

Hg

Sino-Swedish Mercury Management Research Framework

SMaREF

瑞中汞研究框架计划

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“Mercury in Sweden”

水银在瑞典



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Disposition

* **From Linné to the Minamata Convention**

**A historic exposé on the perceptions, assumptions,
and actions regarding Hg in Sweden**

*** With the aim to also demonstrate important Hg
sources**



Carl von Linné, professor at Uppsala University.
We celebrated his 300 year anniversary in 2007.

He introduced mercury for
medical treatment in Sweden!

☿
+
Hg

Linné defended his thesis in the Netherlands 1735.

Back to his fiancée in Sweden in 1738 he couldn't find any job.

So he opened his own medical service in Stockholm.

But nobody dared to go to the unknown doctor.



”No patients, not even a dog”,

he complained after several weeks without any patient at all.

♀
Hg

Linné looked up the patients himself.

They had venereal diseases.

From a French colleague he got a treatment including Hg.

Linné got lots of patients as the rumor spread about the talented new doctor.



☿
Hg

Patients with
syphilis treated
via unction with a
Hg preparation
(year 1498).

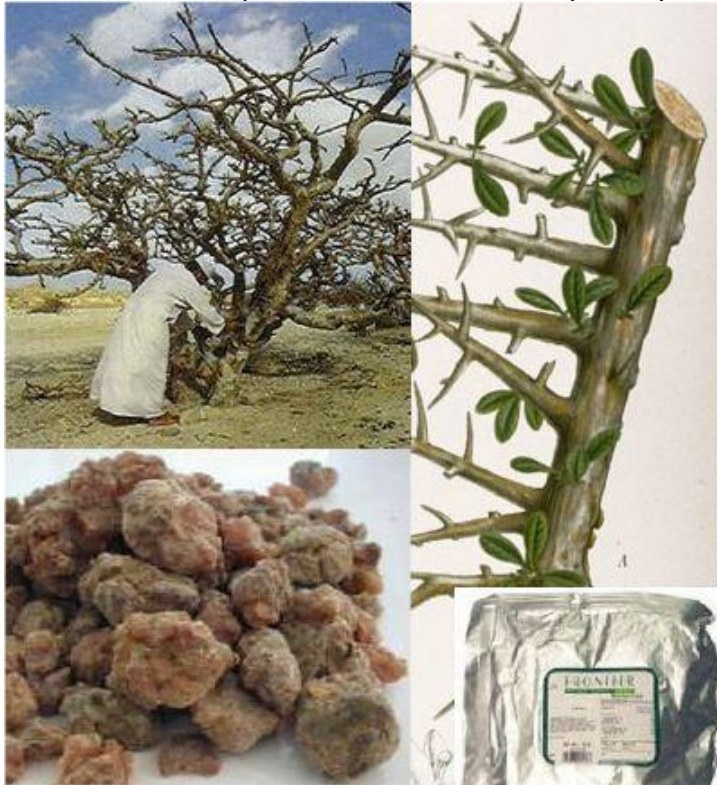


Svidén, 2003 efter Steber, 1498.



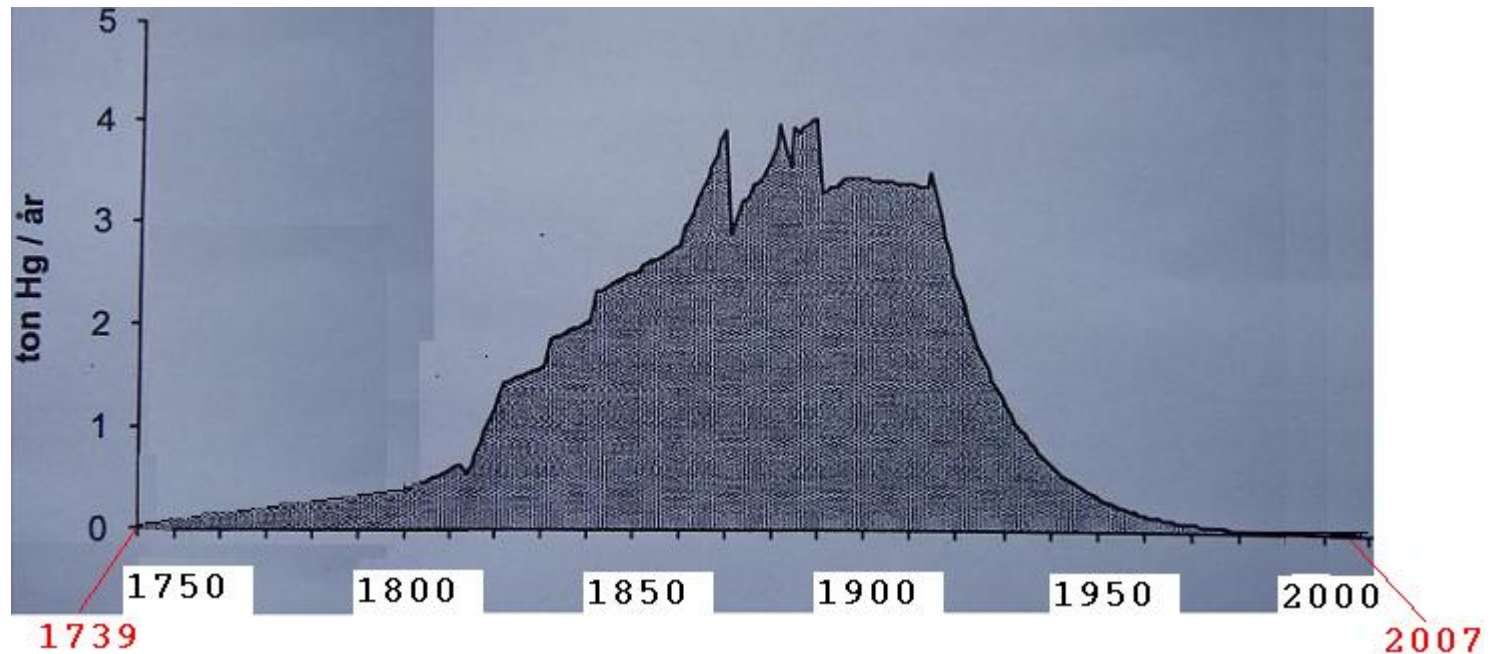
Mercurial water was used externally.

Deep wounds got bandage wetted in mercurial water and filled with Myrrha (gum from *Commiphora molmol*) and lead (Pb).





