Training on Medical Waste Management

in Collaboration with
Al-Essa Medical & Scientific Equipment Co. W.L.L

Environmental Health & Safety Issues

Kuwait University
Health Science Center
29 January – 1 February, 2012

Environmental Health and Safety Issues

- Air Pollution
- Water Contamination
- Land Contamination
- Biological Hazards
- Chemical Hazards – Chemicals / Pharmaceuticals
- Occupational Hazards

Environmental Health and Safety Issues and Medical Waste Management

Activities in clinical, diagnostic, and research facilities have the potential to create environmental health and safety issues at the point of generation of medical waste as well as for the surrounding community and environment.

PVC – Poly Vinyl Chloride

PVC, or vinyl, plastic – the most widely used plastic in medical devices – can be harmful to patients, the environment and public health. There are two key problems associated with PVC:

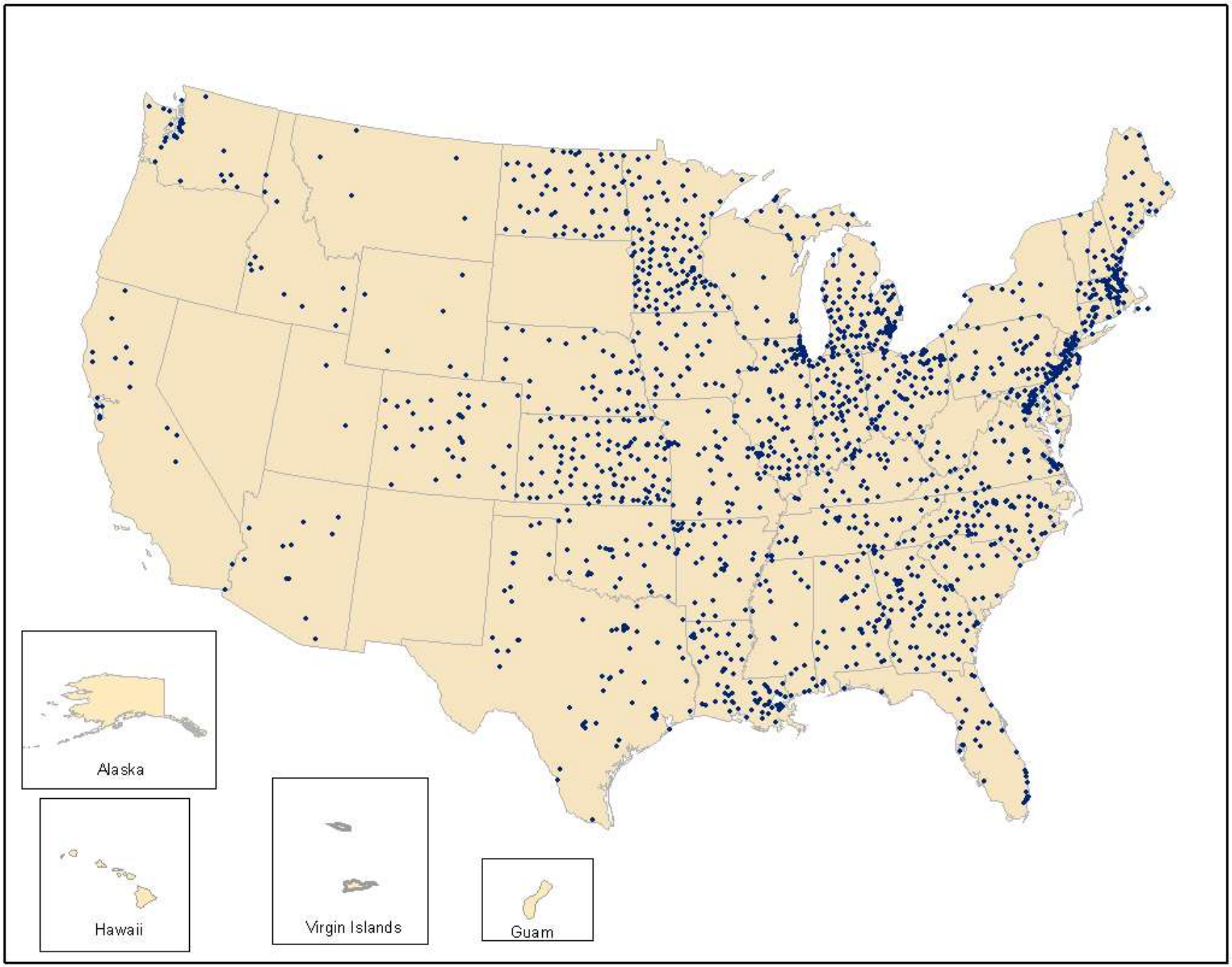
- **Dioxin, a known human carcinogen, can be formed during the manufacture of PVC, and during the incineration or burning of PVC products.**
- **DEHP, a phthalate used to soften PVC plastic that can leach from PVC medical devices, is linked to reproductive birth defects and other illnesses, according to animal studies.**

Countries active in PVC Reduction:

Scandinavian and German speaking countries - PVC phase-out policies and committing to favour PVC-free products in public procurement contracts.

The Vienna Hospital Association, Austria, committed to phasing out PVC in 1992. After more than 15 years of this environmental policy, PVC share in medical devices has dropped from approximately 10% of total weight of medical waste in 1992, to 2.5% in 1995, to just 0.6% in 1999. The proportion of PVC packaging material was reduced from 3.6% to 0.04%.

