6- to 10-year-old children

**No evidence was found that exposure to mercury from dental amalgams was associated with adverse psychosocial outcomes.**

[J Dent Res. 2008 May;87\(5\):470-4.](#)





ELSEVIER

Contents lists available at ScienceDirect

## Journal of Hazardous Materials

journal homepage: [www.elsevier.com/locate/jhazmat](http://www.elsevier.com/locate/jhazmat)



# Scalp hair and saliva as biomarkers in determination of mercury levels in Iranian women: Amalgam as a determinant of exposure

H. Fakour<sup>a,\*</sup>, A. Esmaili-Sari<sup>a</sup>, F. Zayeri<sup>b</sup>

<sup>a</sup> Department of Environment, Faculty of Natural Resources and Marine Sciences, Tarbiat Modares University, Noor, Mazandaran, Iran

<sup>b</sup> Department of Biostatistics, Faculty of Paramedical Sciences and Proteomics Research Center, Shahid Beheshti University of Medical Sciences, Tehran, Iran

### ARTICLE INFO

#### Article history:

Received 23 June 2009

Received in revised form

27 November 2009

Accepted 1 December 2009

Available online 4 December 2009

#### Keywords:

Mercury

Hair

Saliva

Iranian women

Amalgam fillings

### ABSTRACT

The aim of this study was to determine the relationship between mercury concentrations in saliva and hair in women with amalgam fillings and its relation with age and number of amalgam fillings. Eighty-two hair and saliva samples were collected randomly from Iranian women who have the same fish consumption pattern and free from occupational exposures. The mean  $\pm$  SD age of these women was  $29.37 \pm 8.12$  (ranged from 20 to 56). The determination of Hg level in hair samples was carried out by the LECO, AMA 254, Advanced Mercury Analyzer according to ASTM, standard No. D-6722. Mercury concentration in saliva samples was analyzed by PERKIN-ELMER 3030 Cold Vapor Atomic Absorption Spectrophotometer. The mean  $\pm$  SD mercury level in the women was  $1.28 \pm 1.38 \mu\text{g/g}$  in hair and  $4.14 \pm 4.08 \mu\text{g/l}$  in saliva; and there were positive correlation among them. A significant correlation was also observed between Hg level of saliva (Spearman's  $\rho = 0.93$ ,  $P < 0.001$ ) and hair (Spearman's  $\rho = 0.92$ ,  $P < 0.001$ ) with number of amalgam fillings. According to the results, we can conclude that amalgam fillings may be an effective source for high Hg concentration in hair and releasing the mercury to the saliva samples.