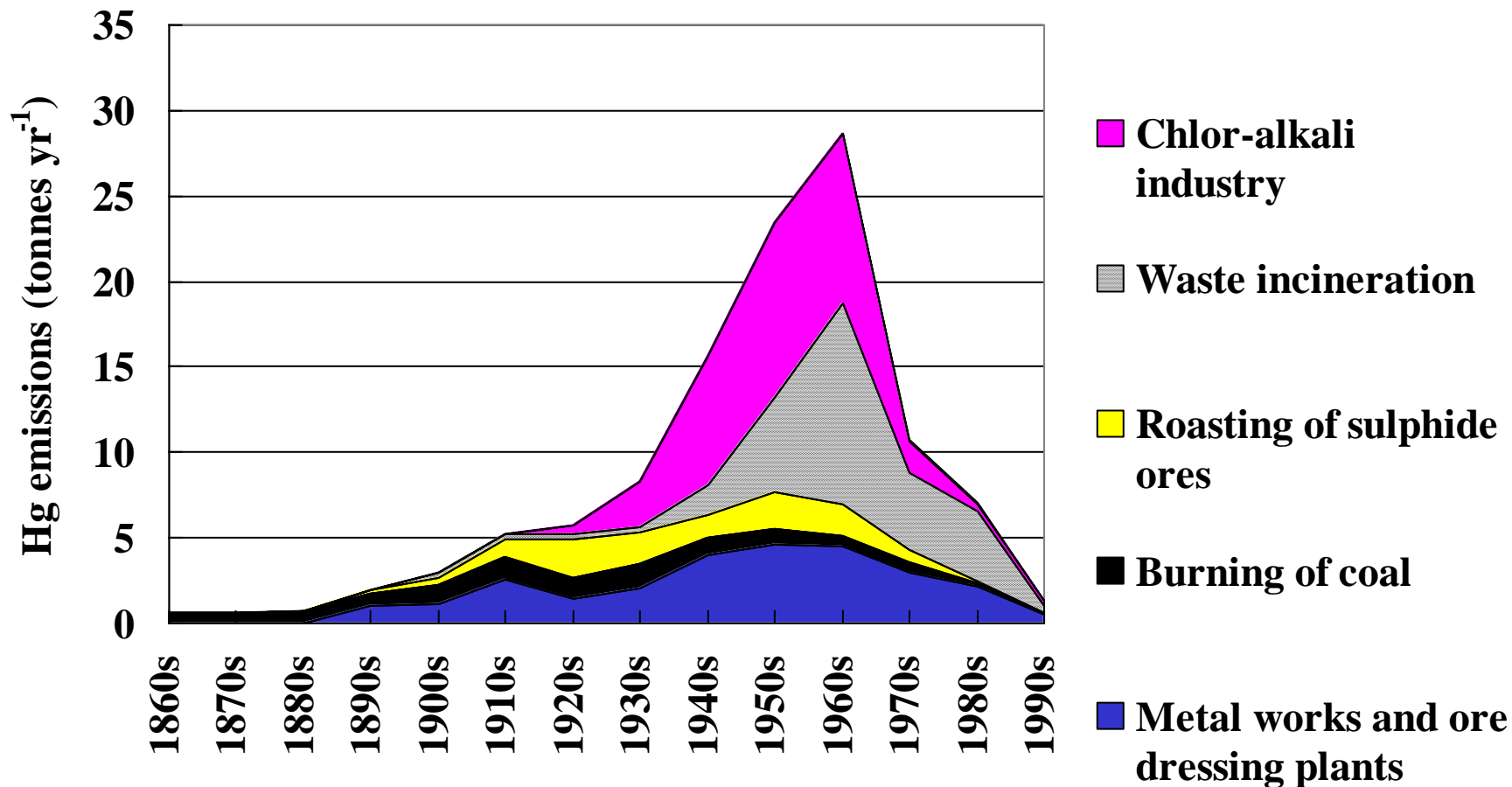
Losses of Hg to the environment in Sweden due to the use of medicines containing Hg.



Svidén, 2003, Hylander, 2007.

Lars.Hylander@slu.SE

Hg use and related emissions were LARGE in Sweden



Anthropogenic point source emissions of Hg to the atmosphere in Sweden 1860 – 2000.

(Details in Hylander. 2001. *Water, Air Soil Pollut.*)

The toxicity of Hg was known but not considered.

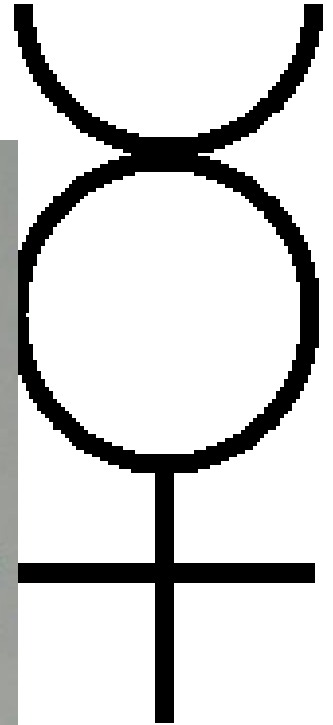
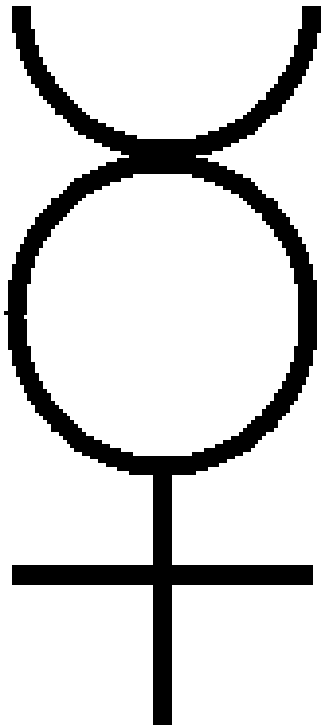


Mad as a hatter.

Figure credits: Lewis Carrol, 1865.

”Alice in the Wonderland”

Could Mercury really be deadly?



Hg

1950

Hg

**Karl Borg found high contents of Hg
in a dead crow (råka from Örtofta, Scania)**

Minamata disease

was officially reported (1956).



Foto: Lars Hylander



Minamata disease

Cat dancing disease 1953

Early human observations
already in the 1940's

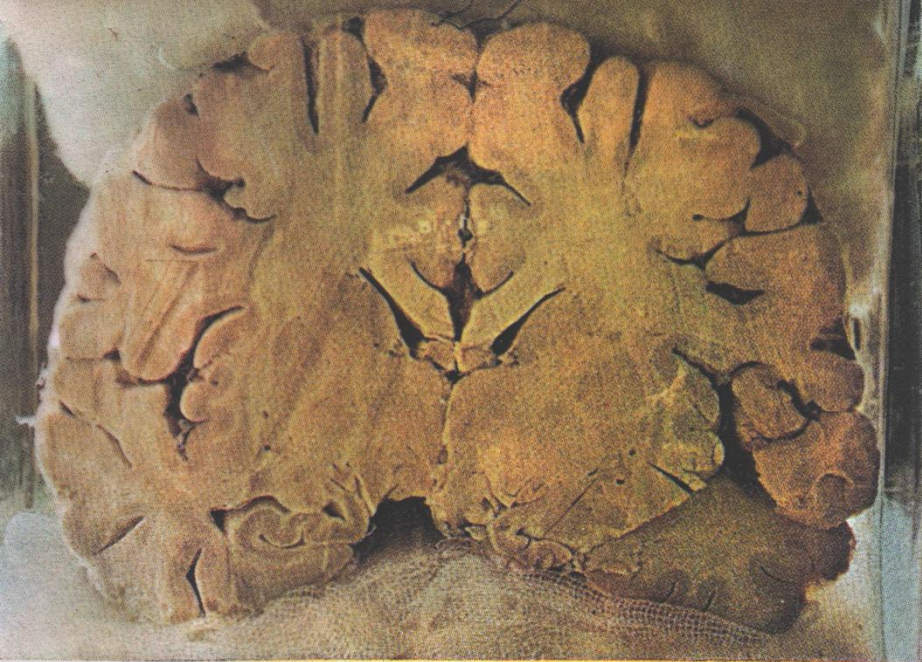
1959 scientifically proved
to be methyl Hg poisoning