In 2004, Karolinska University Hospital in Stockholm County Council, Sweden, estimated it was using 40 tonnes of phthalates per year just in gloves. By mid-2007, Karolinska Hospital had substituted almost half of its PVC and latex gloves for safer nitrile alternatives.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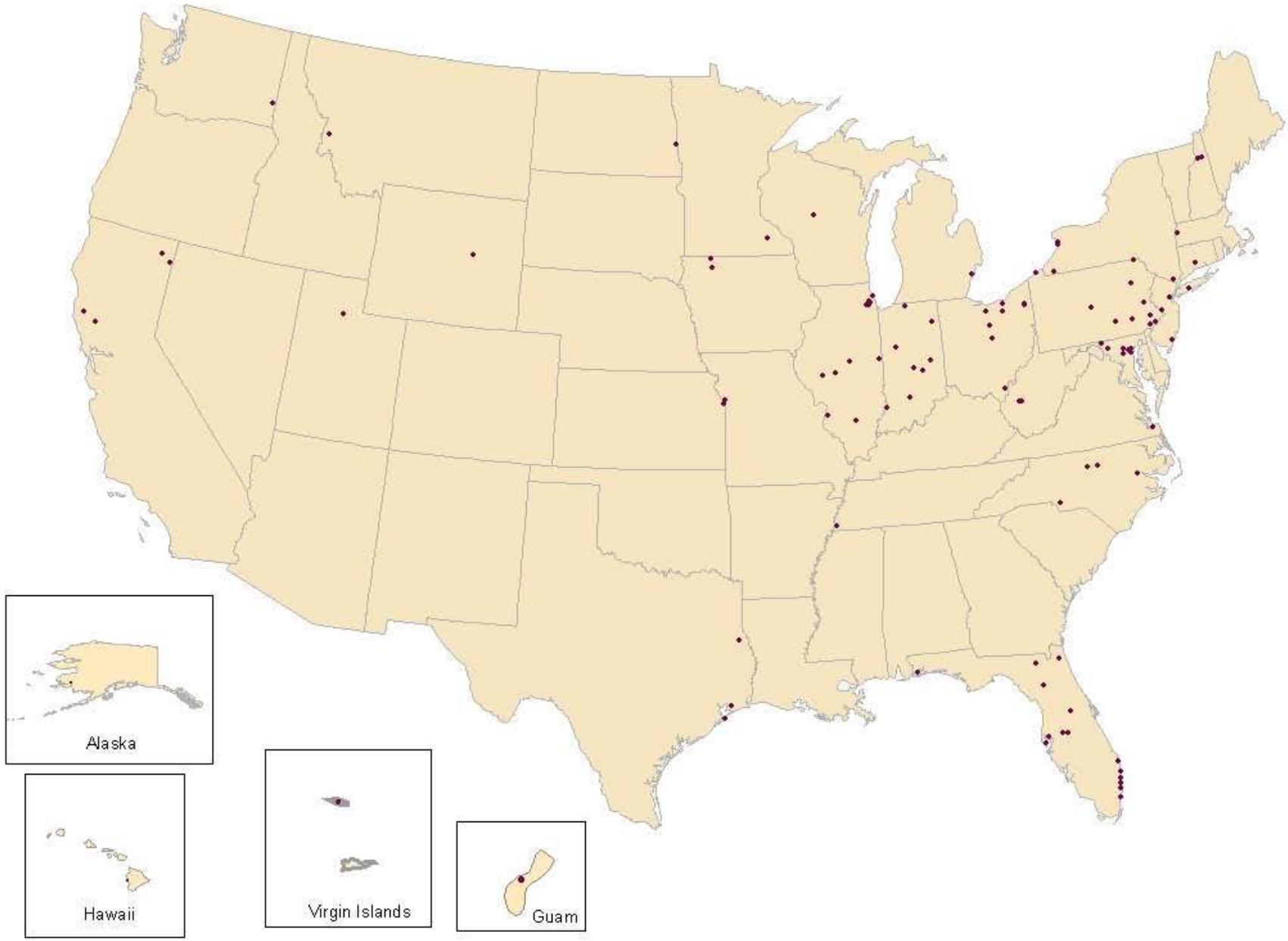
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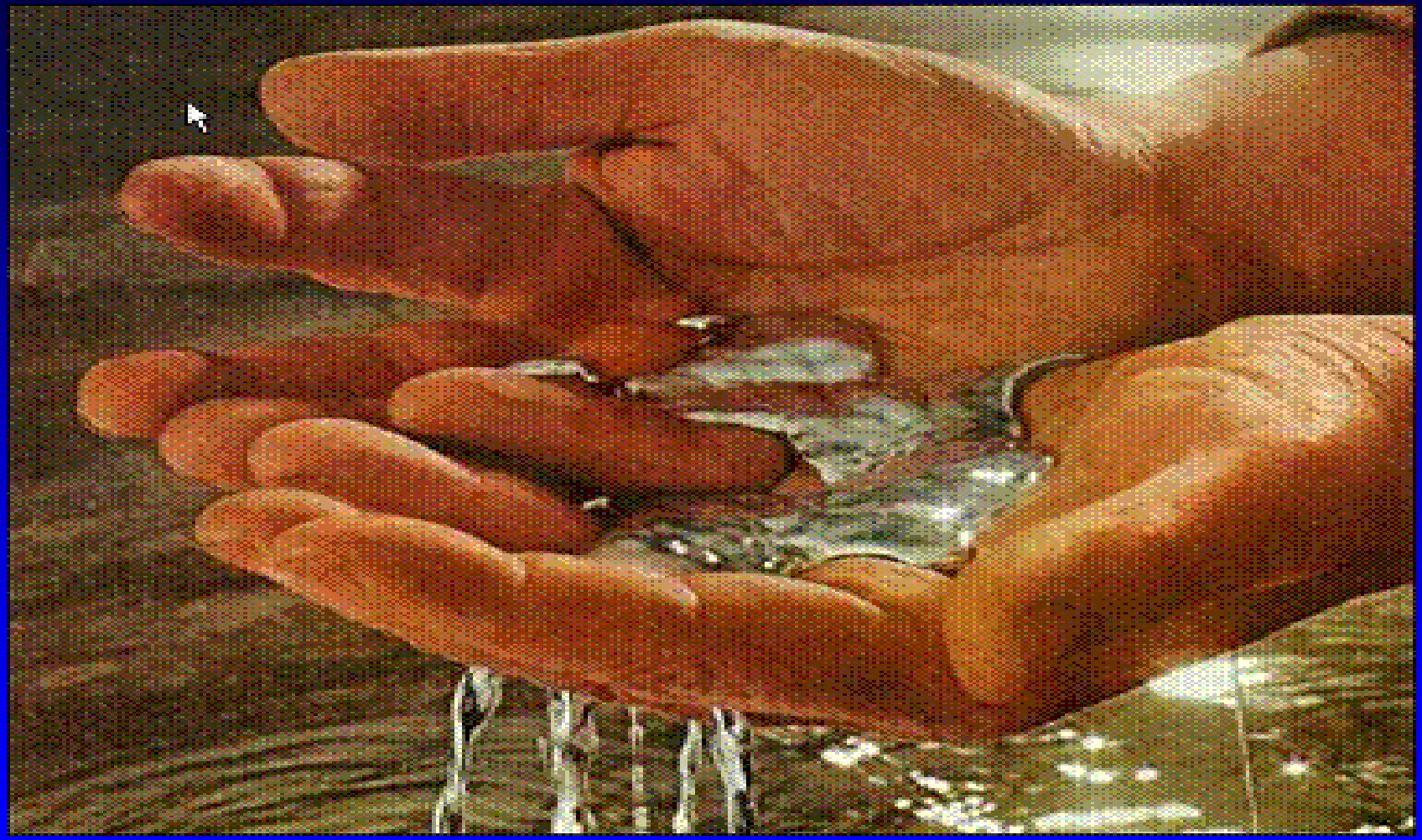
MERCURY



Silver-white, odorless, liquid metal at room temperature

Mercury

Mercury is a potent neurotoxin that can affect the brain, spinal cord, kidneys and liver.

According to the U.S. Centers for Disease Control and Prevention, up to one in 10 women in the U.S. already carry enough mercury in their blood to pose a threat of neurological damage to the fetus.

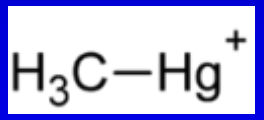
The U.S. EPA ranks the health care sector as the fourth largest source of mercury air emissions due to their contribution to medical waste incinerators.