HEALTH CARE RESEARCH COLLABORATIVE



# Mercury in Dental Amalgam and Resin-Based Alternatives: A Comparative Health Risk Evaluation

JUNE 2012



**Public Health Interventions  
MUST BE BASED ON EVIDENCE**

# GLOBAL MERCURY EMISSIONS

Coal Energy Generation

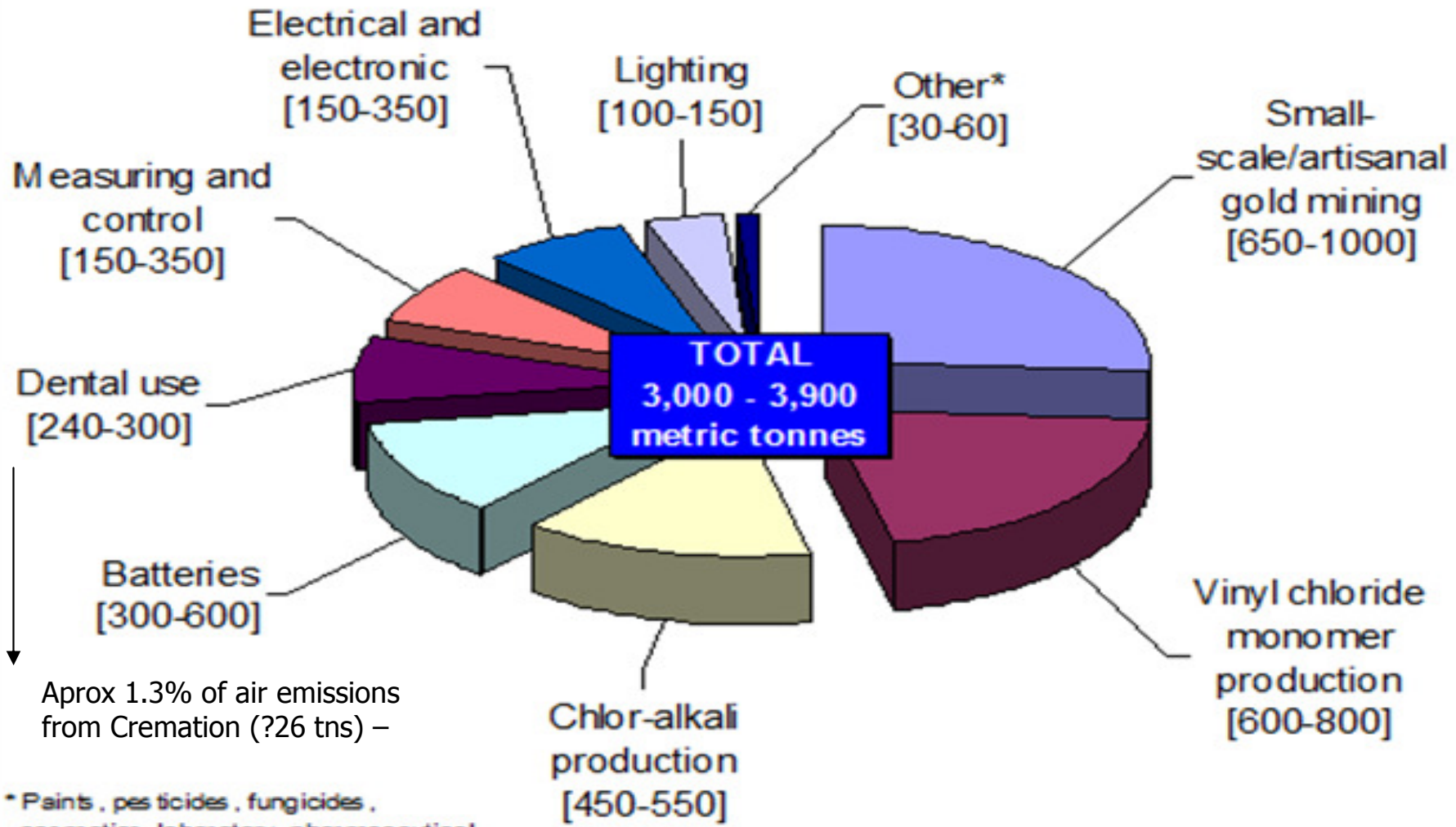


Mining Operations