Another 9 years (1968)
before officially recognised
and Me Hg discharges
stop



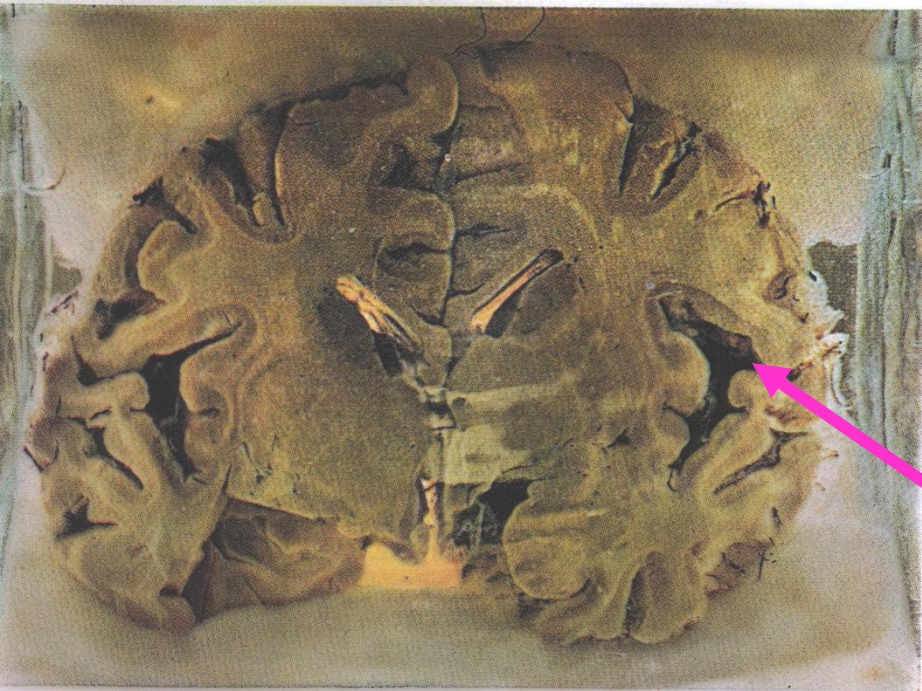
Foto: Eugen Smith

Could suffering and costs been reduced with a more swift action?



”Tom i huvet”
”Vacant mind”

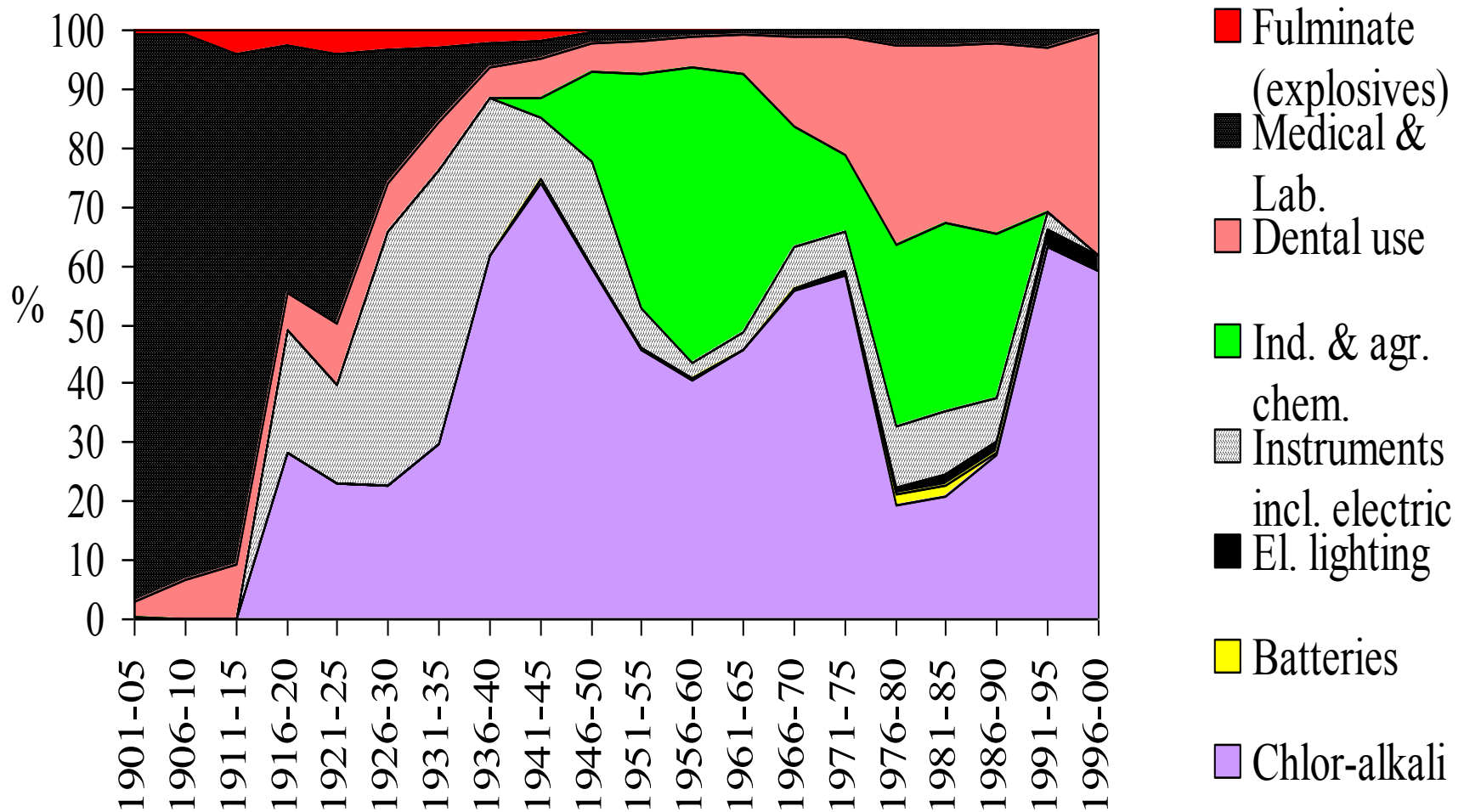
Healthy brain.



Brain from a
person with
Minamata disease.

A hole due to necros.

