Overview of the Investigation of Drinking Water Exposures in Dennehotso, Ganado, Lower Greasewood, Red Mesa and Steamboat

Yolanda Barney, Principal Investigator
Navajo Nation Environmental Protection Agency
Public Water Systems Supervision Program

Matthew Murphy, Co-Investigator
Lauren Lewis, Co-Investigator
Centers for Disease Control and Prevention
National Center for Environmental Heath

Public Health Concerns Related to Water Hauling on Navajo Nation

- Water hauling is widespread
  - ~14,000 households without potable water
- Use of unregulated, untreated source water
  - Mainly livestock wells and natural springs
  - Found to contain bacteria and chemicals (such as natural arsenic and uranium)
- Unsafe storage and handling

Household Investigation of Drinking Water Exposures- 2008

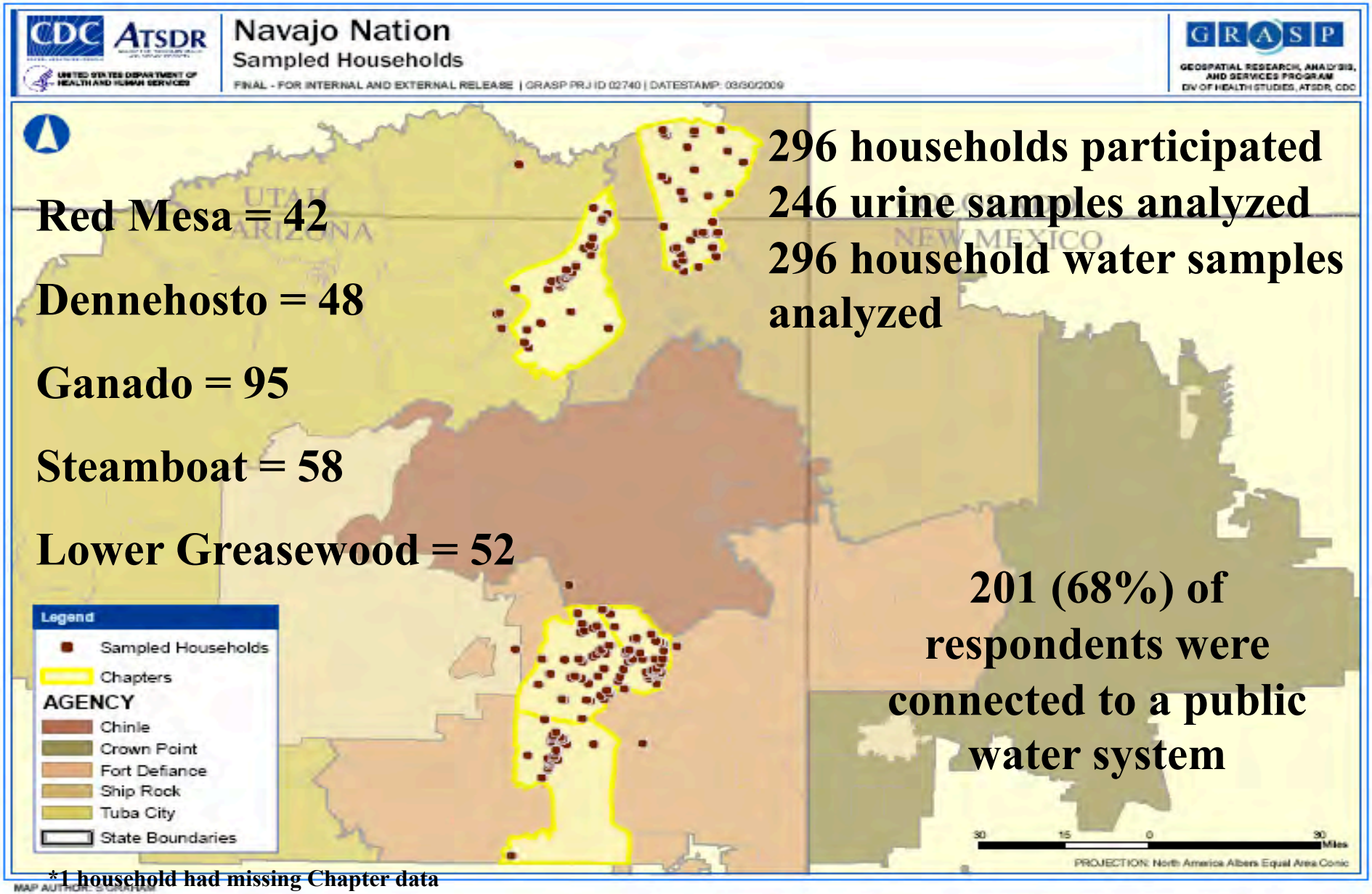
- Collaboration among CDC, Navajo EPA, Navajo Division of Health, Navajo Epidemiology Center, Navajo Veterinary Program, IHS
- Target 5 chapters based on source water survey findings
  - Red Mesa, Dennehotso, Steamboat, Lower Greasewood, Ganado
- Goals:

  To what extent does contamination of unregulated water sources represent a public health threat?

Investigation Design and Data Collection

- Surveyed 296 households in 5 Chapters with and without access to public water
- Community health representatives (CHRs) visited homes and collected information from 1 adult per household:
  - Document water use, hauling and storage methods
  - Test urine for chemical exposures in people
  - Test drinking water in home for bacteria and chemicals
  - Identify additional water sources for further testing
  - Geographic location of home and water sources

Investigation Results



*1 household had missing Chapter data

How Common is Water Hauling?

- 65 (22%) haul some or all of drinking water
- 175 (59%) do not haul water
- 56 (19%) could not be confirmed

Bacterial Analysis

Total # tested for bacteria	Positive for *E. coli*	Positive for total coliforms
285	23(8%)	94(33%)

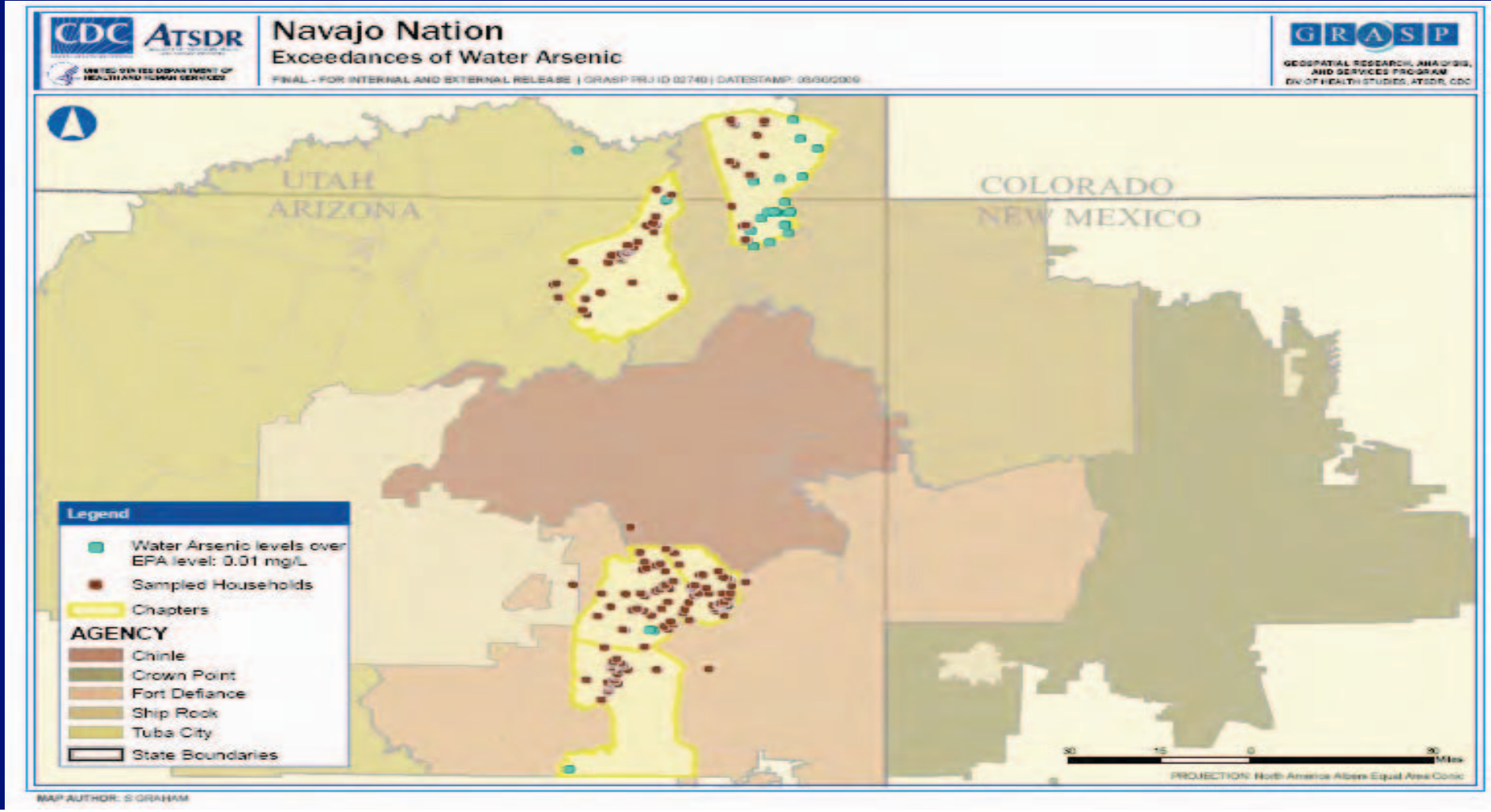
- A significantly higher proportion (73%) of hauled water samples had bacteria compared to non-hauled water samples (18%)