# Global metallic mercury demand by application, 2005 (metric tonnes)



Approx 1.3% of air emissions from Cremation (?26 tns) –

\* Paints, pesticides, fungicides, cosmetics, laboratory, pharmaceutical, cultural/traditional uses, etc.

November 2006

## *Global Mercury Demand (2005)*

# GLOBAL DENTISTRY 2005

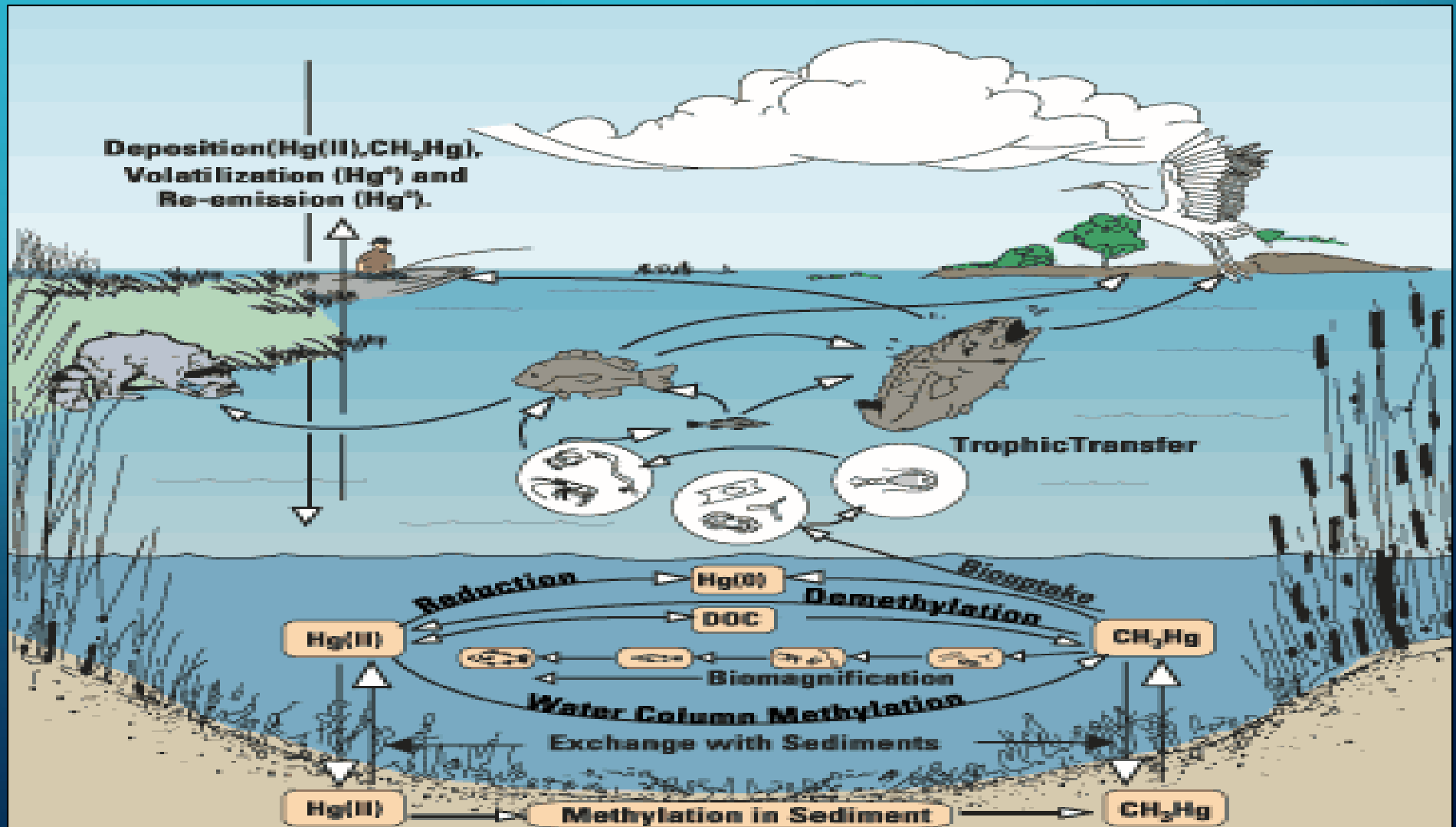
- 240 – 300 tns used
- 1.3% emissions = 26 tns



