Inorganic Arsenic Carcinogenicity: Additional U.S. Evidence

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Presentation Outline

- Studies of arsenic cancer risk in the U.S.
- Indication that southwest Taiwanese data overestimate risks for the U.S.
- Implications of change in slope factor for background arsenic exposures in the U.S.

Recent Studies of Low-Level Exposures in the U.S.

- **Recent studies**
  - U.S. counties (Lamm et al. 2004)
  - U.S. counties (Steinmaus et al. 2003)[a]
  - New Hampshire (Karagas et al. 2004)[a]
  - Utah (Lewis et al. 1999)[a]
  - Supporting data from Argentina (Bates et al. 2004)[a] and Finland (Kurttio et al. 1999; Michaud et al. 2004)[a]
- **Findings**
  - General lack of increased risk due to arsenic
  - Possible risks in some studies for smokers exposed at higher doses

[a] Included in a meta-analysis of low-level arsenic exposure and bladder cancer (Mink et al.)

Other U.S. Epidemiological Data: Water

- **Well water exposures in Oregon, New Hampshire, Nevada, Wisconsin, multiple counties and states**
  - Seven studies
  - Studies evaluated a variety of endpoints related to arsenic using mostly ecological study design
  - Exposed population sizes in the 1,000s to 10,000s
- **Findings**
  - No elevated cancer risks related to arsenic
  - Exception: Increased skin cancer risk in older smokers in Wisconsin but no increases in bladder or lung cancer risk

Other U.S. Epidemiological Data: Air and Soil

- **Smelters in Arizona, Idaho, Montana, New Mexico, Texas, Utah, Washington; pesticide plant in Maryland**
  - Nine studies involving several Superfund sites
  - Most studies evaluated lung cancer using case-control or cohort study design
  - Exposed population sizes in the 1,000s
- **Findings**
  - Overall, little evidence of increase in arsenic-related cancer risk
  - Suggestion of increased risk for men or smokers from pesticide site and for two smelter studies in Canada and Sweden

Implications of Changes in the Arsenic Cancer Slope Factor (CSF)