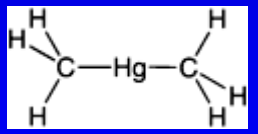
Chemical Forms of Mercury

- Elemental
  - Liquid Metal

- Inorganic Salts
  - Mercuric Chloride

- Organic
  - Methyl, Ethyl, Dimethyl
  - Phenyl Organic Groups

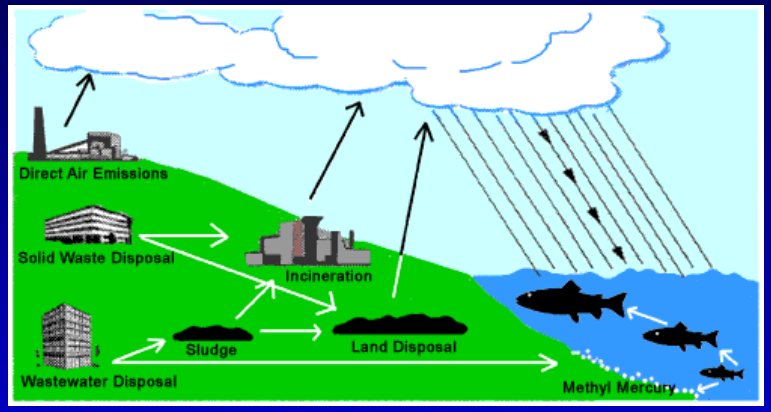




Mercury in the Environment

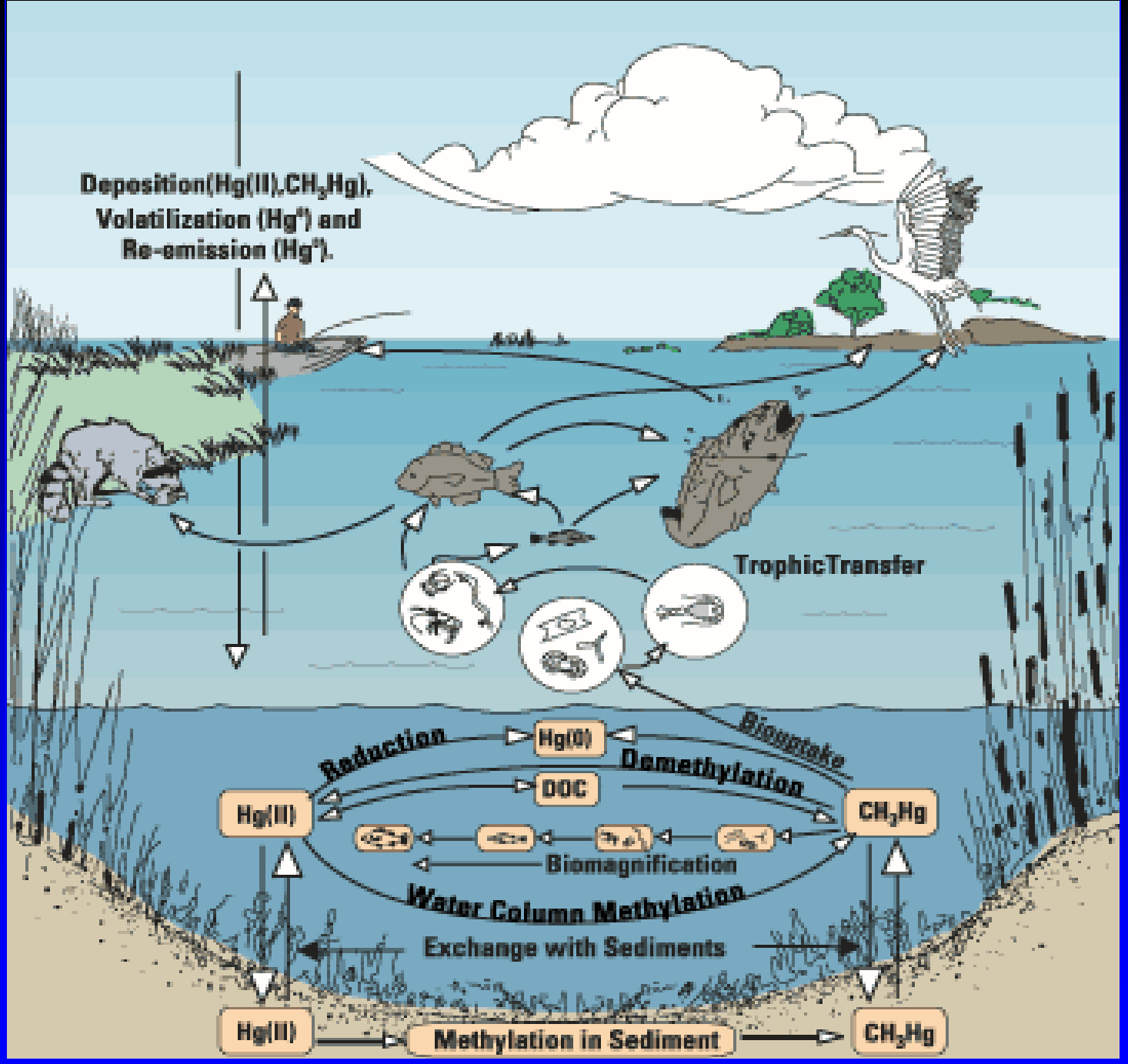
Mercury Cycle

- Emitted from human activities & natural sources
- Circulates in the atmosphere from 6 months to 1½ years



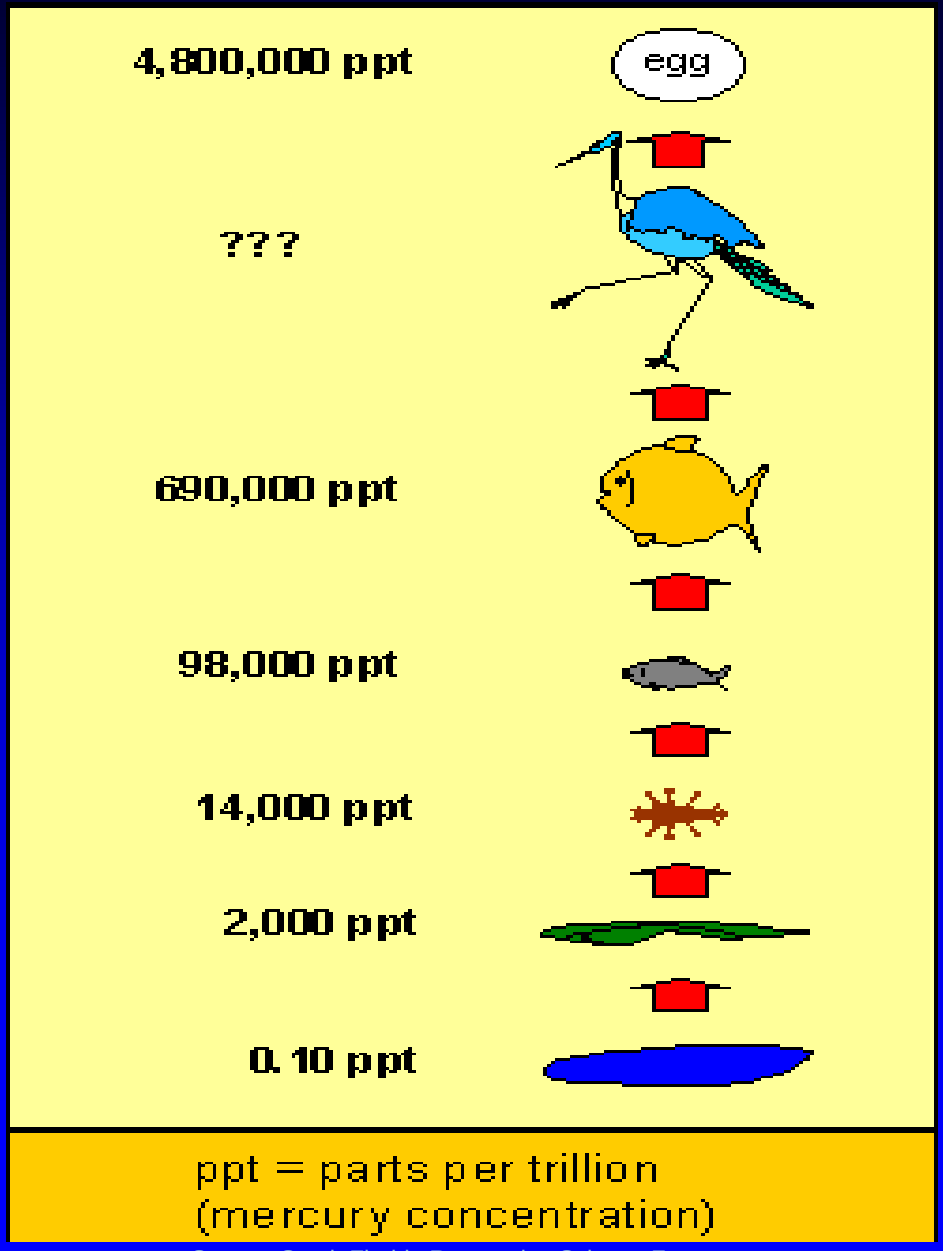
Source: New York State Department of Environmental Conservation