Hong Kong	The choice of restorative materials is mainly based on clinical need. Dental amalgam is the most commonly used, particularly in government clinics.
Xian and Shanxi Province	Composite resins are commonly used in large hospitals (70%), middle level hospitals (60%) and small hospitals and private dental clinics (50%). The decreasing trend of amalgam use continues.
Guangxi Province	Dental amalgam is still used in every public hospital, but only for 8-10% of dental restorations. The majority of private dental clinics (80%) still use dental amalgam based on patients' needs.
Beijing	Composite resins are used in large hospitals instead of amalgam. Dental amalgam is still in use in other hospitals and private dental clinics, although the trend is decreasing.
Shanghai	Dental amalgam is used in hospitals and private dental clinics in about 45% of dental restorations. Hospitals and dental clinics have certain measures for waste handling to reduce mercury pollution, but some of them do not have guidelines to deal with the problems.
Anhui Province	Dental amalgam is the most popular restorative material of choice for posterior teeth because it is cost-effective.
Dalian	Dental amalgam restorations are not used in children. Few are used in other hospitals and dental clinics.
Zhengzhou	Dental amalgam is commonly used for dental restorations. It costs about 50 Chinese dollars per filling; the cost is double for composite resins. There are no adverse reactions to dental amalgam reported by local experts.

Studies have shown that bacteria that process sulfate ( $\text{SO}_4^{2-}$ ) in the environment take up mercury in its inorganic form, and through metabolic processes convert it to methylmercury. United States Geological Survey:

<http://wi.water.usgs.gov/mercury/mercury-cycling.html> 2014





# BIOMAGNIFICATION!

4,800,000 ppt

egg

???

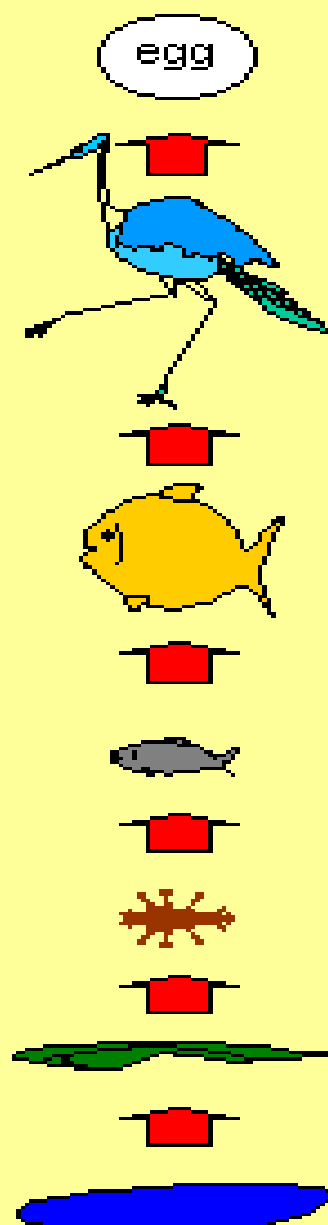
690,000 ppt

98,000 ppt

14,000 ppt

2,000 ppt

0.10 ppt



ppt = parts per trillion  
(mercury concentration)