Consumption pattern of primary plus recycled Hg in Sweden



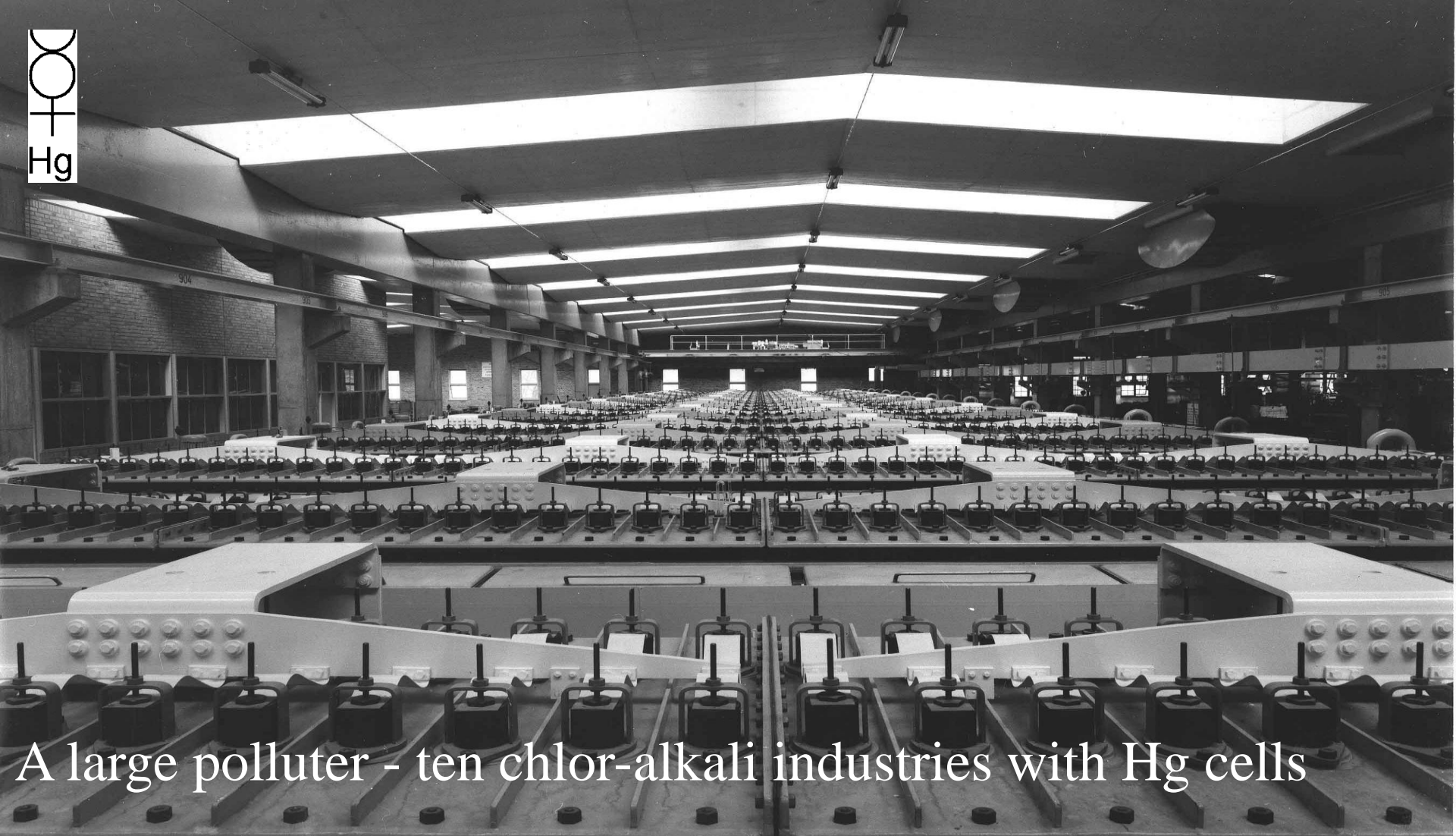
Bans on certain Hg compounds for seed dressing and in paper industry in 1966 and 1967 reduced Hg levels in birds.

(Johnels, Tyler and Westermarck, 1979)

But Hg in fish was still a concern, resulting in blacklisted waters.



DO
+
Hg



A large polluter - ten chlor-alkali industries with Hg cells

Photo courtesy: Akzo Nobel

Chlor-akali is the base for paper and most of the chemical industry.

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The river Delångersån with the lakes Kyrksjön, Långsjön.

Paper pulp factory using Hg, end of 1940-1966



Fishing prohibited!



Average 7.1 mg Hg/ kg f.w. 1966-70
Max. 14 and 20.4 mg Hg/ kg f.w.

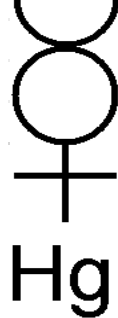
Fresh water world record!

An exhaustive study on mercury in the Swedish environment was launched, covering causes, consequences and corrective methods.

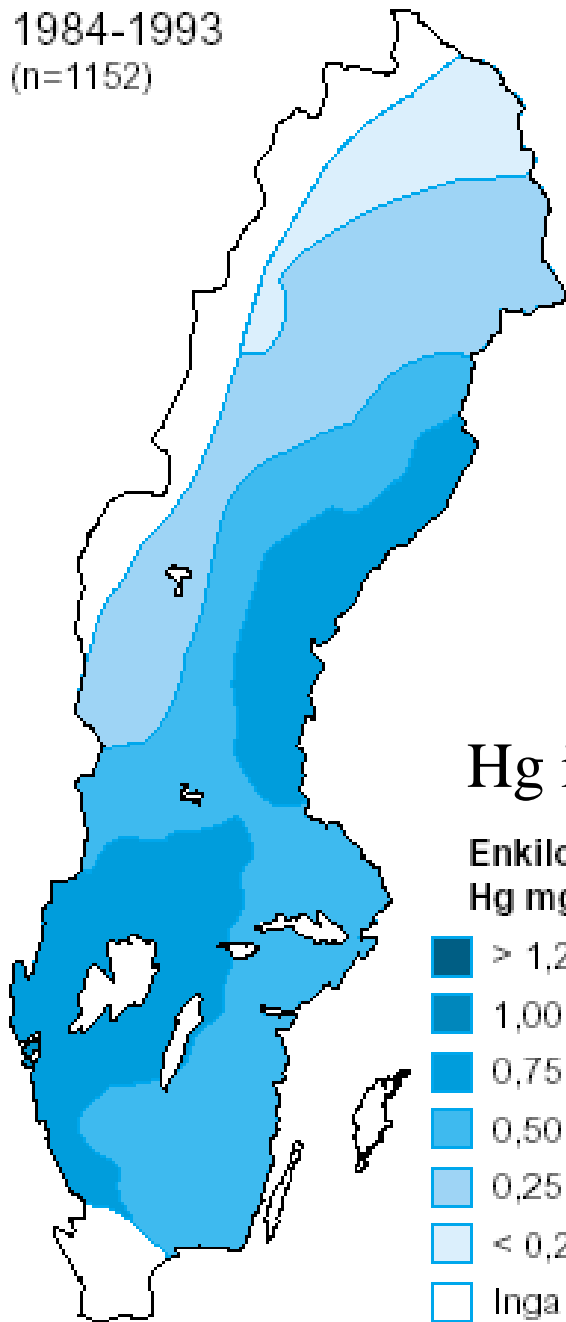
(Lindqvist, Johansson, Aastrup, Andersson, Bringmark, Hovsenius, Håkanson, Iverfeldt, Meili, Timm, 1991).