- Deposited back into land or bodies of water
- Converted into insoluble forms, settling into sediment
- Converted by bacteria into methyl mercury and enters the food chain
- Released back into the atmosphere by volatilization



Source: United States Geological Survey

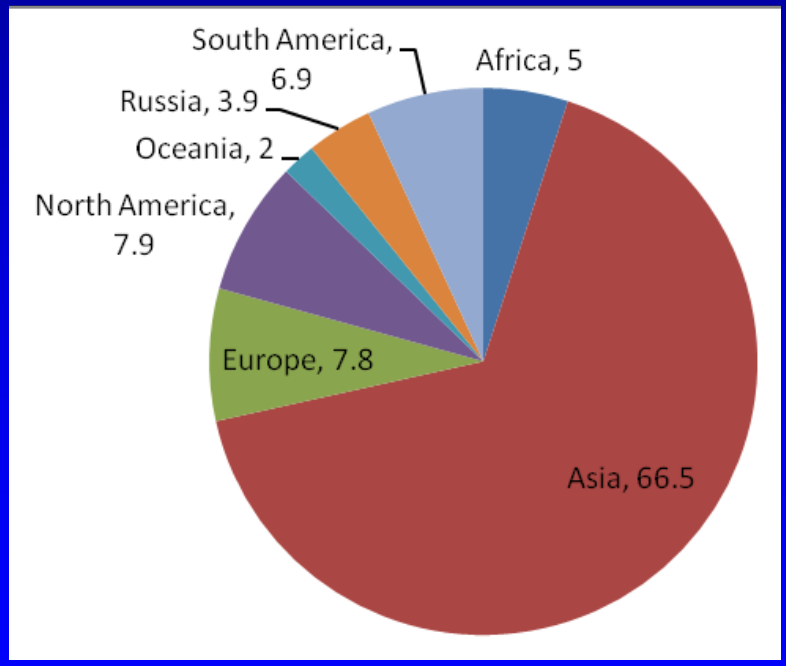
Biomagnification of Mercury



Source: South Florida Restoration Science Forum

Mercury Emissions & Sources from Human Activity

- The global atmospheric emissions of mercury is estimated at 1930 tonnes from human activities in 2005
- Compared to pre-industrial times, levels of mercury in the environment have significantly increased
- The major sources include: coal combustion, gold mining, metal production, waste incineration, and product-use (e.g., thermometers, pressure gauges, etc.)



Global mercury emissions to air from human activities in 2005 by

Health Care Products Containing Mercury and Their Alternatives

- **Product**
  - Hg batteries
  - Esophageal devices, Cantor & Miller-Abbott tubes
  - Hg thermometers
  - Hg-based blood pressure monitoring devices
  - Lamps & lighting devices
  - Hg switches
  - Hg dental amalgams

- **Alternatives**
  - Lithium, zinc air, alkaline
  - Tungsten-filled dilators, products w/ tungsten tubing Anderson AN-20
  - Digital, alcohol, galinstan
  - Aneroid, electronic (oscillometric)
  - Non-Hg lamps, LEDs
  - Non-Hg switches
  - Gold, ceramic, porcelain

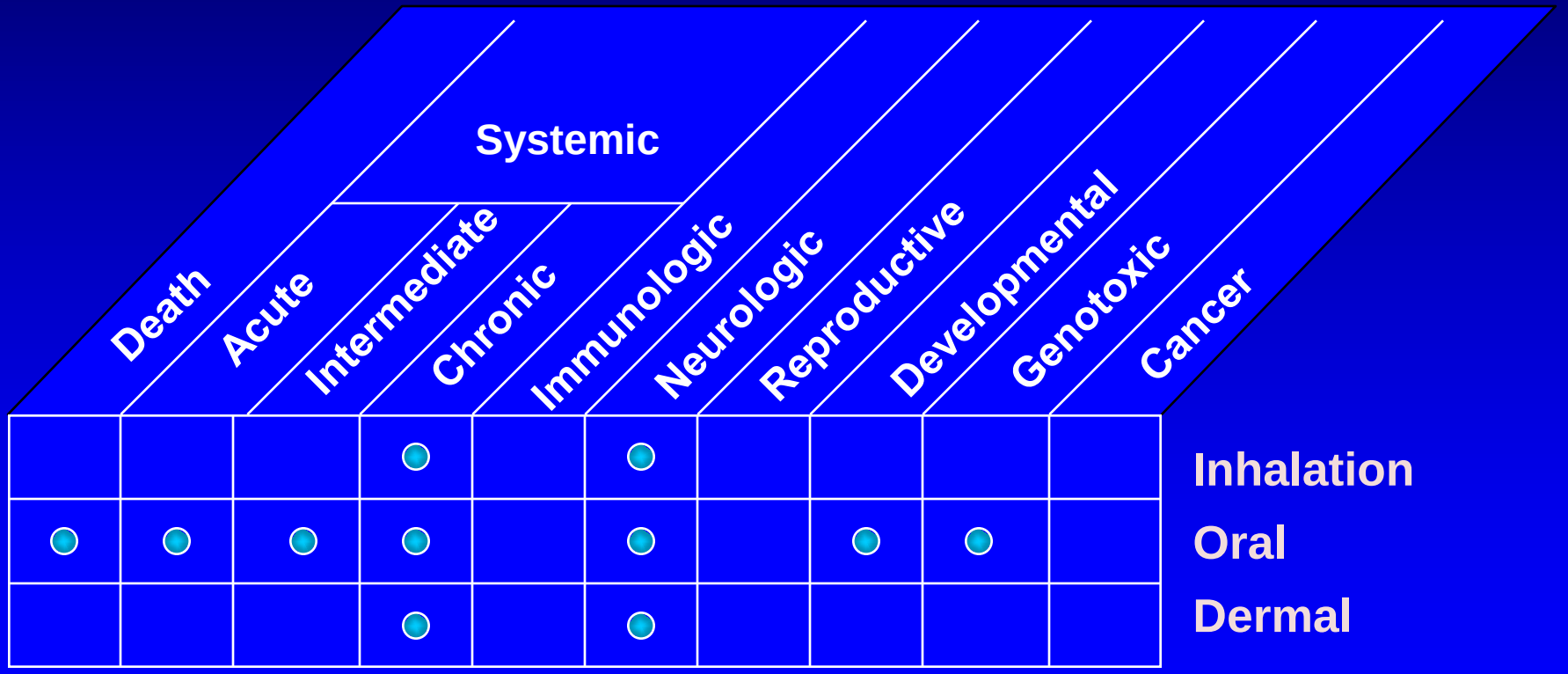
Health Effects of Mercury (Hg)

- Depend on the form of mercury, type of exposure (acute or chronic), route of exposure, dose

EXAMPLES:

- Acute exposure to high levels of elemental Hg
  - tremors, slowed motor nerve functions, memory loss
- Acute inhalation of high amounts of elemental Hg
  - chest pains, acute renal failure, shortness of breath

Summary of Health Effects of Methyl Mercury on Humans



Existing Studies (ATSDR 1998)

WORLD HEALTH ORGANIZATION

WHO Policy on Mercury in Health Care

Short Term: Develop and implement plans to reduce the use of mercury equipment and replace with mercury free alternatives. Address mercury clean up, waste handling and storage procedures.