# CHRONIC EXPOSURE TO HIGH LEVELS OF METHYL MERCURY

- **Minamata disease:** 2,265 cases confirmed in Minamata, Japan as of March 2001

- **Effects:**

- Constriction of visual fields
- Irregular gait
- Loss of muscular coordination
- Loss of speech, hearing, and taste
- Emotional disturbance
- “Living wooden dolls”



Photo: William Eugene Smith

- Congenital Minamata disease diagnosed in 1961

# MINAMATA 2011





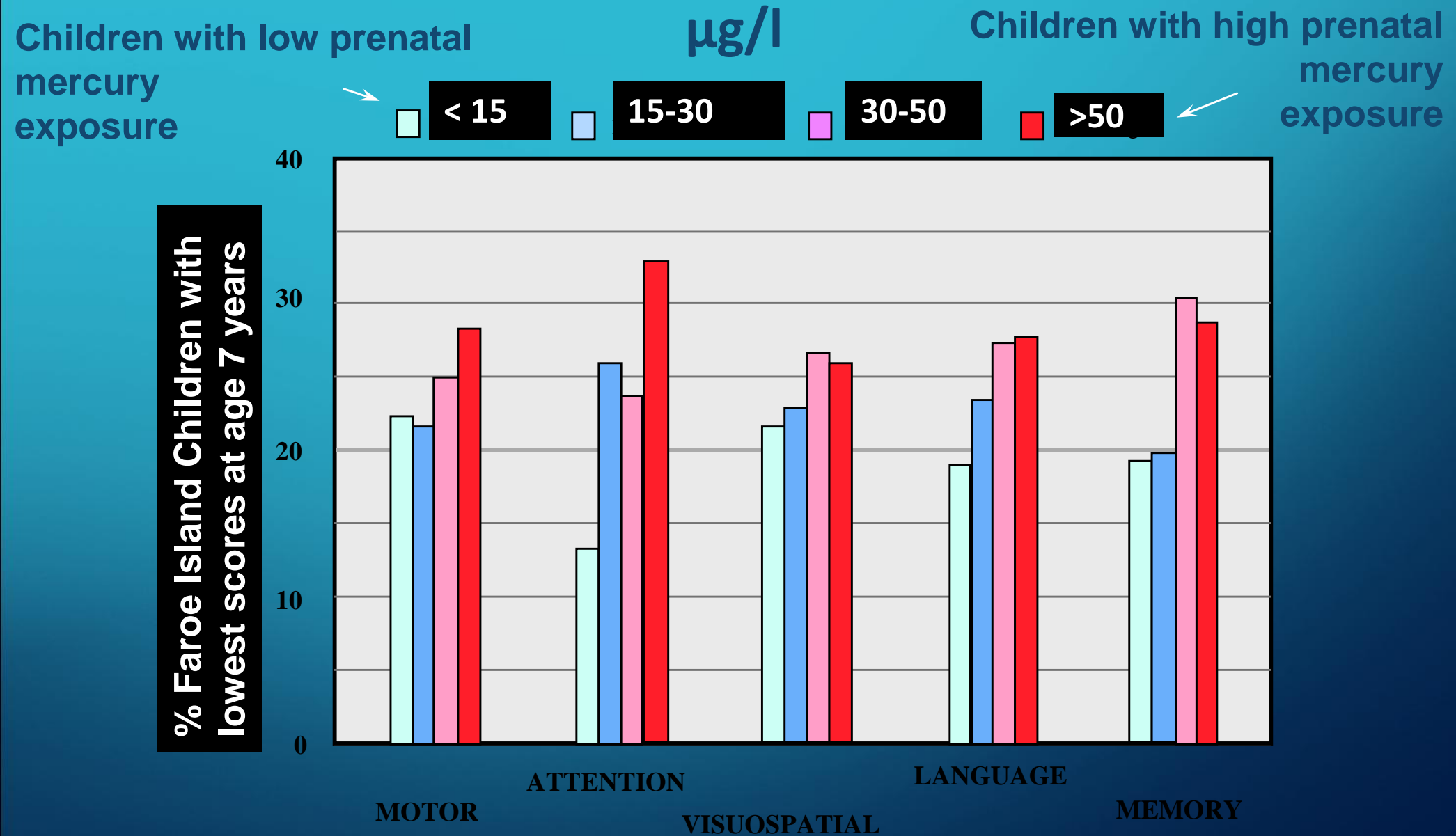
# HEALTH EFFECTS OF PRENATAL EXPOSURE TO MERCURY: FAROE ISLANDS STUDY

- Prospective cohort study of 700 mother-infant pairs enrolled at birth
- Mean mercury levels in mothers hair 6.8 ppm (range 0.5-27 ppm)
- Study controlled for PCB exposure