Water Nitrates and Arsenic

EPA Primary drinking water limit	N (%) samples above limit	Potential Health Effects associated with exposure
Nitrates > 1mg/L	42 (14%)	Blue Baby Syndrome: shortness of breath in infants < 6 months old
Arsenic ≥ 10ug/L	33 (11%)	Skin changes, neuropathy, gastrointestinal illness, increased risk for lung, skin and bladder cancer

Geographic Distribution of Water Arsenic Levels

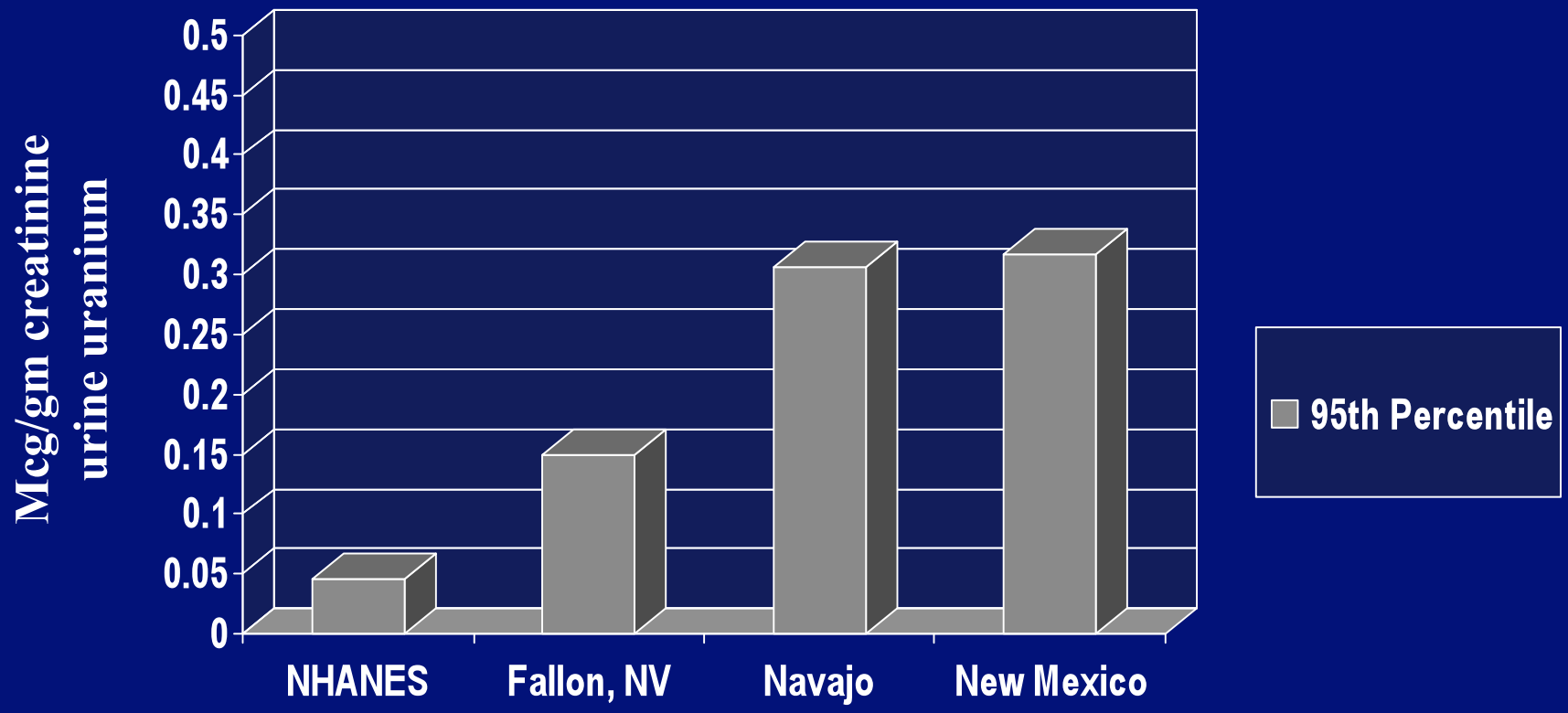
- 82% samples > Arsenic EPA limit were from Red Mesa



Human Exposures to Inorganic Chemicals (Urine Samples)