Medium Term: Increase efforts to reduce use of unnecessary mercury equipment .

Long Term: Support a ban of mercury containing devices and promote alternatives.

www.mercuryfreehealthcare.org www.noharm.org

Mercury Spill - Who do you Contact?

Anyone who has questions regarding mercury or spill procedures should contact their Laboratory Supervisor, their own Supervisor, or the HSC Safety Committee.

Contain Spill

- Prevent the spread of mercury when cleaning up a mercury spill.
- Mercury beads can splash and roll around.
- Secure the area around the spill, so the mercury does not get "tracked" or "kicked" around.

Restrict Area

- **Cease activities and keep the area restricted until the entire spill is cleaned up.**

Mercury Vacuum

- One can use a special vacuum cleaner is available which is designed to pick up mercury droplets safely.

Location of Mercury Vacuum

- If there is no vacuum available for use do not try to use a shop vac or other device.

Temporary Control

- If a mercury vacuum is not readily available, cover the spill with sulfur or zinc powder as a temporary control measure.
- Cover from the perimeter of the spill toward the center. Do not walk through the spill or the sulfur or zinc powder.

Special Care

- Special attention must be taken in cleaning cracks and crevices where the mercury may have settled.

Specialty Wipes

- **All visible mercury beads are collected using the mercury vacuum followed by specialty wipes.**

Mercury Beads

- Mercury beads easily enter cracks and crevices.

Sulfur Impregnated Cloths

- Sulfur impregnated cloths may be used for a final wipe down of the area being cleaned

Mercury Waste

- Mercury waste and all waste materials contaminated with mercury must be labeled before disposal.

Disposal

- No mercury, including broken thermometers, may be disposed of in the normal trash or into the sewer system.

Air Monitoring

- Air monitoring should be used in conjunction with the mercury vacuum to ensure the complete removal of mercury and to assess spill cleanup personnel exposure.

PROCEDURES TO BE FOLLOWED FOR SMALL CHEMICAL SPILLS

- Contain Spill.
- Notify all staff.
- Close all drains.
- Switch off all electrical equipments.
- Cordon off the area.
- Assist any person that has been exposed to Chemical spill.

PRECAUTIONARY MEASURES

- Put on all protective clothing, goggles and acid resistant gloves.
- Cover all wet spills with absorbent packs or with loose PP.
- Clean up all dry spill using the scoop.
- Try not to mix chemicals when scooping up. Ask Safety Officer for a list of incompatible chemicals.
- Place all dry chemicals in a sturdy plastic bag, tie with vinyl bag ties, and label if contents are known.

PRECAUTIONARY MEASURES

- Pick up all broken glass using tongs and put it into the broken glass containers supplied in every lab. Take note of all information on the Labels from broken containers, both safety information and toxicity.
- After the absorbent packs have absorbed 10-20x there own weight, they are saturated and need to be replaced by another absorbent pack.
- Put saturated absorbent packs into plastic bags for disposal.

SPILLS REQUIRING SPECIAL PROCEDURES

- **Acid Chlorides**

  Use saw dust or or dry sand.

  Avoid water and avoid sodium bicarbonate.

- **Alkali Metals (lithium, sodium, magnesium, potassium)**

  Smother with dry sand or cover with contents from a Class “D” fire extinguisher. Use of a Class “D” fire extinguisher is the preferred extinguishing method. Avoid contact with water.

SPILLS REQUIRING SPECIAL PROCEDURES

- **White or Yellow Phosphorus**

  Blanket with wet sand or wet absorbent.
- **Bromine**

  Neutralize spill with a 5% solution of sodium thiosulfate.

  Absorb with inert absorbent material.
- **Hydrofluoric Acid**

  Neutralize with soda ash or lime (or absorb spill with special HF spill pillow).

  Absorb with inert absorbent material.

Biological Safety Cabinet

Chemical Fume Hood

Liquid Waste from Dental Clinics could be Hazardous

Asma Ali Zain 14th November 2011

Quantitative analysis of mercury concentration in the waste water released from dental clinics in UAE' was done between January 2010 and June 2011 on 38 wastewater samples from 28 public dental clinics in Sharjah and Abu Dhabi.

The study has shown that the average concentration of Hg (mercury) in all samples was 317.7 microgram per litre. According to Dubai Municipality's environmental standards, the maximum limit allowed for discharge of mercury containing waste to the sewerage system is 10 microgram per litre and to land for irrigation is only one microgram per litre," said Dr Sausan Al Kawas.

Pharmaceutical Waste Management

Environmental Issues….

