The Big Four: How Arizona's Most Comprehensive Groundwater Quality Assessment Relates to Discount Shopping

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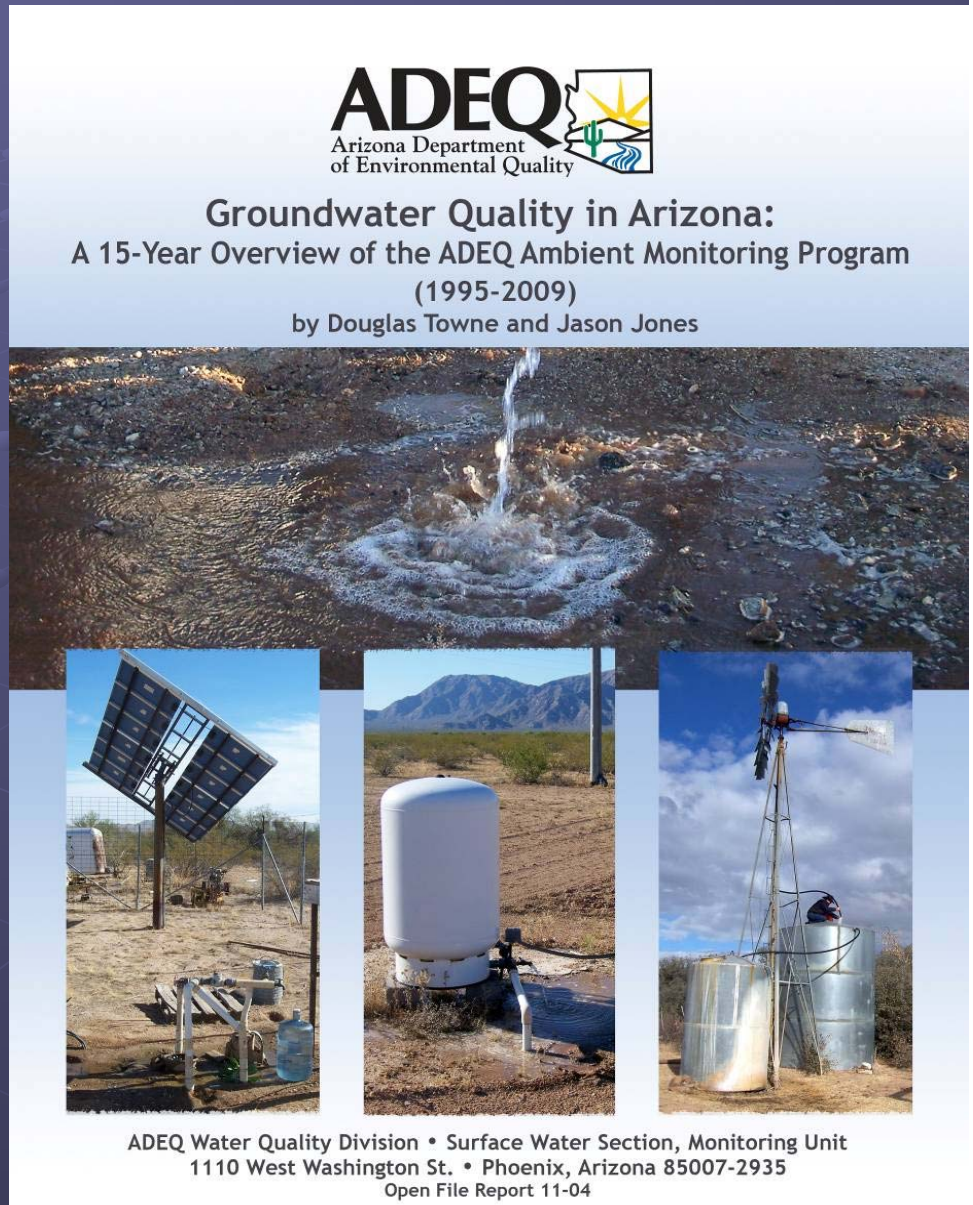
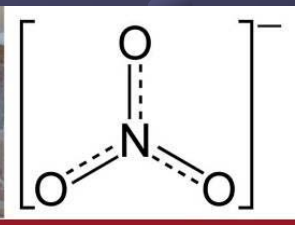
Groundwater Quality in Arizona: A 15-Year Overview of the ADEQ Ambient Monitoring Program (1995-2009)

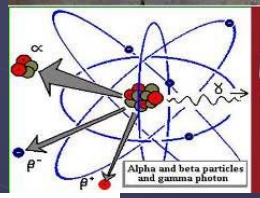
- Original title a bit tedious; wanted to have a little fun with the study
- Same content, only the name has been changed
- However, a slightly different emphasis in this era of tight budgets
- New Mantra: using scientific research to save the public money