1984-1993
(n=1152)

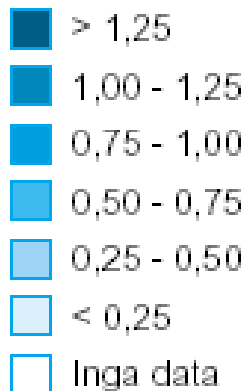


Mercury in the environment



Hg in pike (1 kg) mg Hg/ kg f.w.

Enkilosgädda
Hg mg/kg



METALLER I STAD OCH LAND
Nv Rapport 5184. 2002, som citerar
Andersson och Lundberg, 1995.



**Hg polluted sites were surveyed
and some of them remediated.**

The polluted
Örserumsviken
the Baltic Sea,
Västervik, as
appearing in
the 1960's.



4 decades later and 750 kg less Hg



Foto: Kenneth Hardy Axelsson, Fotohuset AB i Västervik och Bertil Ljung.

Total cost: 15 millions US\$ (115 millions skr)
corresponding to 20 000 US\$/kg Hg
(150 000 skr/kg)



Rolfstaån, Delångersån

Too expensive to remediate!

Photo credits: Länsstyrelsen i Gävleborg

Knowledge gathered Species

Metallic or elemental Hg (Hg^0)

Inorganic Hg e.g. Hg(I), Hg(II) also Hg^{2+} & salts

Organic Hg when combined with C.

Notably methylmercury (MeHg or CH_3Hg^+)

Continous conversions in nature and society!

(UNEP Chemicals. Global Mercury Assessment. Report. 2002.

<http://www.chem.unep.ch/mercury/>)



Hg is very toxic and it is spread globally due to its characteristics

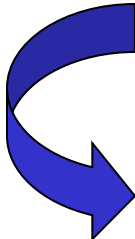
(Guimarães et al., 1995; Nationalencyklopedin, 1992; UNEP, 2002 and ref. therein)


Element Nr 80 (after gold) in the metal group of the periodic table

Atomic weight, average 200.59

Stable isotopes: (196)198-204

Radio isotopes: e.g. ^{203}Hg , half time 47 days

Hg⁰ stays ~1 year in the atmosphere  **2-3 turns around the globe**



High vapour pressure so evaporates easily.



Let's not destroy such an important food source as fish!

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Global co-operation necessary to reduce Hg in Swedish fish



Kids and foetus
are most
sensitive to
poisonous
substances such
as Hg

Hg



continued use of Hg!

Paying too little may cost too much!

☉
+
Hg

A shift in paradigm from a resource to refuse.

In which cavities should we put Hg waste?



Teckning: Monica Kauppi, Heavy Metal Bulletin



Boliden,
the largest producer
of mined Hg in the
EU after that
Almadén, Spain,
closed in the
1990:s, had to put
mined Hg back into
their mine.



Boliden tackas för fotot.



Export ban of Hg to reduce Hg use in artisanal and small scale gold mining

Small scale gold miners in the Philippines and Latin America using Hg.





Amalgamation can also be done in the washing pan. Amalgam and Hg is then poured into a cloth...

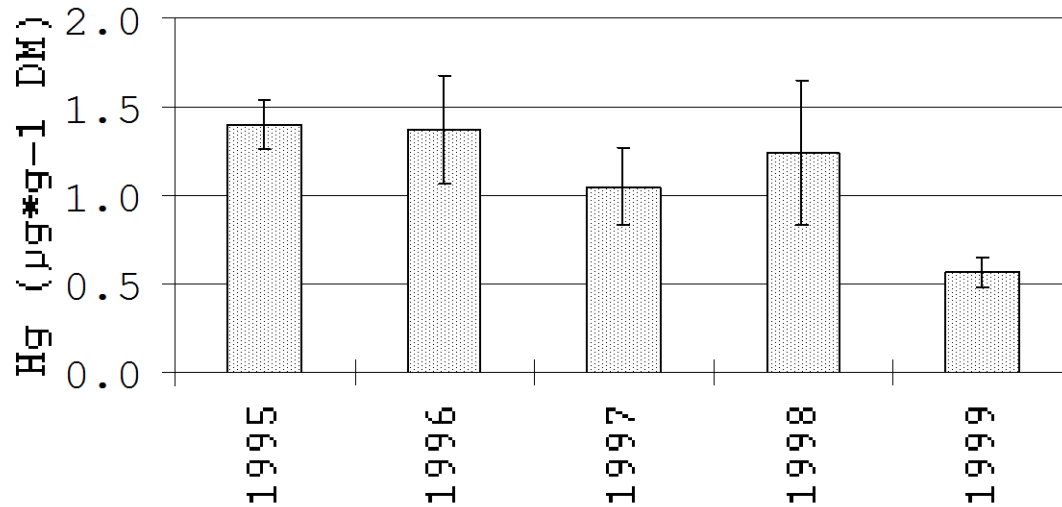
♀
+
Hg

Tracker dog



Mercury-tracker dog
detects Hg also where
logically thinking humans
would not have found it.

Kristina von Rein and Lars D. Hylander. 2000. Experiences from phasing out the use of mercury



Mercury content (average and SD) **in** sewage **sludge** before and **after a Hg collecting campaign** at the end of 1998.

(Ängstorp's plant, Laholm, Sweden).

Dental amalgam.

Damaged beauty.



Photo: ALEXANDER LINDER

Ala Lombolo, a lake in Sweden,
which must be restaured because of 200 kg
mercury emitted from a dental clinic and a laboratory.

Hg



Evolution of **dental amalgam** usage in Sweden



Photo credit:

SVEN-OLOF ENGLUND

1938 Public dental health care service started to offer free dental care with amalgam to pregnant women .

1950's Free amalgam fillings to school kids.

~1960 Peak of caries. 99% of all seven-year-old kids had decayed teeth.

1970's Recommendation to not use amalgam to pregnant women.

1980`s Agreement to not use amalgam to kids and youth.