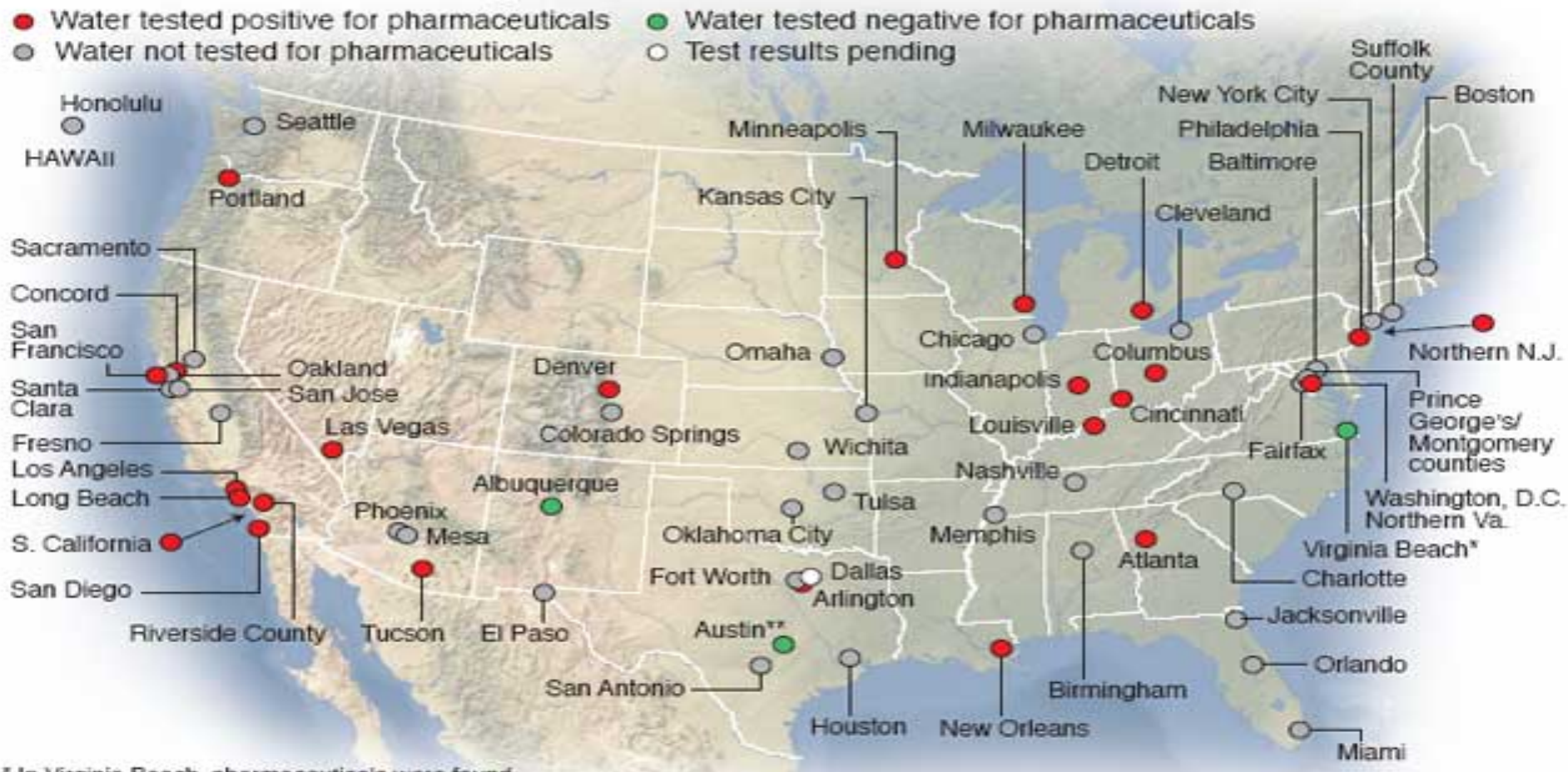
Waste Dujour……

What is in your Water you drink?

Major water sources positive for pharmaceuticals

At least one pharmaceutical was detected in tests of finished drinking water supplies for 24 metropolitan areas, according to an Associated Press survey of 62 major water providers. Only 28 tested finished drinking water. Test results vary widely. Some water systems said tests had been negative, but the AP found independent research showing otherwise.

Pharmaceuticals in drinking water



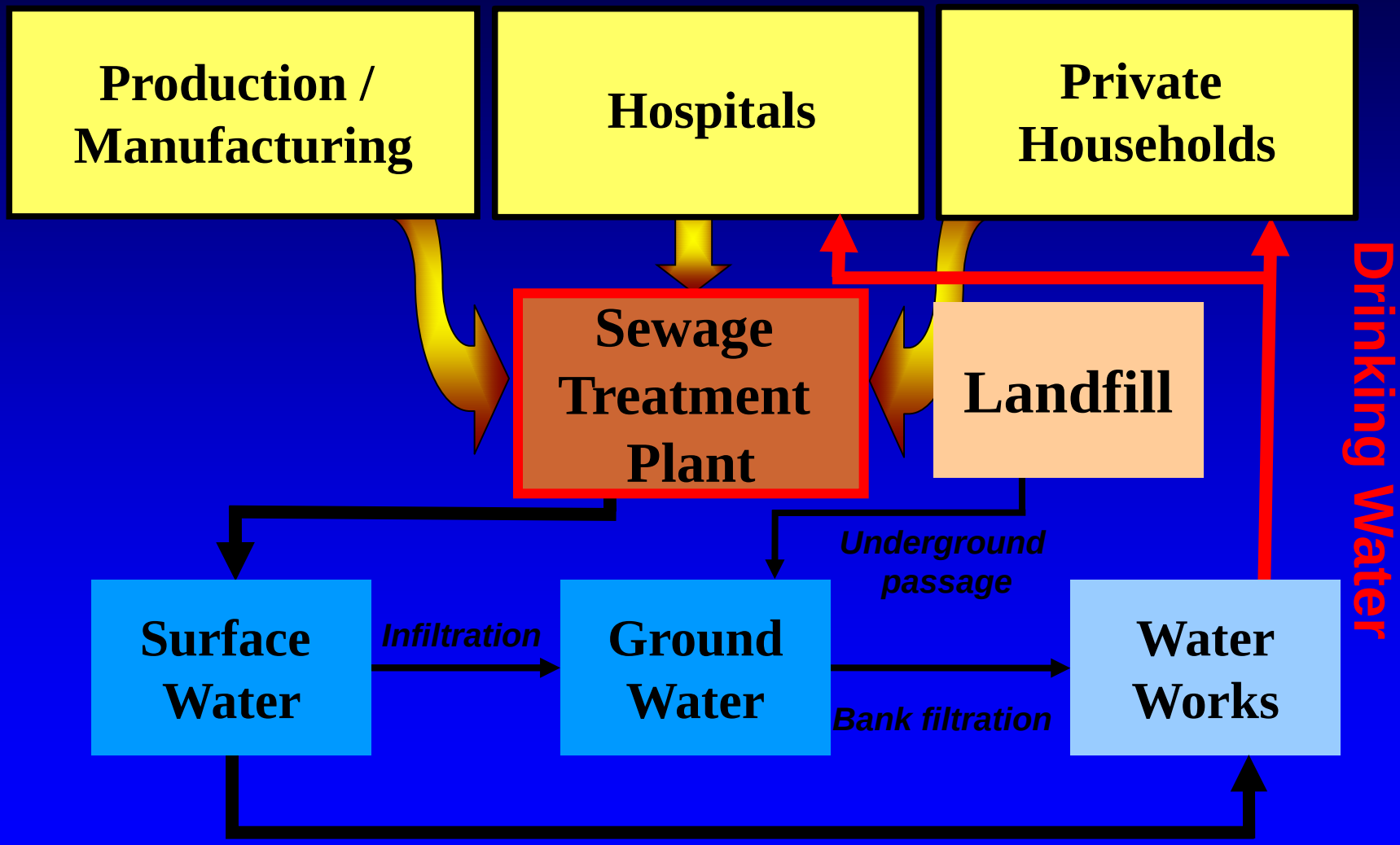
* In Virginia Beach, pharmaceuticals were found in source water but not in treated drinking water.
** Drinking water in Austin, Texas, was tested for only one prescription drug, a synthetic birth control chemical.

NOTE: All places include some surrounding areas except: Albuquerque, N.M.; Arlington, Texas; Fresno, Calif.; Long Beach, Calif.; Los Angeles; Memphis, Tenn.; New Orleans; New York City; and Orlando, Fla.

SOURCES: Drinking water providers' responses to Associated Press questions; AP review of scientific literature.