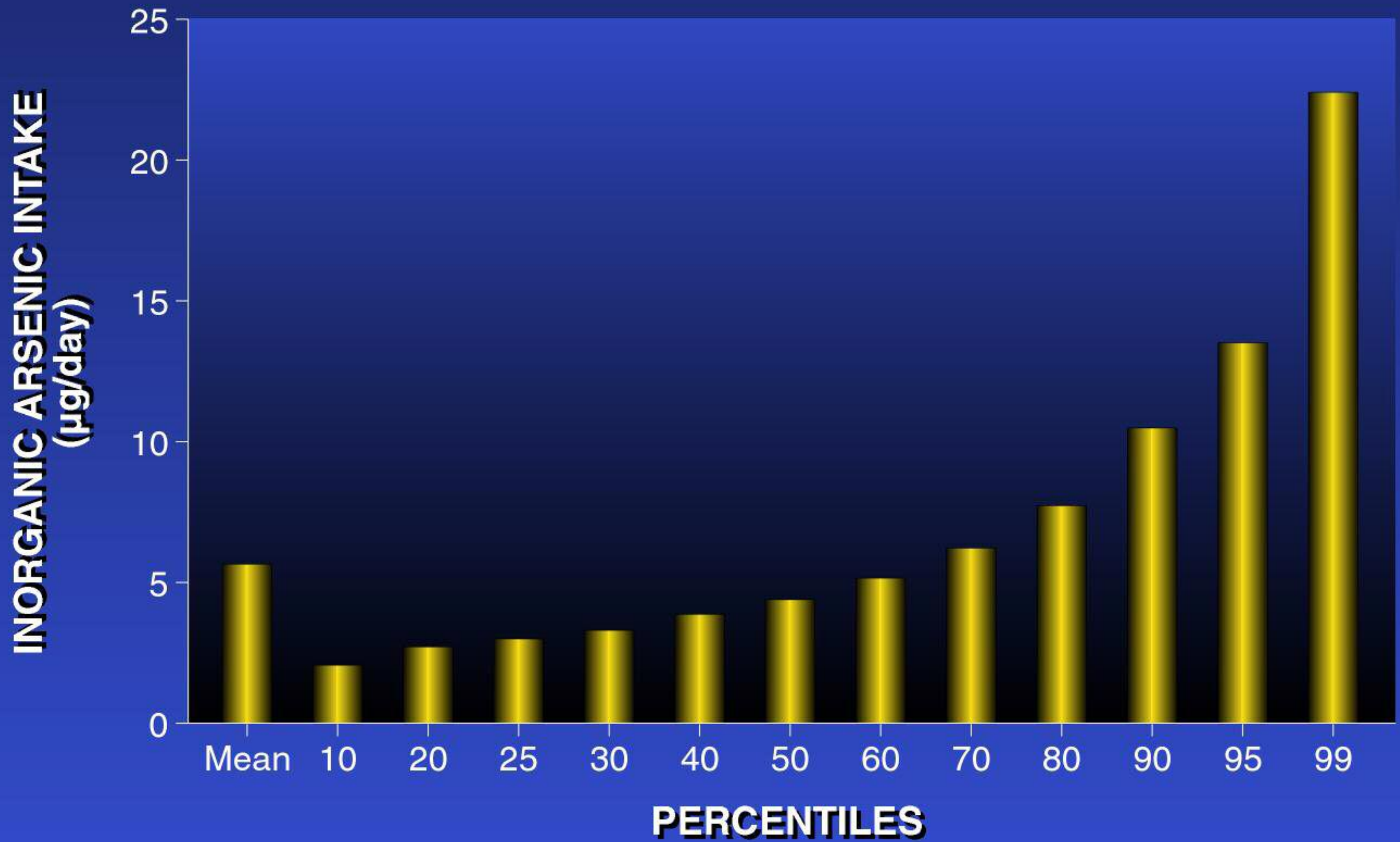
- Arsenic occurs naturally in the environment
- Diet and water are primary sources
- Background exposures for naturally occurring substances provide perspective for regulatory risk assessments
- Background arsenic risks using existing EPA CSF are typically greater than a one-in-a-million cancer risk

Inorganic Arsenic Intake from Diet and Water for Total U.S. Population

- **Probabilistic modeling of arsenic intake**
  - Dietary and water intake patterns (USDA Continuing Surveys of Food Intake by Individuals, 1994–1998)
  - Inorganic arsenic data on 40 foods (Schoof et al. 1999)
  - Regional distributions of arsenic concentration for drinking water and water used in food preparation (U.S. EPA 2000, 2001). Truncated arsenic concentration at 10 ppb.