# Mercury: Effects of Low Dose Prenatal Exposure

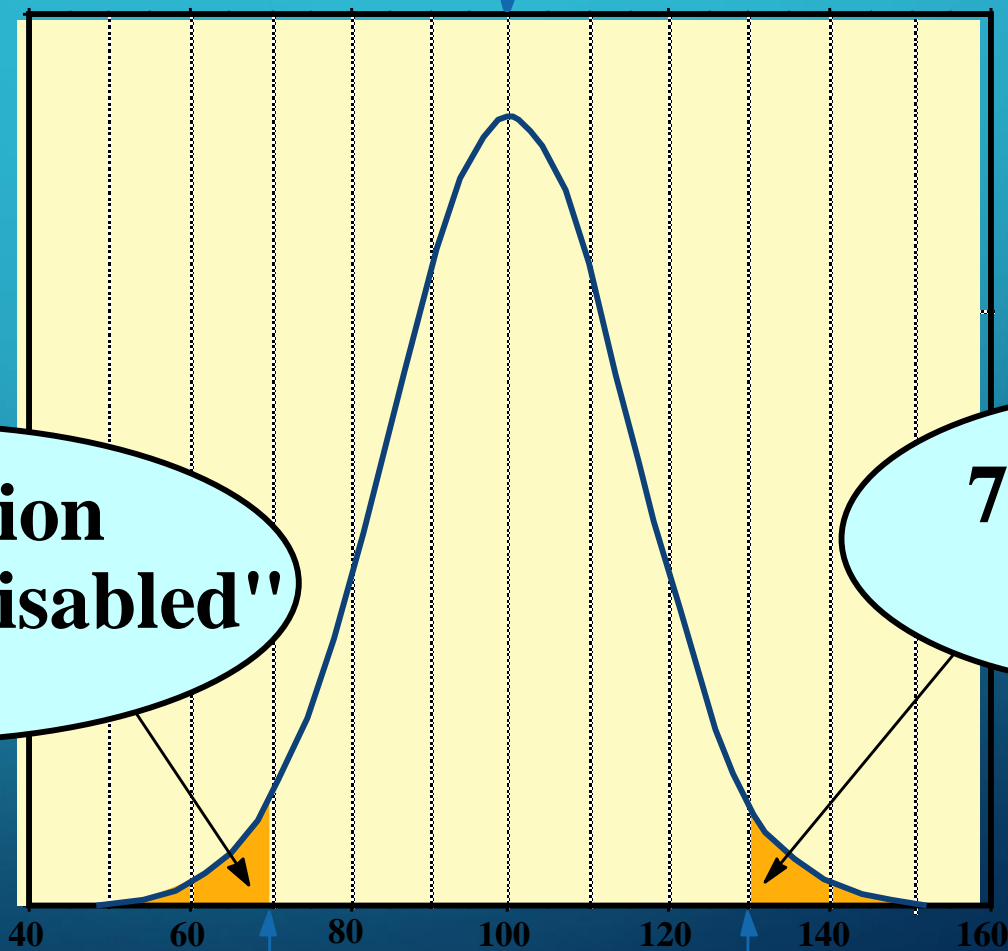


# THE SIGNIFICANCE OF SMALL EFFECTS: EFFECTS OF A SMALL SHIFT IN IQ DISTRIBUTION IN

A  
POPULATION OF

**300 MILLION**

mean 100



**7.0 million  
"mentally disabled"**

**7.0 million  
"gifted"**

**70**

**I.Q.**

**130**

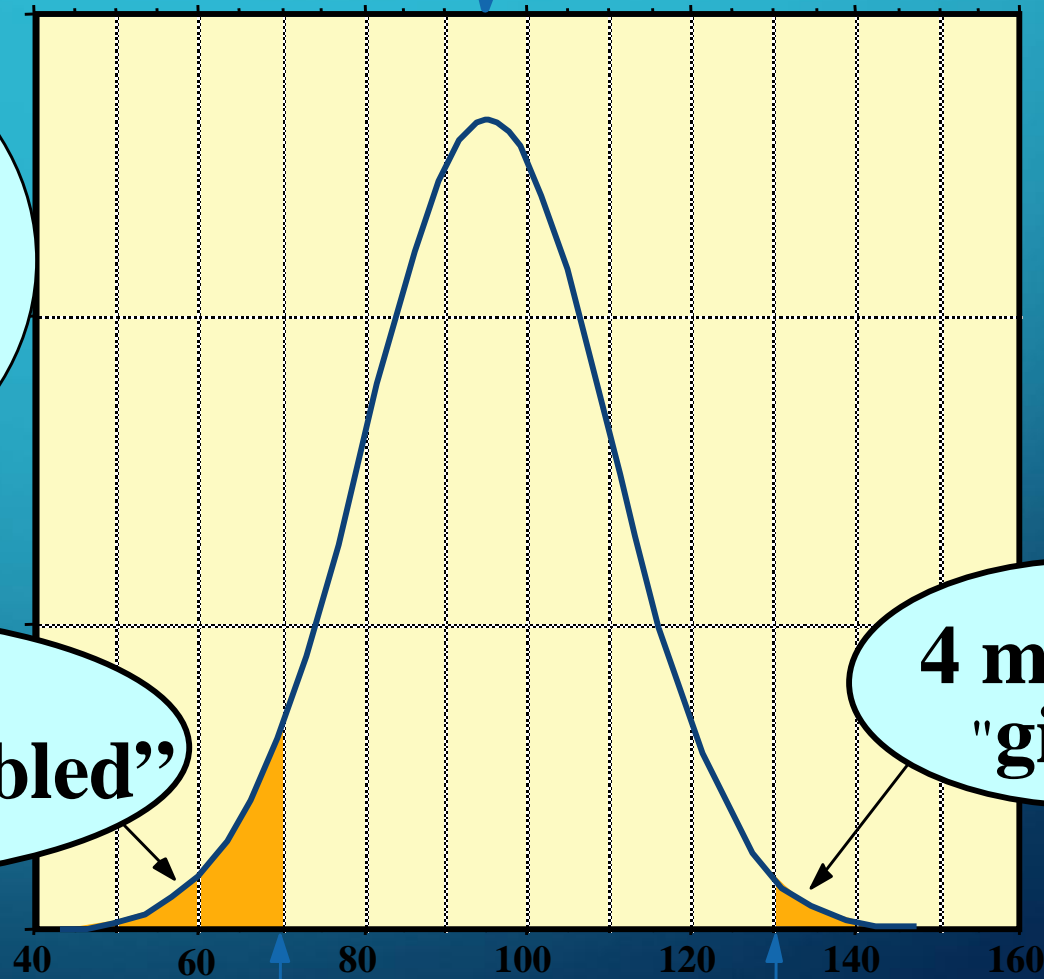
# 5 POINT DECREASE IN MEAN IQ

Mean 95

**57% INCREASE**  
IN  
**"Mentally Disabled"**  
Population

**11 million**  
**"mentally disabled"**

**4 million**  
**"gifted"**



70

I.Q.

130

# Public Health and Economic Consequences of Methyl Mercury Toxicity to the Developing Brain

Leonardo Trasande, Philip J. Landrigan, and Clyde Schechter  
Mount Sinai School of Medicine, New York, New York, USA  
Environ Health Perspect 113:590–596 (2005).