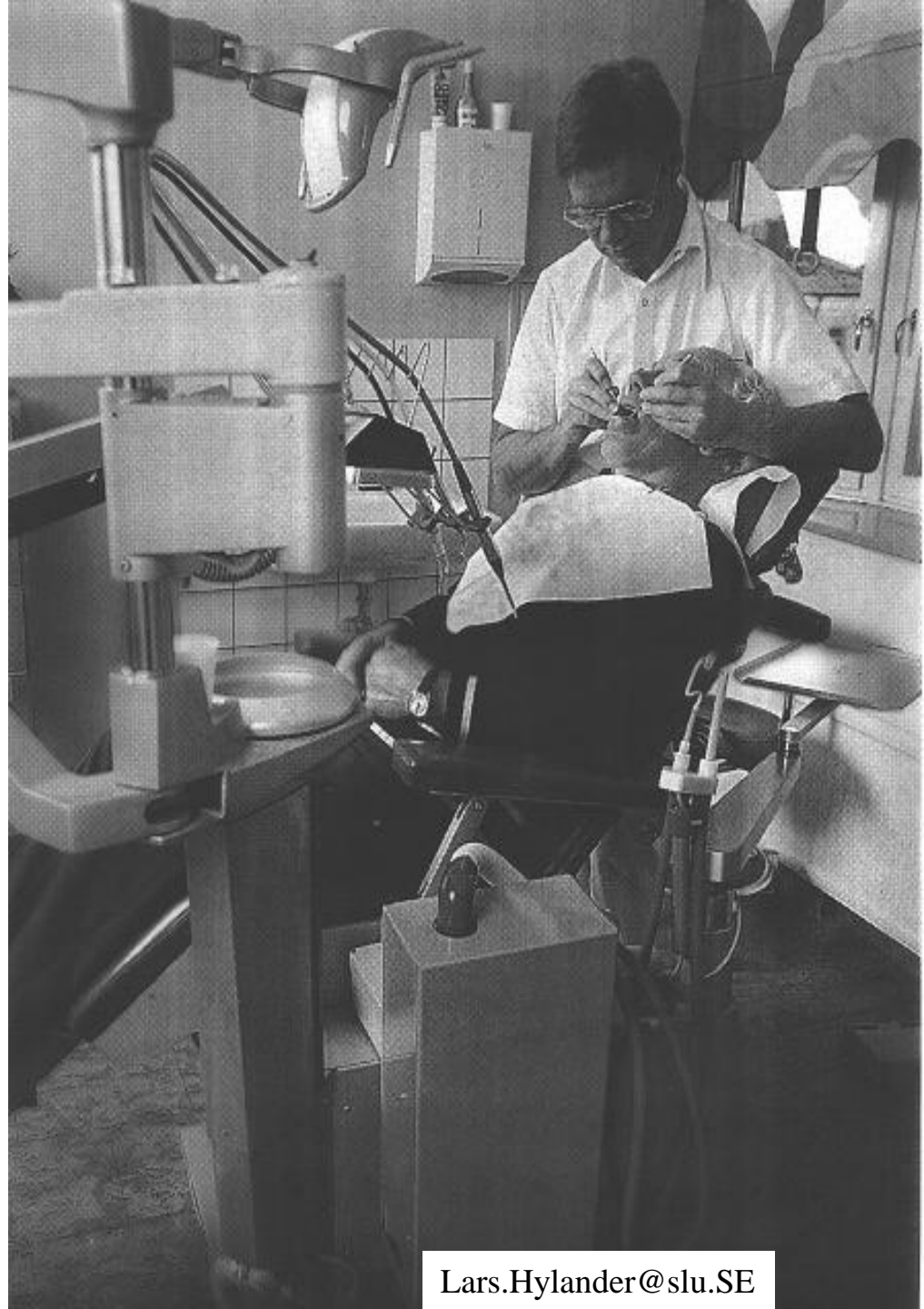
1997: Görel Thurdin, Minister of the Environment, suggests a ban of dental amalgam.

2003: 2-5 per cent of new fillings made with amalgam.

2005: 30–45% of 18–19 years Swedes have no caries at all.

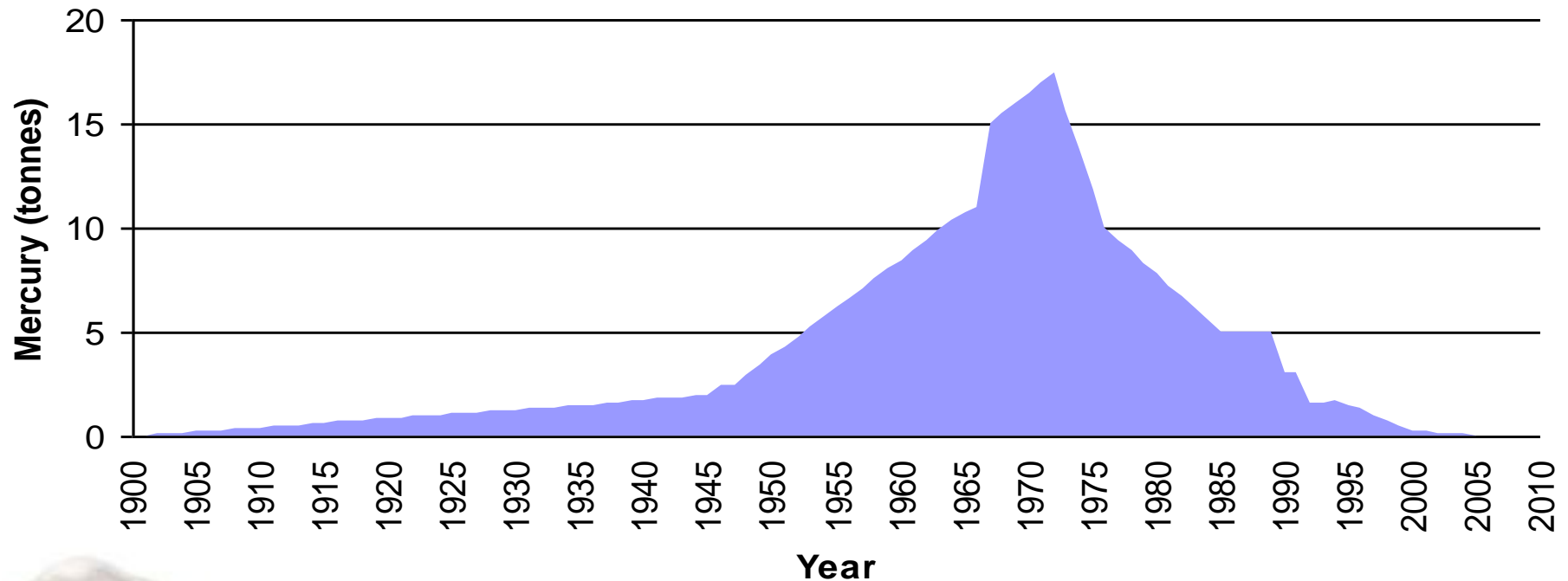
Dental amalgam was not phased out with voluntary options (KEMI, 1998).

Therefore a general ban including dental Hg was introduced from 1st of June 2009 (certain exceptions such as fluorescent lamps, button cells <1% Hg, some chemical analyses).



Swedish dentists were until 2009 putting one of the most toxic elements we know just a few centimeters from the brain.

Indirect human exposure maybe worse due to large losses to water and air.



Mercury used annually in dentistry in Sweden

The European Commission's scientific committee (SCHER) has recognized that the use and subsequent release of mercury from dental amalgam can contaminate the fish we eat.

See: Final Opinion on Environmental risks and indirect health effects of mercury from dental amalgam (update 2014)
http://ec.europa.eu/health/scientific_committees/environmental_risks/docs/scher_o_165.pdf

Study on the potential for reducing mercury pollution from dental amalgam and batteries



Dental amalgam
to be banned
in the EU?