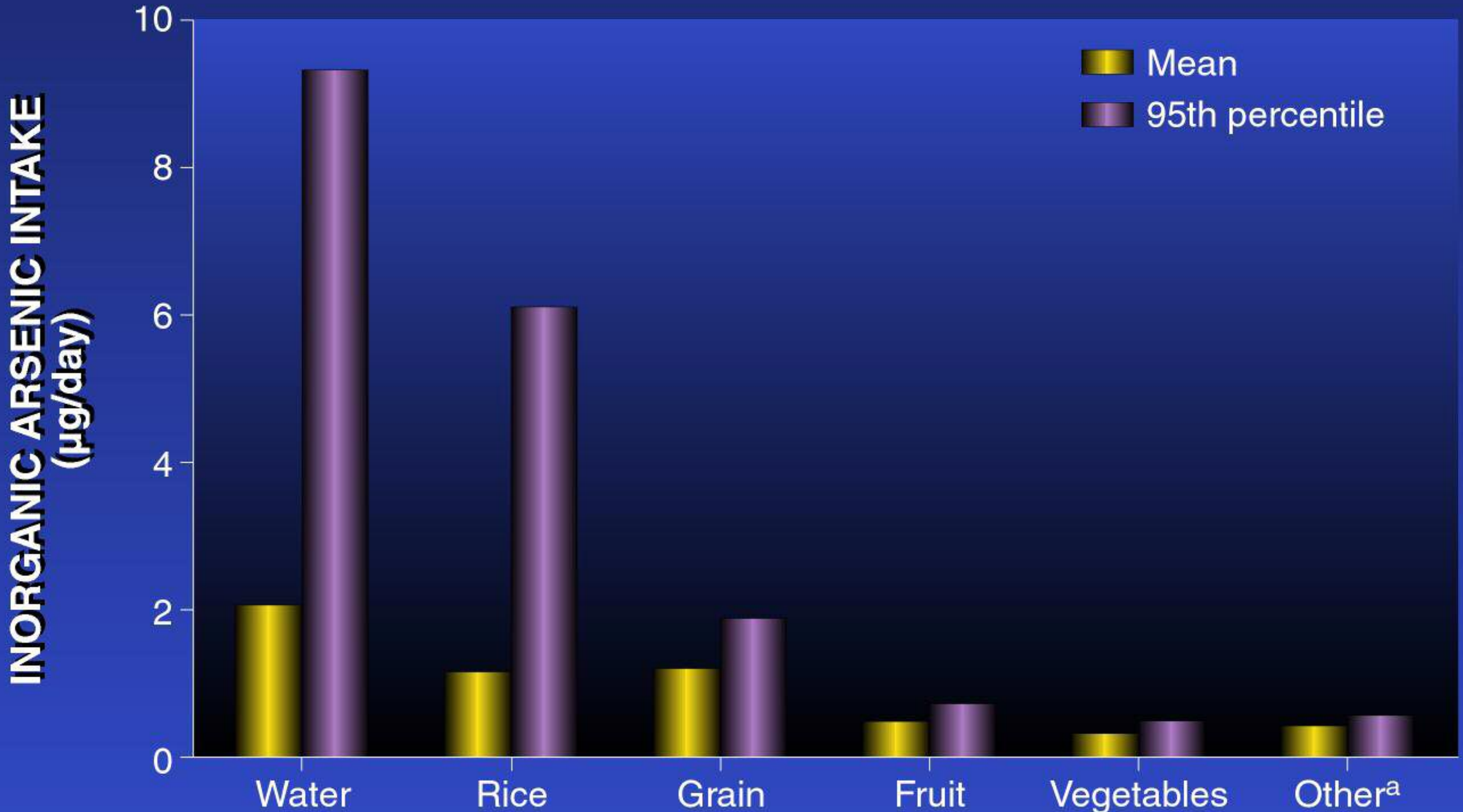
Note: Expanded analysis of Yost et al. (2004) to include diet and water for the total population