**\$1.3 billion**

**each year is attributable to mercury emissions from U.S. power plants.**



Photo: Illinois State Geological Survey



# COMPARISON OF MERCURY (PPM) AND OMEGA-3 FATTY ACID (G/100G) IN FISH SPECIES

## High Mercury Species:

Tilefish: 1.6 H:g, 0.17 O-3s

Shark: 1.3 Hg, 0.07 O-3s

Swordfish: 0.95 Hg, 0.58 O-3s

## High Omega-3 Species:

Mackerel: 0.08 Hg, 3.61 O-3s

Herring: 0.01 Hg, 2.34 O-3s

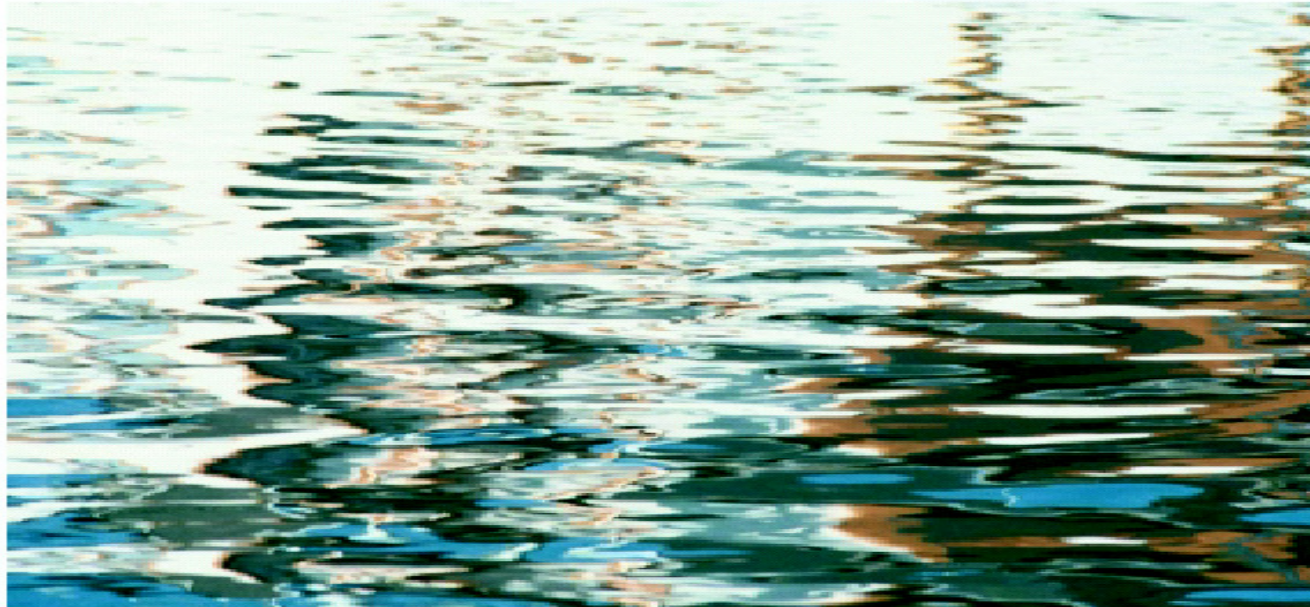
Tuna, albacore: 0.26 Hg, 2.33 O-3s



# GREAT LAKES **FISH** CONSUMPTION

---

## ADVISORIES



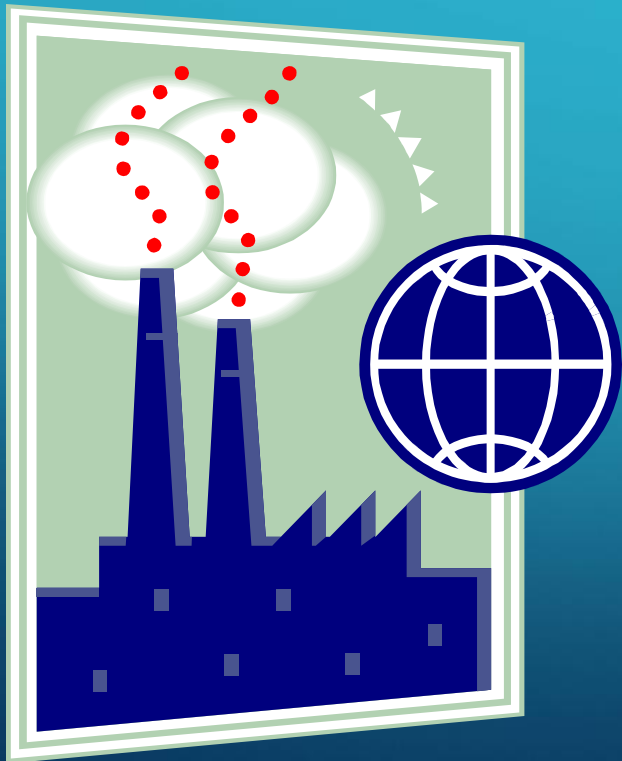
### **The Public Health Benefits and Risks**

Discussion Paper prepared by the Health Professionals Task Force  
for the International Joint Commission

---

**January 2004**

# KEEP MERCURY OUT OF THE FISH NOT FISH OUT OF THE MOTHER





UNITED NATIONS ENVIRONMENT PROGRAM  
GOV COUNCIL DECISION 25 (2009)  
MERCURY

- Intergovernmental negotiating committee in  
2010 , 2011, 2012
- Elaborate a legally binding instrument by  
2013









# Minamata Convention Agreed by Nations

Sat, Jan 19, 2013

Global Mercury Agreement to Lift Health Threats from Lives of Millions World-Wide

| Français | 中文

Email 52

Tweet 47

Share 228

Share 16

+1 8



Geneva/Nairobi, 19 January 2013 - International effort to address mercury-a notorious heavy metal with significant health and environmental effects-was today delivered a significant boost with governments agreeing to a global, legally-binding treaty to prevent emissions and releases.

# Global Treaty on Mercury Pollution Gets Boost from United States



UNEP's Achim Steiner Welcomes First Ratification of the Minamata Convention on Mercury.