DGENV

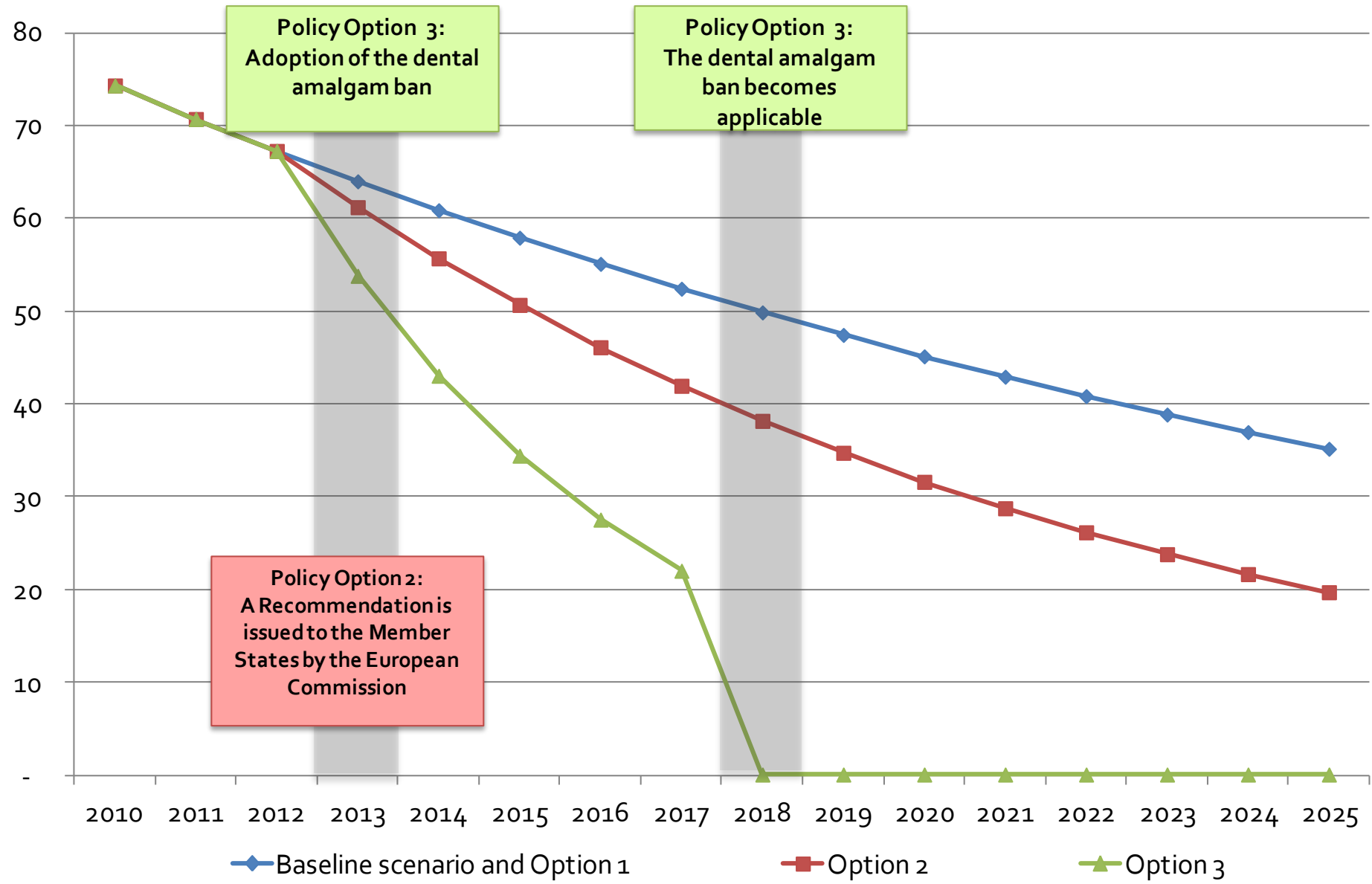


BIO Intelligence Service (2012).

http://ec.europa.eu/environment/chemicals/mercury/pdf/Final_report_11.07.12.pdf



Projected annual demand for dental mercury in the EU (t Hg)



Silver fillings are the dominating restoration material in China and Professor Bian Jin You at Peking University rejected a proposal to inform the patients that silver fillings are same as dental amalgam with 50% Hg.

Future Use of Materials for Dental Restoration, Report of the meeting convened at WHO HQ, Geneva, Switzerland
16th to 17th November 2009



The Minamata Convention,

a global legally binding instrument on mercury



Prepared via 5 INC (Intergovernmental negotiating committees)

INC 1, Sweden, Stockholm, 7–11 June 2010.

INC 2, Japan, Chiba, 24–28 January 2011.

INC 3, Kenya, Nairobi, from 31 October to 4 November 2011.

INC 4, Uruguay, Punta del Este, 27 June to 2 July 2012.

INC 5, Switzerland, Geneva,
13 to 18 January 2013

FINALLY:

Japan, Minamata and Kumamoto,
7 to 11 October 2013.



The Minamata Convention

Article 18

Public information, awareness and education

1. Each Party shall, within its capabilities, promote and facilitate:

(a) Provision to the public of available information on:

(i) The health and environmental effects of mercury and mercury compounds;

(ii) Alternatives to mercury and mercury compounds;



Actions to achieve the intention of the Minamata Convention

**1. Flue gas cleaning at fossil
fuelled power plants, although
better to replace fossil energy with
renewable energy.**

Sun, wind, water power!

Bioenergy?

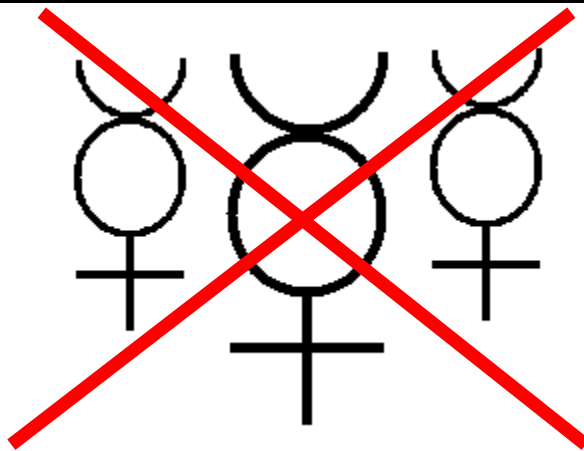
Primarily for food (“human energy”)

2. Separation of Hg in metallurgical smelters should continue!

Reduces atmospheric Hg emissions from gold, Cu, Fe, Pb, Zn smelters.

Handle the Hg produced properly (so called byproduct Hg).

3. INFORM, Inform, inform that Hg is NOT necessary



Replace Hg thermometers by digital or alcohol thermometers.

Replace dental amalgam with healthy teeth or Hg free fillings.

Use Hg-free blood pressure manometers.

