


Arsenic in the Environment: Health Effects and Risk Assessment

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The background of the slide is a close-up photograph of water with concentric ripples. The ripples are most prominent in the lower half of the image, where they form a large, circular pattern. The water is a light blue-grey color, and the ripples create a textured, wavy appearance. The text is centered over this background.

Characteristics
Sources
Uses

Arsenic Characteristics

- Most natural waters contain inorganic species
 - As (III) or arsenite predominant in ground waters
 H_3AsO_3
 - As (V) or arsenate in surface waters H_2AsO_4 &
 HAsO_4^{-2}

Natural Arsenic Levels

Crystalline Rock	Avg. 2 ppm
Soil	1-40 ppm
Ground Water	0.01 – 800 ppb As high as 40,000 in hot springs
Surface Water	2.38 – 65 ppb As high as 22,000 in river water

Some Arsenic Uses/Anthropogenic Sources

- Smelting of metals
- Pharmaceutical industry (medicines)
- Pesticide manufacture (very limited)
- Wood preservative – CCA [in phase out]
- Cattle and sheep dips
- Feed additives
- Dye stuffs
- Petroleum, coal, and wood burning
- Semiconductor manufacture
- Waste incineration

Toxicokinetics

The background of the slide is a close-up photograph of water with numerous concentric ripples. The ripples are most prominent in the lower half of the image, where they form a large, circular pattern. The water is a light, pale blue color, and the ripples create a textured, wavy appearance across the entire surface.

Toxicokinetics

- Absorption
 - Soluble forms
 - Humans – 40 % to complete absorption
 - Animals – 50% to complete absorption
 - Insoluble forms
 - Limited absorption

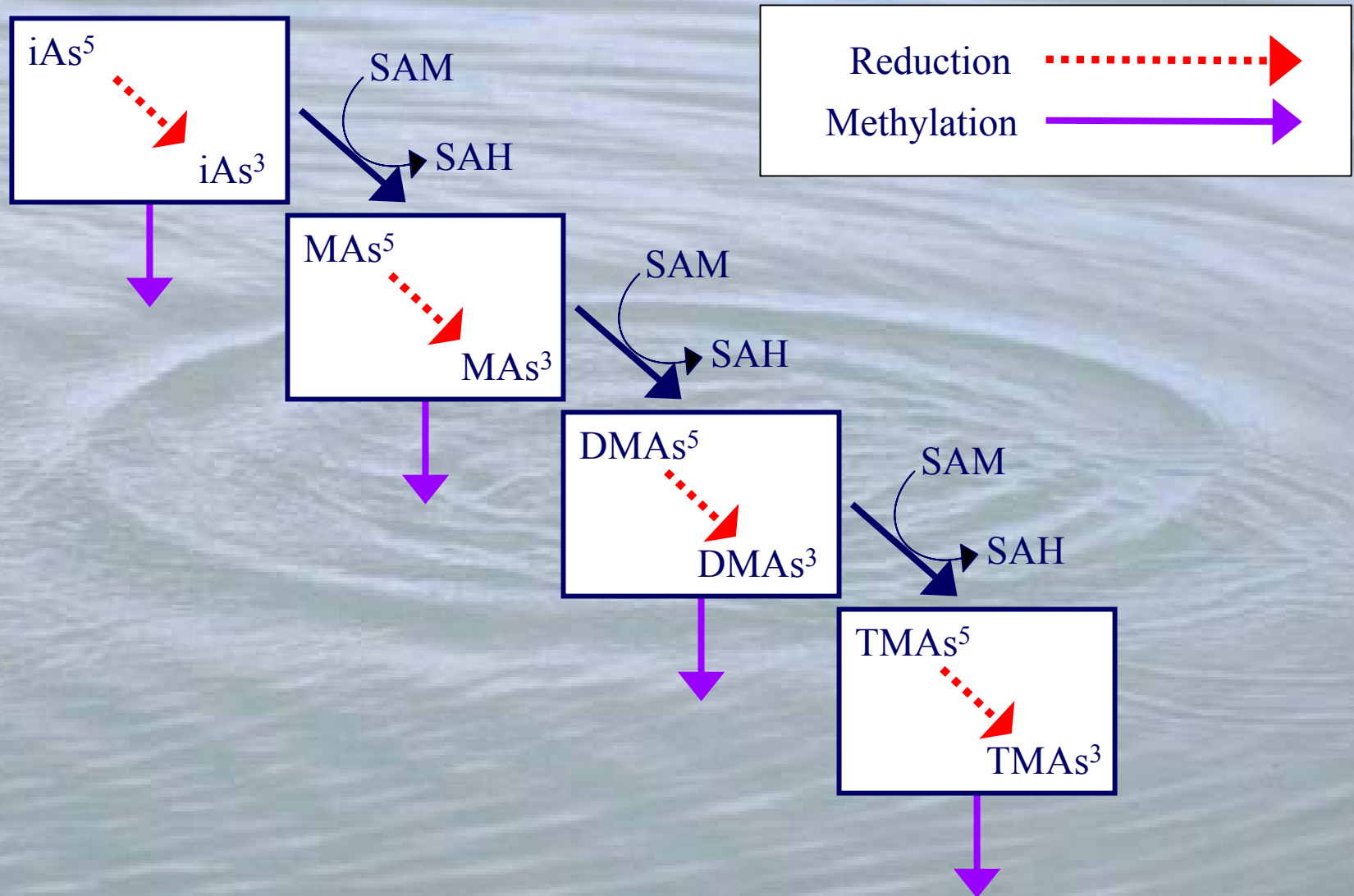
Toxicokinetics cont.

- Distribution
 - Found in all humans – Blood conc. (1-5 ppb)
 - Smokers (2 – 10 ppb)
 - Occupational exposure (~ 10 ppb)
 - Taiwan (20 – 60 ppb)
 - Poisonings (1,000 – 2,000 ppb)

Distribution

- Highest levels (ppb)
 - Nails (0.89)
 - Hair (0.18)
 - Bone (0.07 – 0.12)
 - Heart, kidney, liver, lung (0.03 – 0.05)

Metabolism of Inorganic Arsenic



Excretion

- Primarily via urine
 - 60% - 95% in 5 days
- Fecal excretion low

Adverse Health Effects

Non-Cancer

Acute Toxicity

<u>Animal</u>	<u>LD₅₀ (mg/kg)</u>
Rats	15 - 293
Mice	26 - 43
Guinea pigs	9
Humans	1 - 4 (approx)

Acute Effects – Humans

(est. LD₅₀ ~ 1-4 mg/kg)

- Peripheral neuropathy
- Anemia
- Renal and liver dysfunction
- Skin pigmentation
- EKG abnormalities
- Severe GI effects

Chronic Toxicity: Humans

Vascular

- Taiwan
 - Blackfoot disease
- Poland
 - Vintners
 - 6 cases of gangrene
- Chile
 - Raynaud's disease

Chronic Toxicity: Humans

- Nervous system
 - Peripheral neuropathy – legs and arms
- Cranial nerves
 - Loss of hearing in Japanese infants

Adverse Health Effects

Cancer

Countries Reporting Tumors After Arsenic Exposure

- Taiwan
- Mexico
- Argentina
- Chile
- China
- Mongolia
- Japan

Cancers Associated with Exposure to Arsenic in Drinking Water

- Skin
- Bladder
- Lung
- Kidney
- Liver
- Prostate

Lifetime Risk of Cancer (per 1000)