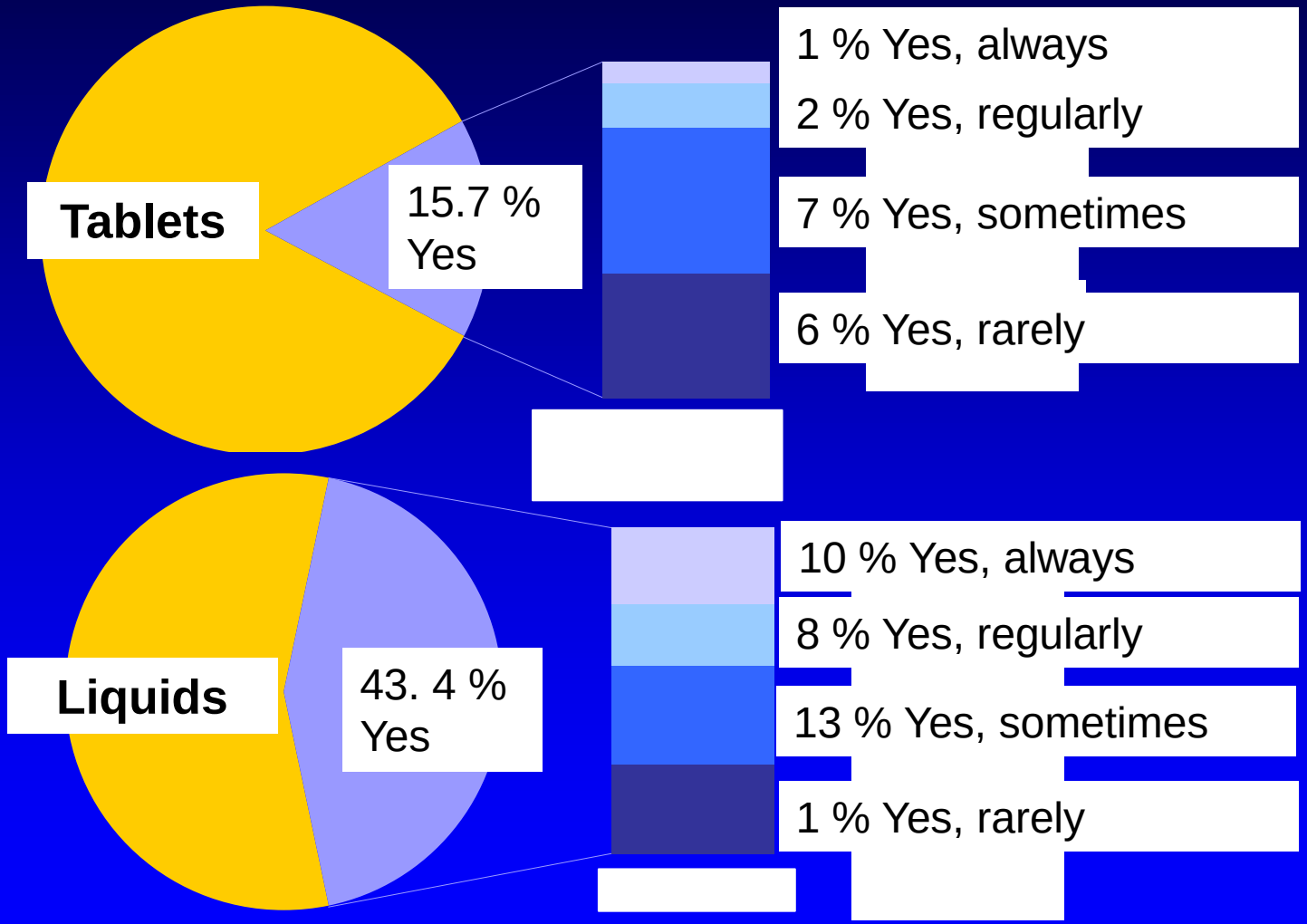
AP

Human Pharmaceuticals in the Water Cycle



Unused Pharmaceuticals down the drain: A Poll (1306 interviews)

📖 www.start-project.de, Götz and Keil 2008



Risk Management Strategies

1. Technology
(Advanced) effluent treatment
short to mid-term

Obstacles:
- Technology limited
- Reaction by-products
- Not all waste water treated
- Energy demand
- Not possible/ affordable in less developed countries

Not sustainable

📖 Jones et al. (2007) Environ. Sci. Technol 41:5085-5089, Wenzel et al. (2008) Water Sci. Technol. 57:27-32

2. Behaviour
Usage: patients, doctors, pharmacists;
life-style drugs
mid-term

Obstacles:
Needs time
Not for administered share of drugs

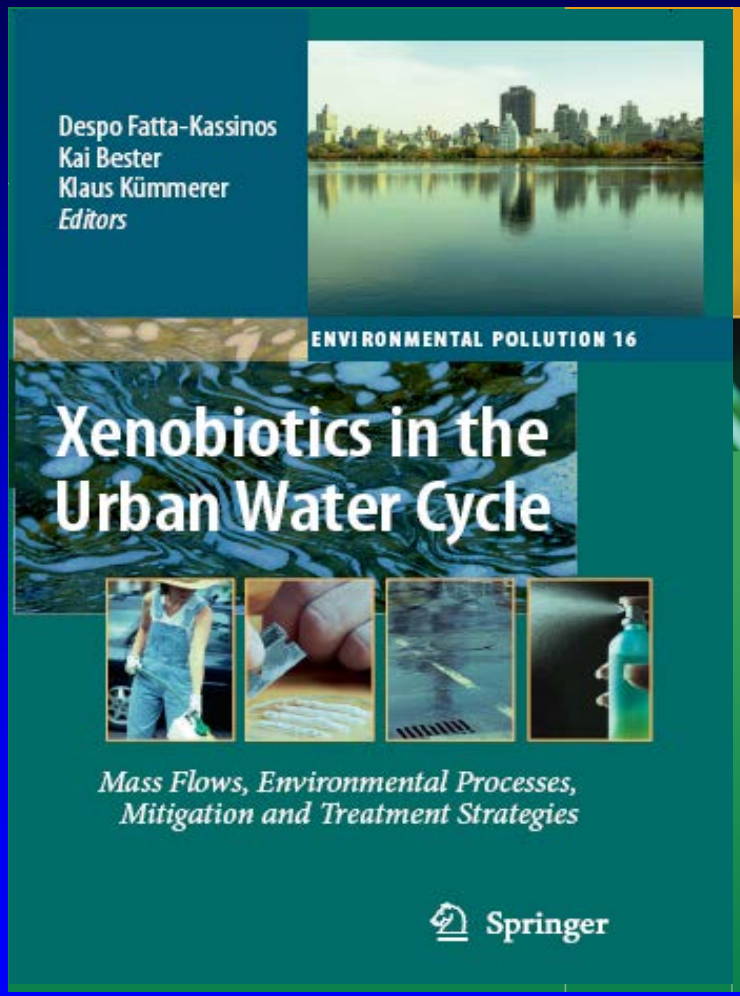
3. Active compounds
substitution of critical compounds
benign by design
long-term