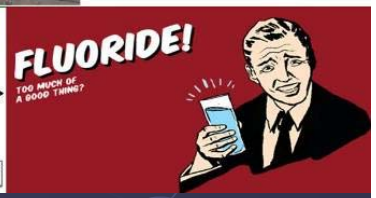


Presentation Outline

- Overview of GW program
- Reason for the report
- Results of study
- Putting the results into action

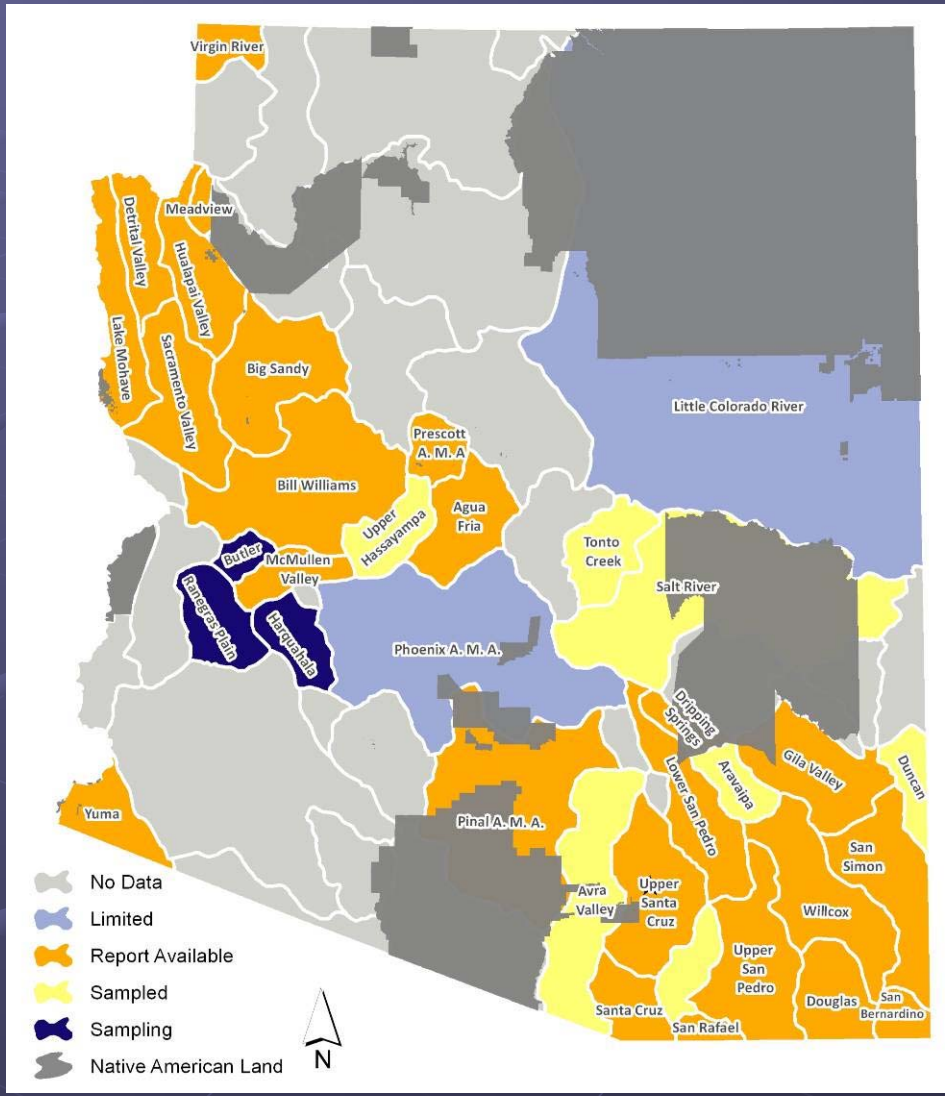






ADEQ Ambient GW Monitoring Program

- Goal is to characterize GW quality in Arizona
- Since 1995, have sampled 30 of the state's officially designated 51 GW basins
- Studies designed to examine broad GW quality conditions
- Baseline reports published on 22 basins
- From a peak of 8 hydrologists, only 1 in program since 2005

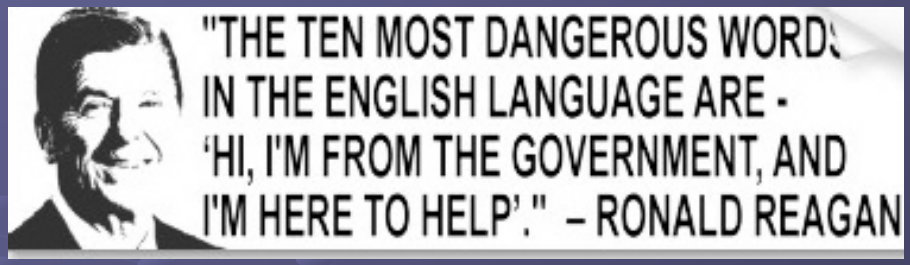


Groundwater Program Realities - Monitoring

- Sample domestic, stock, irrigation, and public supply wells and springs
- Every well is different and many are a challenge to collect a valid sample
- Much of Arizona remains remote, rugged country – it takes time and work to collect groundwater samples