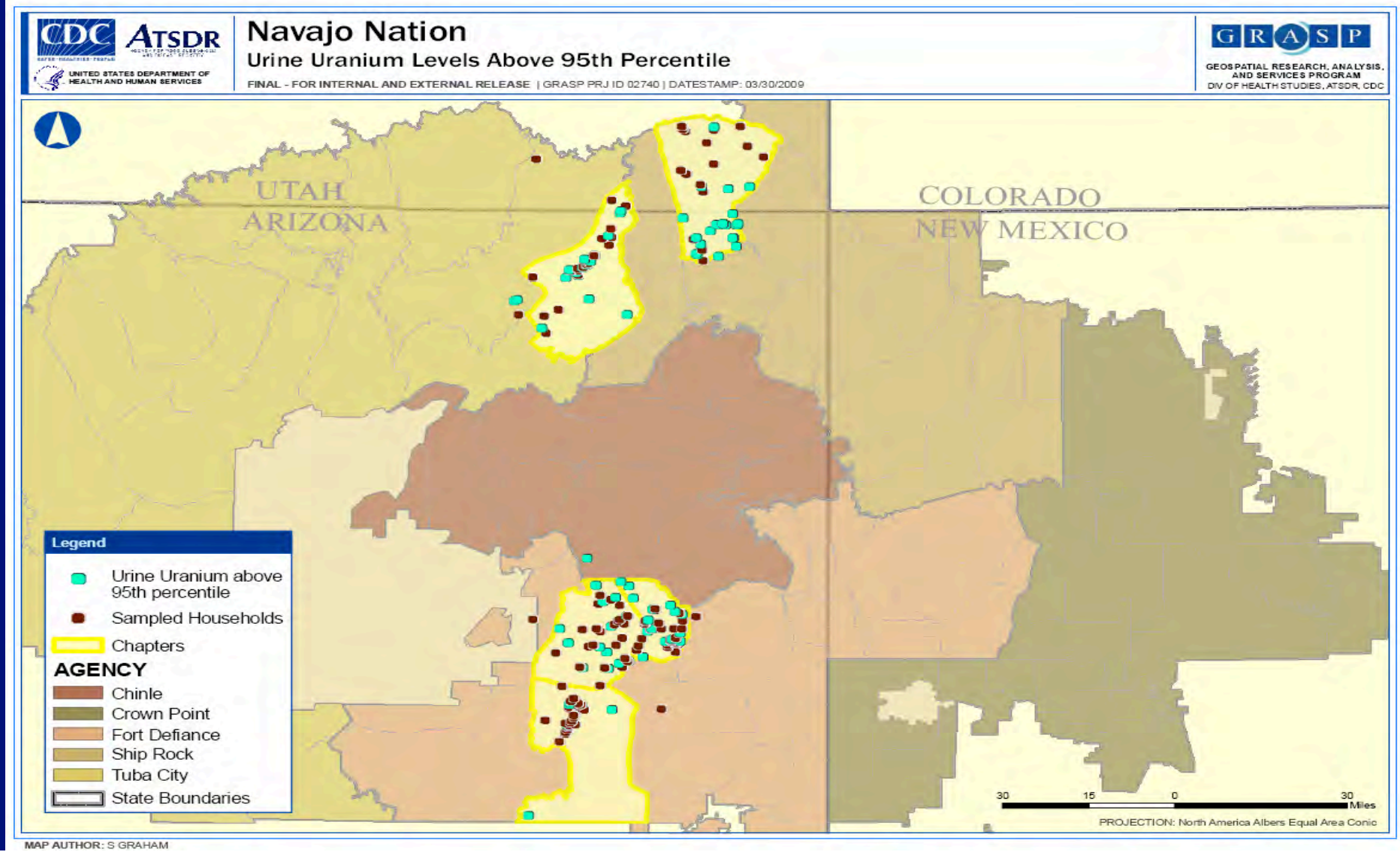
- Uranium =most frequent
  - Linking urine contaminant levels to direct health effects can be challenging
  - Compared levels to 95th percentiles of :
    - NHANES
    - New Mexico Biomonitoring Project
    - Fallon Nevada Study
  - No values at levels known to cause human health effects

95th Percentile of Urine Uranium Levels



Potential for known health effects

Geographic Distribution of Urine Uranium Levels > NHANES 95%



Summary of Key Findings

- 22% of households haul water for drinking, including some with access to public water
- Those that haul water are more likely to be exposed to bacterial contaminants in drinking water
- Human exposure to uranium as measured in urine was:
  - Lower than levels known to cause health effects
  - Higher in this population than the general US population
  - Comparable to other Southwest populations
- Drinking water contamination does not appear to be the sole source of uranium or other chemical exposures in this population

What This Data Does Not Tell Us

- The source of uranium exposure
- The contribution of mining to uranium exposure
- The extent of historical exposure to uranium
- Health impact of uranium exposure

Current Activities: Disseminate Results and Follow up

Individual Level:

- Reporting individual results to participants
- Offer urine testing to other family members
- Offer enrollment into IHS Medical Monitoring Program

Community Level:

- Identify and test new sources of drinking water
- Physician Awareness
- Community Awareness

National Level:

- Congressional Meetings- Navajo 5-Year Plan

NEXT STEPS

- Continue to share results and work with other agencies (IHS, EPA, and Navajo agencies) to assist in guiding policy and interventions to improve access to safe water
- Clinical GI illness study
- Potential Congressional funding

THANK YOU!!!

Cadmium

- Not detected in household water samples
- 10% of urine samples were unusually high
- Arsenic, nitrates, cadmium, and uranium are the primary chemicals to be discussed