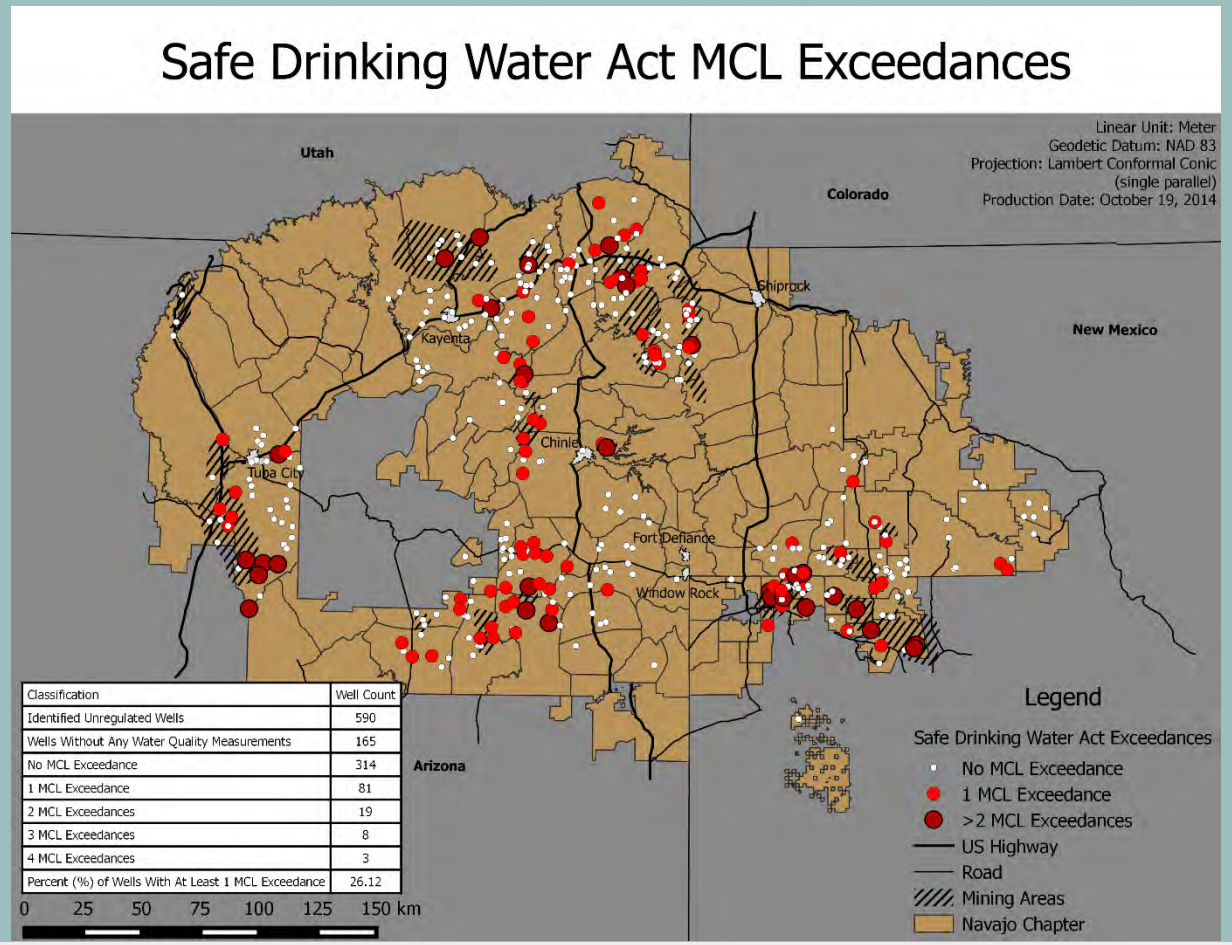


GEOGRAPHIC TOOLS IN HEALTH RISK RESEARCH

Presenter: Joseph Hoover, PhD
Translator from English into Russian: Elena O'Donald, PhD

Community Environmental Health Program, College of Pharmacy, University of New Mexico