Sampling Program Realities - Public

- Voluntary – must “sell” your program to well owners



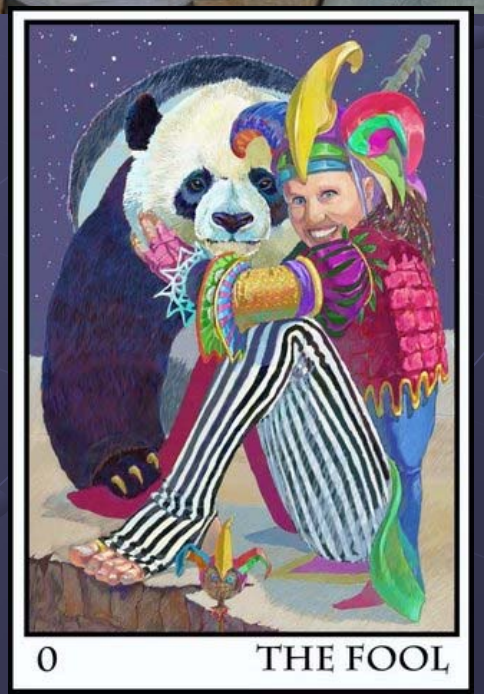
- Encounter various reactions from Arizona well owners as a government employee

- Learn subtle – and not so subtle – clues concerning which homes and people to approach

- Learn tricks to get well owners to work with you

Sampling Program Realities - Public

- Recently collected an usual sample
- An artist gave permission to sample her well
- Asked a favor in return: could she use our images in her series of paintings of tarot cards?
- You never know what awaits you at the next well; in many ways, Arizona remains the Wild West….



Impetus for Report

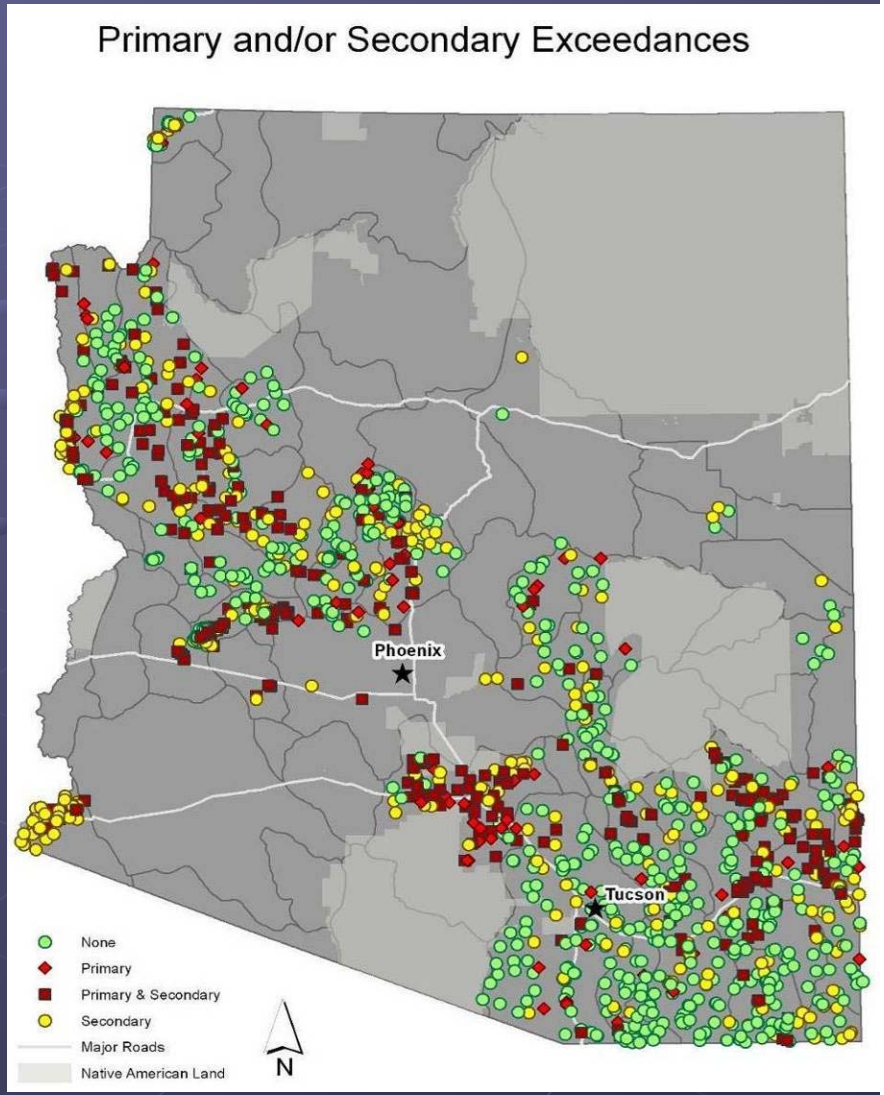
- Most Arizonans are on public systems and receive water that meets drinking water quality standards
- However, there are roughly 100,000 private domestic wells that represent 5% of the state's population
- These wells have almost no water quality testing requirements
- A report that sampled 49 wells found a high percentage not meeting water quality standards
- What insights can ADEQ provide to Arizona domestic well owners?