Nairobi, 7 November 2013 - The United States has strengthened the international effort to bring down emissions and releases of a notorious heavy metal after simultaneously signing and ratifying the Minamata Convention on Mercury.

The treaty, adopted on 10 October in the Japanese city of Kumamoto and named after the place where thousands of people were poisoned by mercury in the mid-20th century, has now been signed by 93 countries.

# MINAMATA TREATY

- **The Parties to this Convention,**
- 
- Recognizing that mercury is a chemical of global concern owing to its long-range atmospheric transport, its persistence in the environment once anthropogenically introduced, its ability to bioaccumulate in ecosystems and its significant negative effects on human health and the environment,
-

# **DENTAL AMALGAM**

**WHO EXPERT CONSULTATION NOVEMBER 2009**

- **A global near term ban on amalgam would be problematic for public health and the dental sector, but phase down should be pursued by:**
  - **Promoting disease prevention and alternatives to amalgam**
  - **Research and development of cost-effective alternatives**
  - **Education of dental professionals and raising public awareness**



# MINAMATA MERCURY CONVENTION requires

- Measures to be taken by a Party to **phase down** the use of dental amalgam shall take into account the Party's domestic circumstances and relevant international guidance and shall include two or more of the measures from the following list:



Measures to be taken by a Party to phase down the use of dental amalgam shall take into account the Party's domestic circumstances and relevant international guidance and shall include two or more of the measures from the following list:

- (i) Setting national objectives aiming at dental caries prevention and health promotion, thereby minimizing the need for dental restoration;
- (ii) Setting national objectives aiming at minimizing its use;
- (iii) Promoting the use of cost-effective and clinically effective mercury-free alternatives for dental restoration;
- (iv) Promoting research and development of quality mercury-free materials for dental restoration;
- (v) Encouraging representative professional organizations and dental schools to educate and train dental professionals and students on the use of mercury-free dental restoration alternatives and on promoting best management practices;
- (vi) Discouraging insurance policies and programmes that favour dental amalgam use over mercury-free dental restoration;
- (vii) Encouraging insurance policies and programmes that favour the use of quality alternatives to dental amalgam for dental restoration;
- (viii) Restricting the use of dental amalgam to its encapsulated form;
- (ix) Promoting the use of best environmental practices in dental facilities to reduce releases of mercury and mercury compounds to water and land.

# PRODUCTS SUBJECT TO ARTICLE 4, PARAGRAPH 1

DATE AFTER WHICH THE MANUFACTURE, IMPORT OR EXPORT OF THE PRODUCT SHALL NOT BE ALLOWED (PHASE-OUT DATE)

The following non-electronic measuring devices except non-electronic measuring devices installed in large-scale equipment or those used for high precision measurement, where no suitable mercury-free alternative is available:

**2020**

- (a) barometers;
- (b) hygrometers;
- (c) manometers;
- (d) thermometers;**
- (e) sphygmomanometers**

# MINAMATA TREATY

- Article 16

- Health aspects

- Parties are encouraged to:
- protect populations at risk
  - Which may include setting targets for mercury exposure reduction,
- Promote appropriate health-care services for prevention, treatment and care for populations affected by the exposure to mercury or mercury compounds

# Additional Reading

1. The Minamata Convention on Mercury: attempting to address the global controversy of dental amalgam use and mercury waste disposal. Mackey TK, Contreras JT, Liang BA. *Sci Total Environ*. 2014 Feb 15;472:125-9. doi: 10.1016/j.scitotenv.2013.10.115. Epub 2013 Nov 27.
2. New mercury treaty exposes health risks. Bender M, Lymberidi-Settimo E, Groth E 3rd. *J Public Health Policy*. 2014 Feb;35(1):1-13. doi: 10.1057/jphp.2013.39. Epub 2013 Oct 3.
3. Lessons in Forging Global Change, 3. Karliner, J. Cohen, J. Orris, P. *Stanford Social Innovation Rev*, Winter 2014

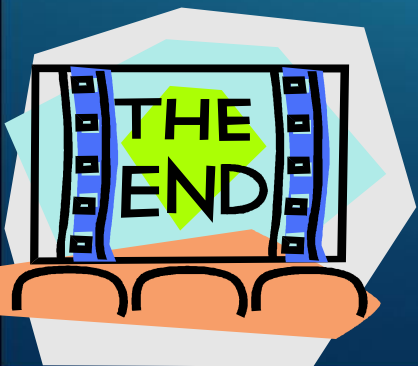


# ACKNOWLEDGEMENTS

Thanks to my Colleagues at University of Illinois  
And elsewhere

and  
Postings on the Internet

For providing me many excellent slides for editing



# THANK YOU