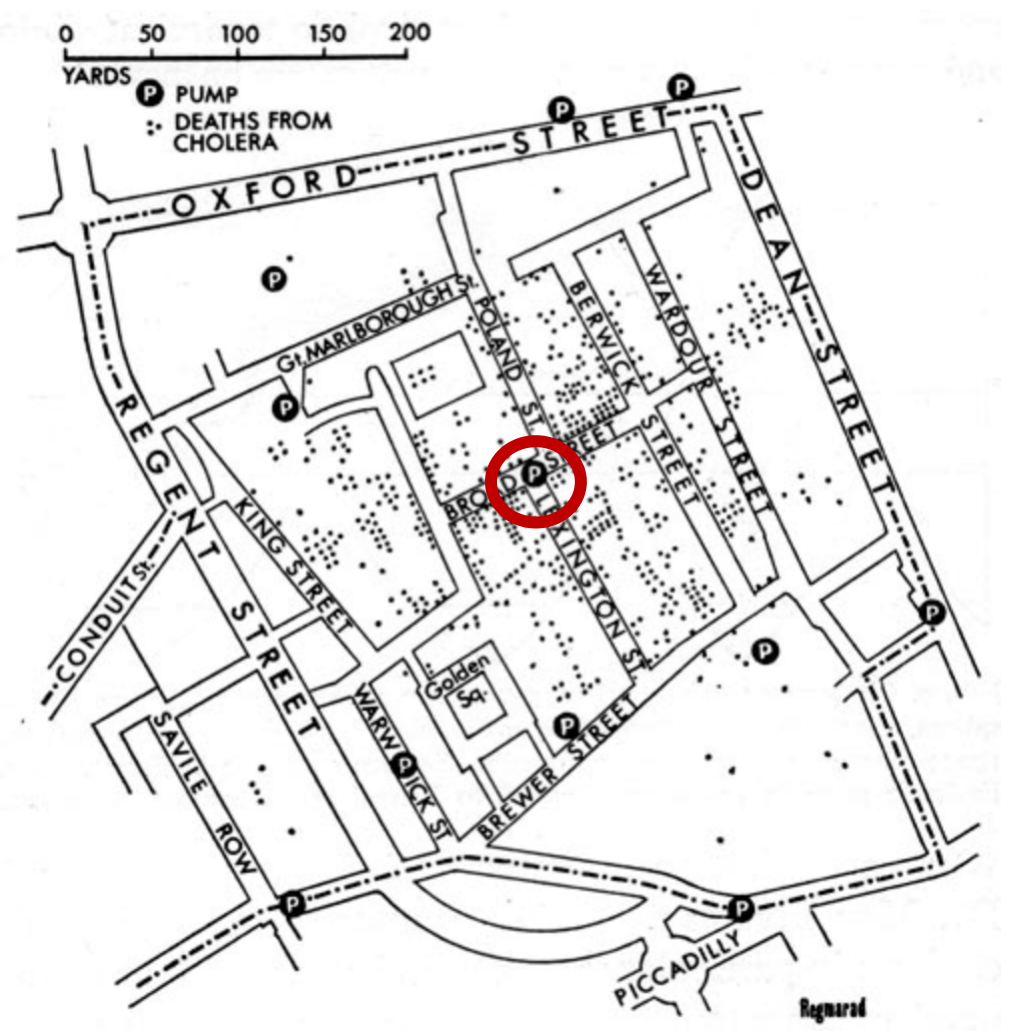
UNM HEALTH SCIENCES CENTER

Iiná Nizhóní

Bi-National Health Risk Seminar Series, Albuquerque, New Mexico November 19, 2014

CEHP

SETTING THE CONTEXT: GEOGRAPHY AND HEALTH



John Snow Cholera Map: Broad Street Pump 1854

- Two decades of research by geographers (and others) have demonstrated that the environment is a critical component of individual health
  - Place and neighborhoods are important factors of individual health outcomes
  - Where you live and work matters
- A variety of geospatial tools and methods have been developed to account for some of the challenges of using health and environmental data in a spatial framework
  - Measurement
  - Visualization
  - Decision support