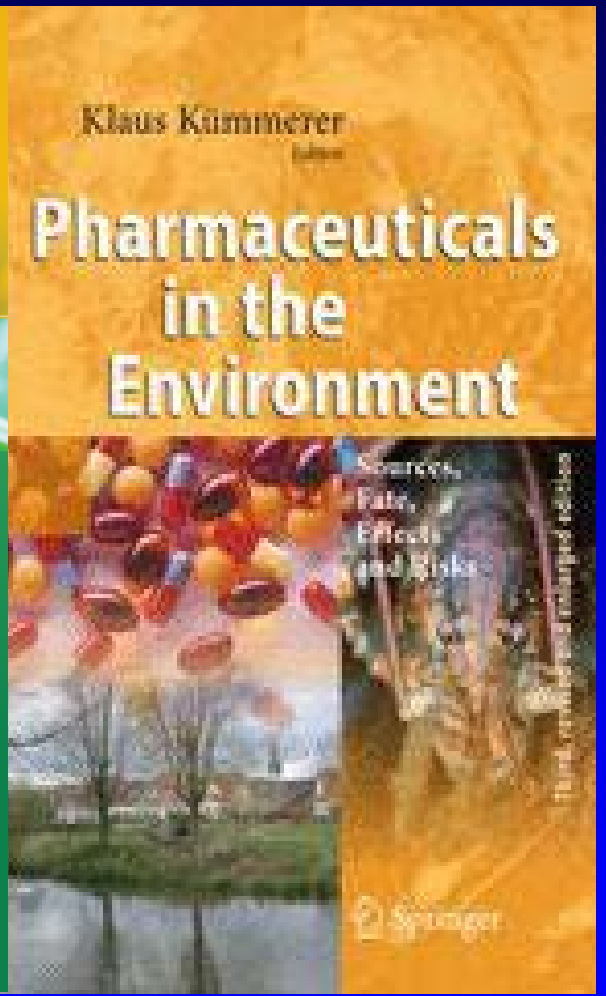
- Smart solution
- Business case of the future
- Needs new understanding,
- Different thinking, and good education

Important building block for sustainable pharmacy

📖 Kümmerer (2007) Green Chem. 9, 899

Need More Information?





PILLS – objectives

The aims of the project are

- to gain comparable (scientific and practical) solutions for the treatment of pharmaceutically burdened wastewater and
- to widen discussion about the problem in order to increase the public awareness of protective measures.

PILLS – partners

Six partners coming from six European States are working together in the PILLS-project:

- France
- Germany (Lead Partner)
- Luxembourg
- Switzerland
- The Netherlands
- United Kingdom

Project duration: September 2007 – December 2011
Budget: Approx. 8 million Euro; 50% co-financed by ERDF

The PILLS partnership is supported in the framework of the INTERREG IV B programme of the European Union.

http://www.pills-project.eu/

Safe Management of Wastes from Health-Care activities

WHO European Centre for Environment and Health
Rome, Italy

World Health Organization
Geneva
1999…New Edition coming soon……2012

- Agency for Toxic Substances and Disease Registry – ATSDR

- 1992 Report to US Congress

ATSDR Conclusions

The greatest risk of transmission of infectious agents associated with medical waste is occupational:

- Janitorial and laundry workers
- Nurses
- Emergency medical personnel
- Refuse workers

ATSDR Conclusions

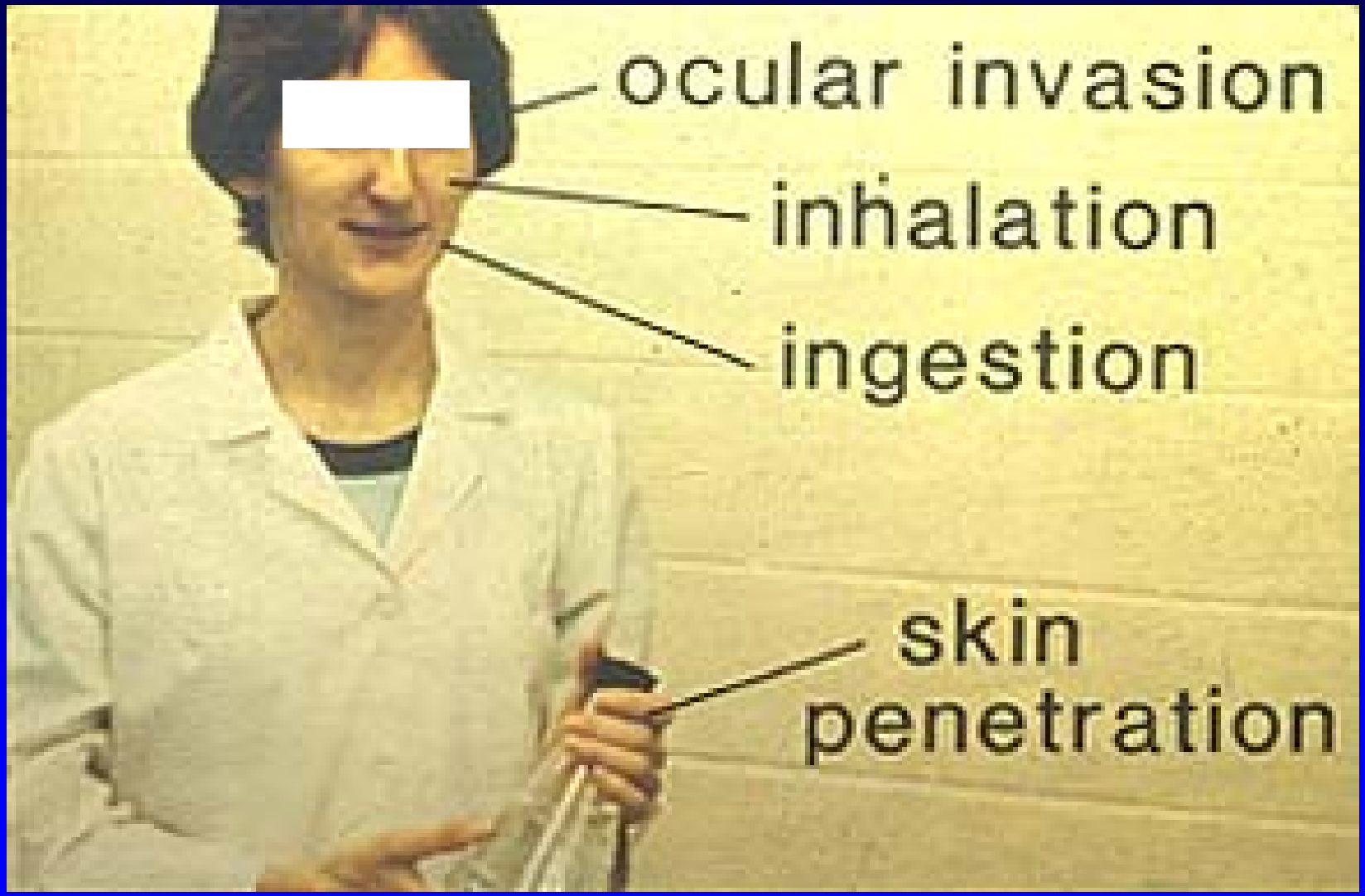
The general public's health is not likely to be adversely affected by medical waste generated in the traditional health care setting.

What are the risks associated with Medical Waste ??

- Industrialized/High Income Countries
  - Occupational Impact?
  - Public Health Impact?
  - Perception of Risk?

- Non-industrialized/Low Income Countries
  - Occupational Impact?
  - Public Health?

Where are the Risks ??



HEALTHCARE WASTE

ROUTES OF EXPOSURE?

INHALATION - RELEASE OF AEROSOLS CONTAINING PATHOGENS ?

YES

CONTACT – INTRODUCTION
THROUGH CUTS, ABRASIONS, AND SPLASHES ?

YES

PERCUTANEOUS - CONTACT THROUGH ACCIDENTAL CUTS AND STICKS

YES

INGESTION – INTAKE OF CONTAMINATED FOODS

NOT LIKELY….