LED (light emitting diodes) NOT CFL

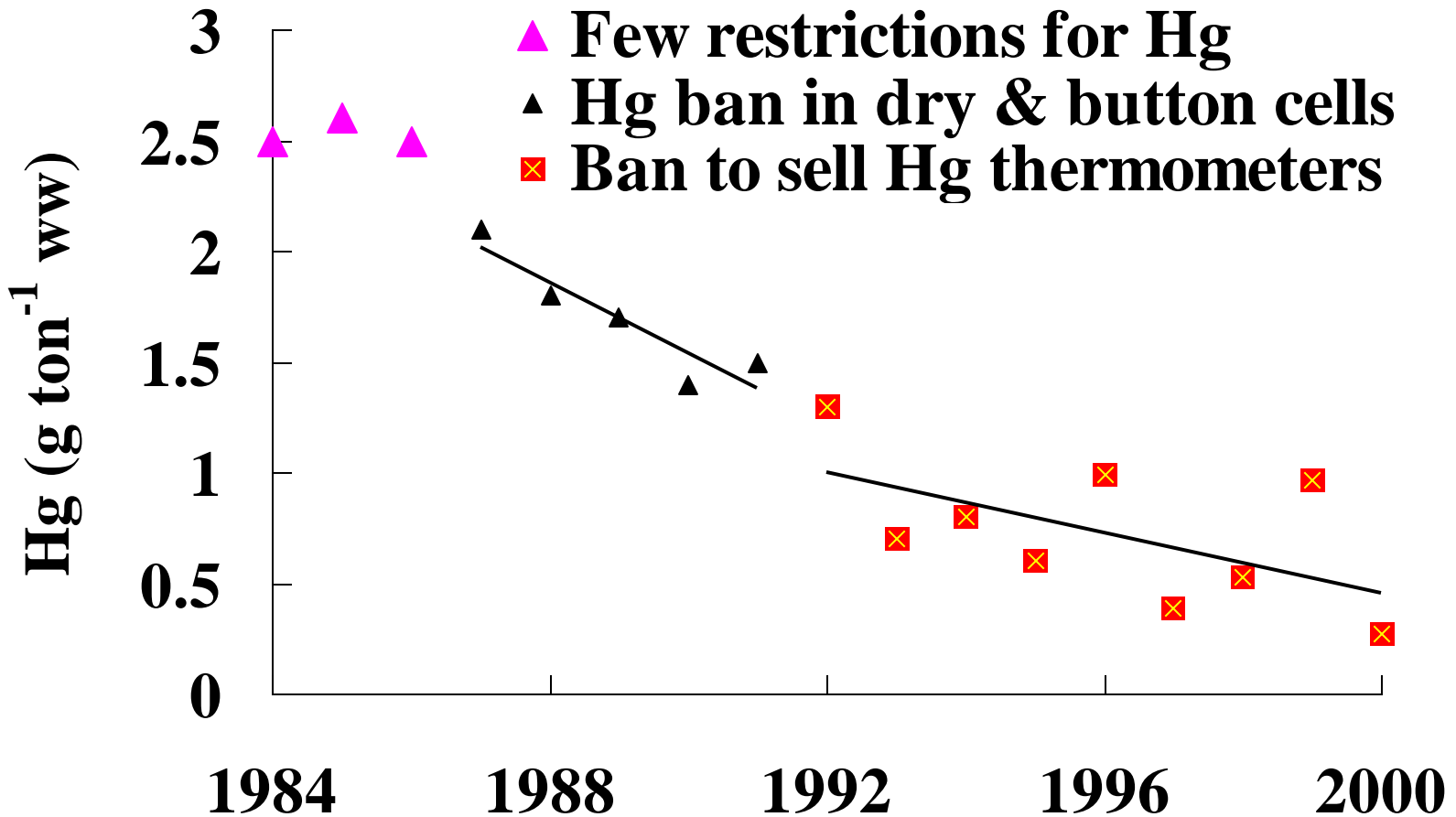
Which light will give our kids a bright future?





Let's go for LED!

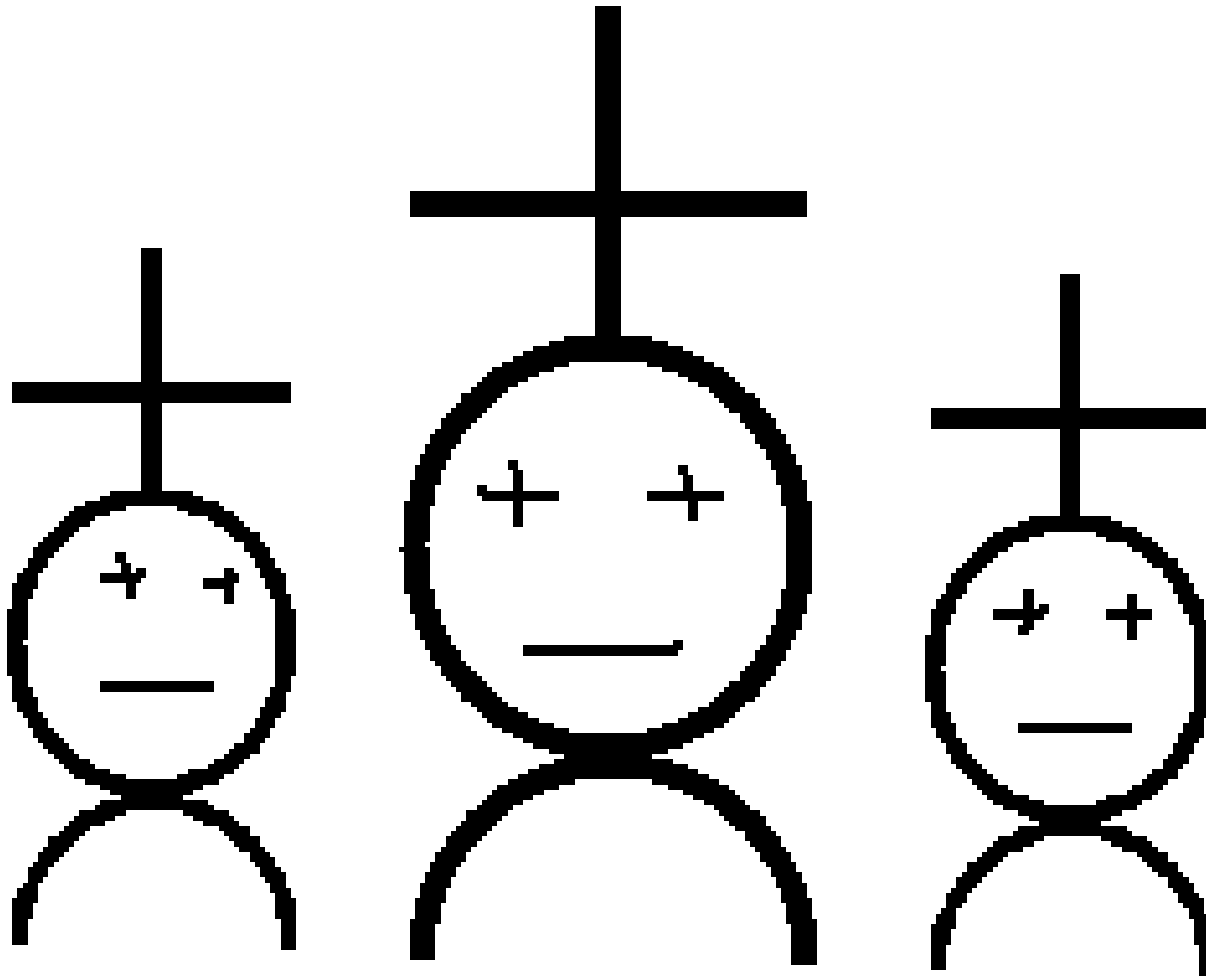
4. Political actions are necessary



Mercury in waste in Uppsala, Sweden, related to legislation regarding products containing Hg.

(Hylander, et al., 2003. *Sci. Total Environ.*)

Rest in peace



Linné stated:



»Medicinernas etiketter lova botemedel,
men burkarne innehålla förgift»



*"The labels of medicines are promising
treatment but the tins contain poisons."*



How to use the experience from
the past 300 years?



Good luck with the project!

Thanks for the attention!