NAVAJO NATION: PUBLIC WATER SYSTEM ACCESS

Drinking water access on the Navajo Nation remains a critical challenge

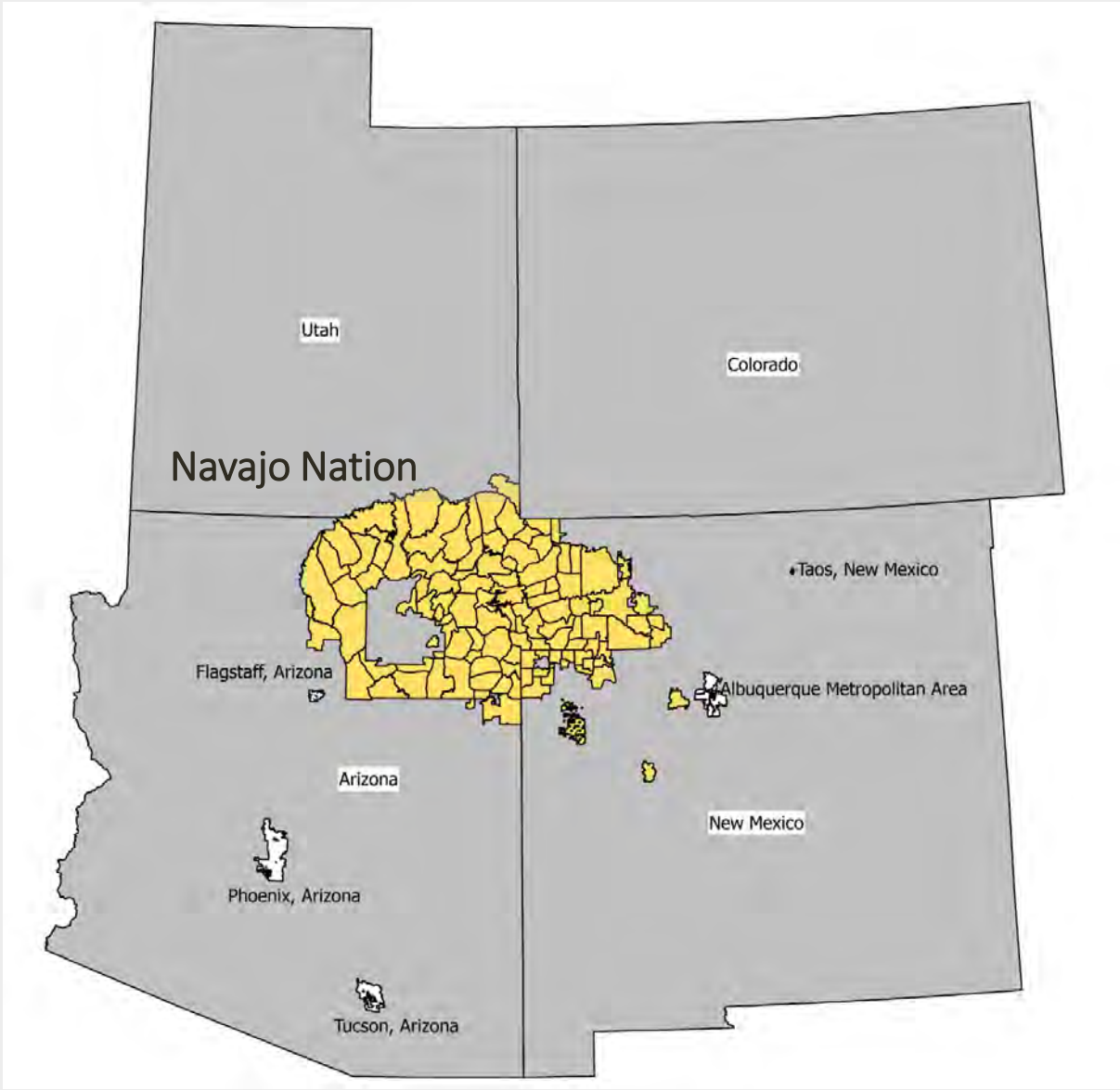
- Approximately 30% of residents (~50,000 individuals) do not have access to regulated public water systems
  - Lack access to safe drinking water
- Rely on water hauling as their sole source of drinking water

- Many people haul water from unregulated sources
- Water quality at these sources remains unknown and may be an important source of heavy metal exposure
- Challenge: Assessing metal exposure through drinking water

UNREGULATED WATER QUALITY: DATA SOURCES

Some sampling has been done but by multiple agencies over a long period of time. These data exist in multiple locations, in multiple formats and aren't easily consolidated.