Inorganic Arsenic Intake: Diet and Water (≤10 ppb) for Total Population



BE0830 0805 Total Population

Intake Composition at Mean or ≥95th Percentile



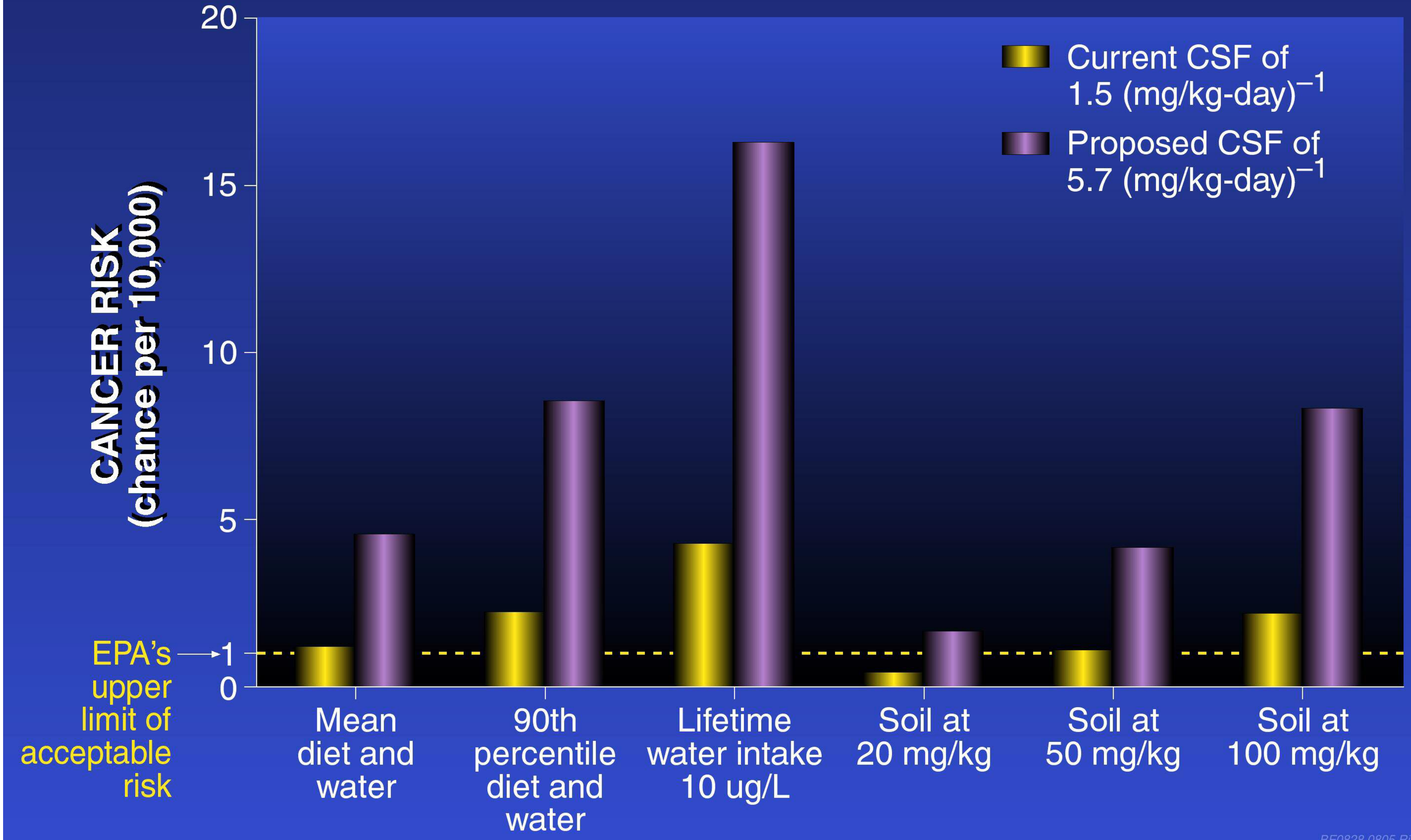
[a] The "Other" group comprises meat, legumes, nuts, seeds, potato, eggs, milk, sugar, condiments, and fish

BE0831 0805 Intake Comp.

Diet and Water Composition

- Those with high-end inorganic arsenic intake have higher water arsenic levels and eat more rice
- 6 μg/day of inorganic arsenic comes from rice at the 95th percentile and above
- One cup of cooked rice contains about 4 μg of inorganic arsenic

Arsenic Risk Estimates Based on Current and Proposed CSF



BE0828 0805 Risk with CSF

Conclusions

- Additional U.S. studies of exposure to arsenic in water or from smelter communities support the findings of a meta-analysis of recent studies
- Findings indicate that southwest Taiwanese data overestimate risks for low-level arsenic exposures in the U.S.
- Implication of overestimation: Erroneous conclusion that background arsenic exposures are a major public health concern in the U.S.