Need: Compile existing water quality measurements



Water quality data collected by:

DEI
DINÉ ENVIRONMENTAL INSTITUTE

CDC
Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Navajo Nation Environmental Protection Agency

USGS
science for a changing world
U.S. Geological Survey

WATER QUALITY DATABASE OBJECTS (ABBREVIATED)

Water Sources

Name/ID
Aquifer
Water Uses
Type
Data Source
Regulation Status
Water Source Status

Political Areas

Chapters
Grazing District
BIA Agency

Database Management System

- PostgreSQL (PG) version 9.3.5
- PostGIS version 2.1.3

- Benefits of using PG and PostGIS:
  - Natively store location geometry
  - Connect with GIS software
  - Open source

Water Analytes

Results
Sources
Analysis Lab
Analysis Method
Sampling Agency
Analyte Code

Arsenic In Unregulated Drinking Water Sources

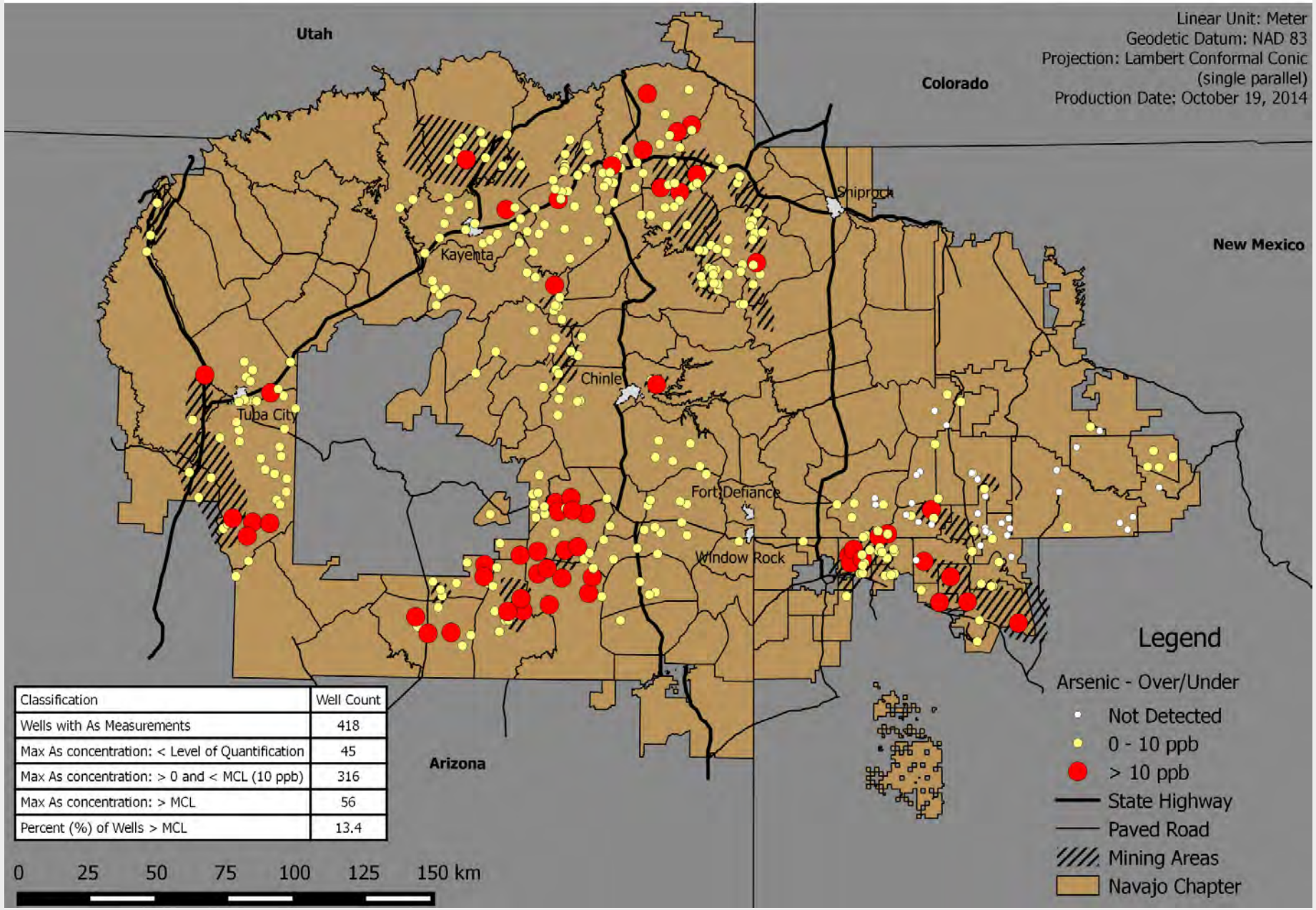
Cartographic Representation of Arsenic groundwater concentrations

MCL: Maximum Contaminant Level – the legal threshold for a contaminant in public drinking water. MCL for arsenic is *10 parts per billion* in drinking water

Unregulated Water: Groundwater sources that are not part of public water systems

Mining areas: Generalized areas of former uranium mining in and near the Navajo nation

- **13% of tested wells have Arsenic > 10 ppb**

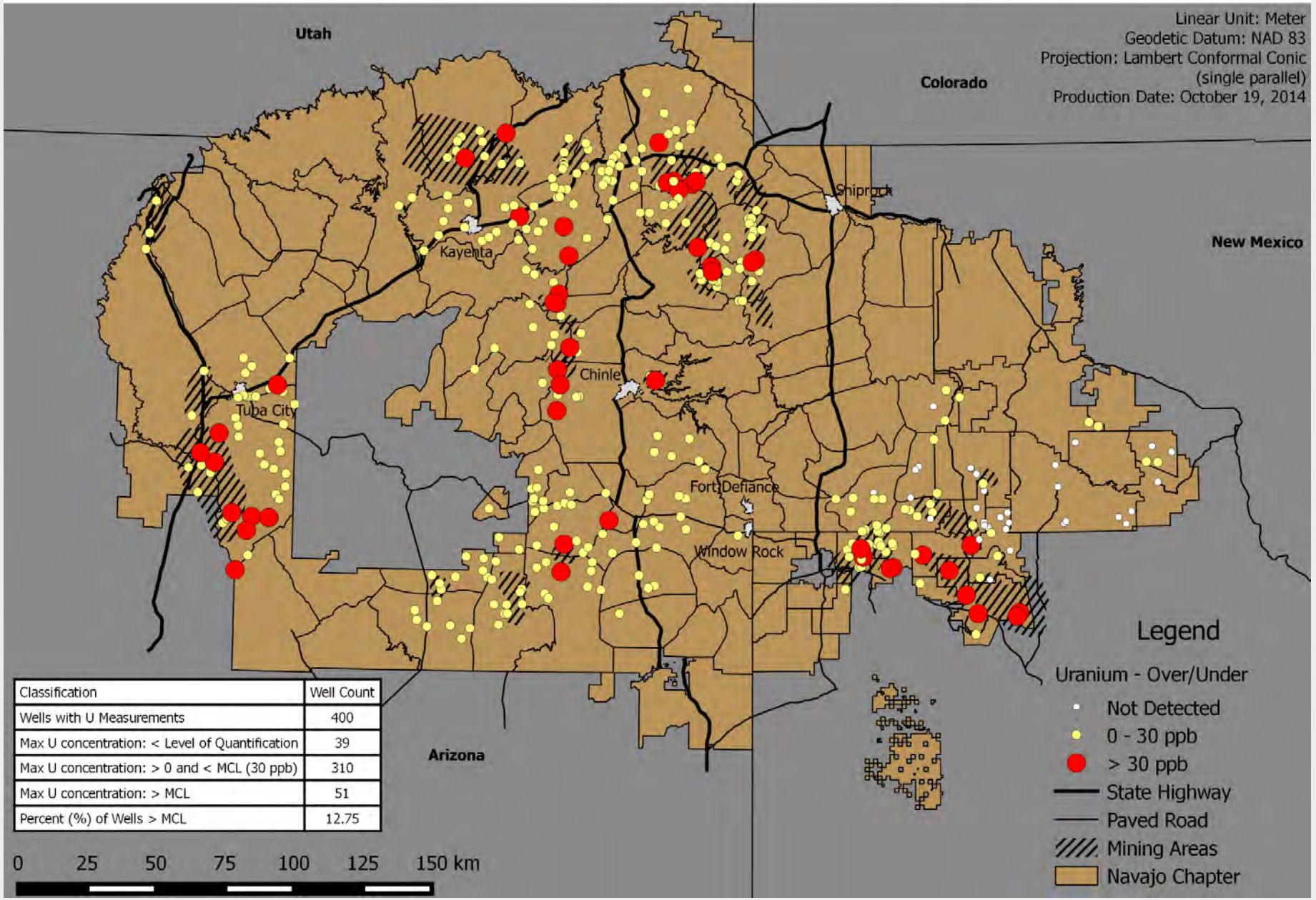


Uranium In Unregulated Drinking Water Sources

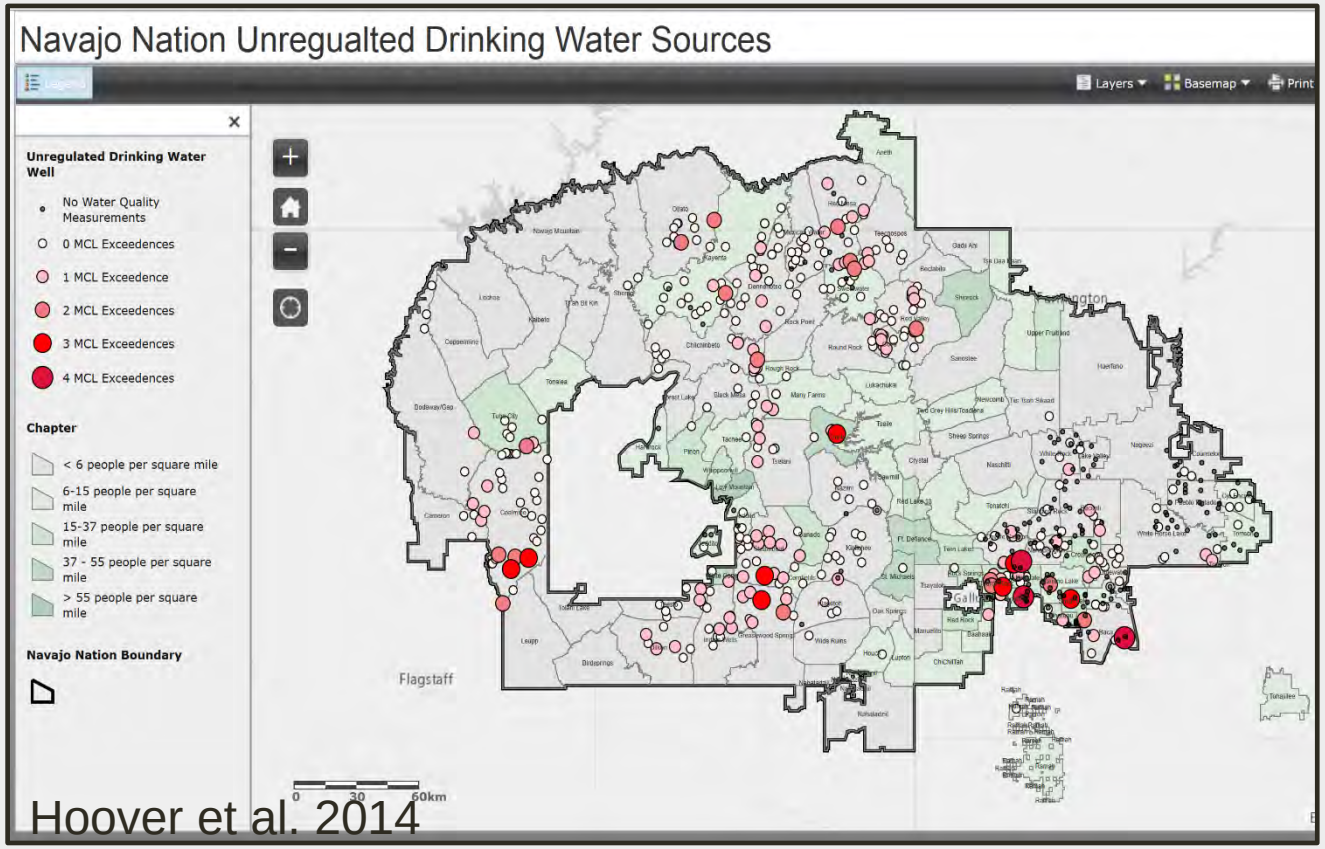
Cartographic Representation of Uranium groundwater concentrations

MCL for uranium is *30 parts per billion* on drinking water

- **13% of tested wells have Uranium > 30 ppb**
- The locations of the arsenic contaminated wells are different than the areas where we find uranium contaminated wells. Drinking water contamination by these two metals are not spatially co-located.

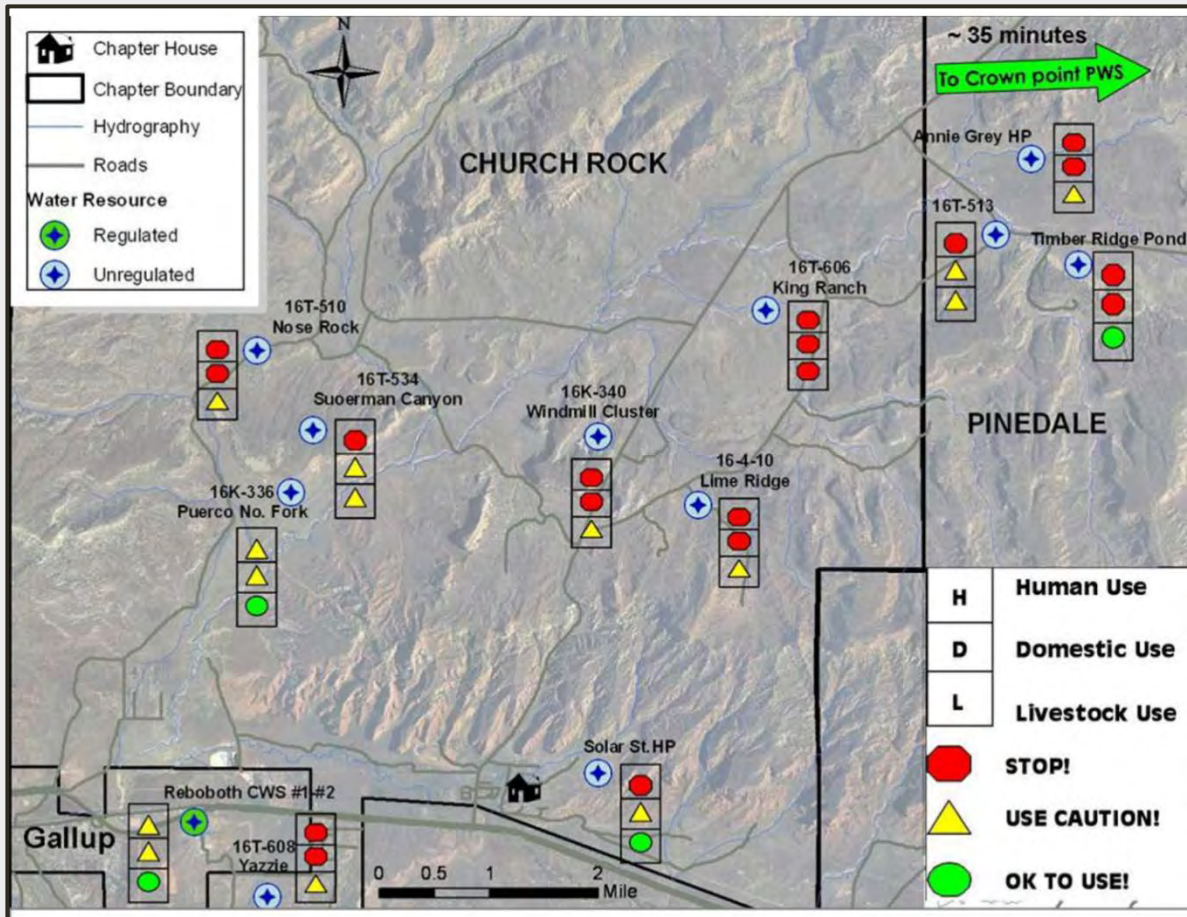


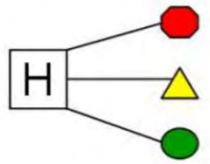
HEATH, ENVIRONMENT AND DECISION SUPPORT



Hoover et al. 2014

- Proto type application that visualizing unregulated water source contamination through the Navajo Nation.
- Benefits: Interactive, dynamic and user friendly





deLemos et al. 2009

NEXT STEPS

Use compiled geospatial information to assess:

- Exposure pathways: statistical modeling and visualization
- Community health and environmental literacy
- Results dissemination via online tools
- Assess spatial uncertainty in data and models
- Evaluate the spatial distribution of contaminated water sources

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