Summary of Samples Collected by ADEQ's Ambient Program, 1995-2009

- 1,477 inorganic samples – collected at every site
- 553 radionuclide samples – collected at one-third of sites especially near granite rock or mining areas
- 287 VOC samples – usually collected in urban areas
- 115 pesticide samples – collected in agricultural areas

ADEQ GW Sampling Results

- 31% of sites had health-based or “Primary” water quality exceedances
- 52% of sites had aesthetics based or “Secondary” water quality exceedances
- 42% of sites met all health and aesthetics-based water quality standards



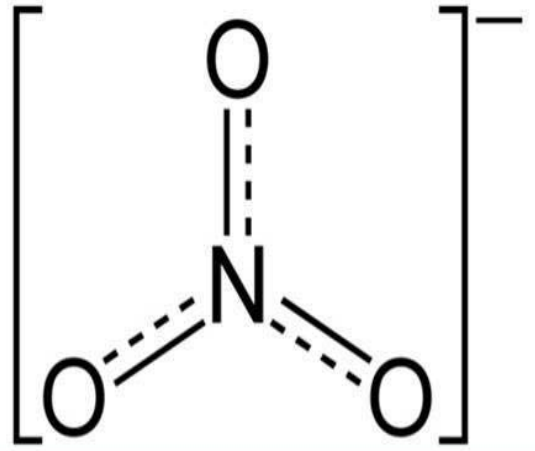
Health-Based Water Quality Exceedances

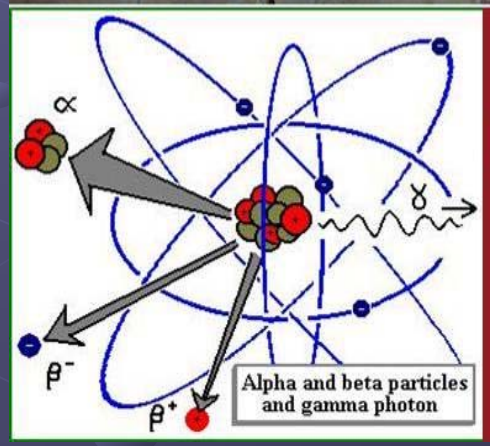
- VOC/pesticide detections are rare
- Many trace elements detections are rare (antimony, beryllium, cadmium, lead, mercury, nickel & thallium)
- Others are detected but rarely exceed standards (barium, copper, & selenium)
- 97% of water quality exceedances were caused by only 4 constituents
- What were the 4 constituents?

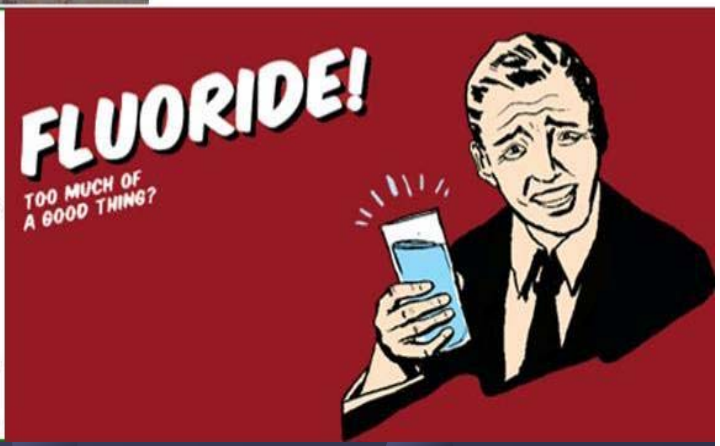
Arizona's "Big Four"

- Of the 459 sites exceeding health-based standards:

- Arsenic – 60%
- Fluoride – 31%
- Nitrate – 25%
- Gross alpha – 22%
- Others – 3%



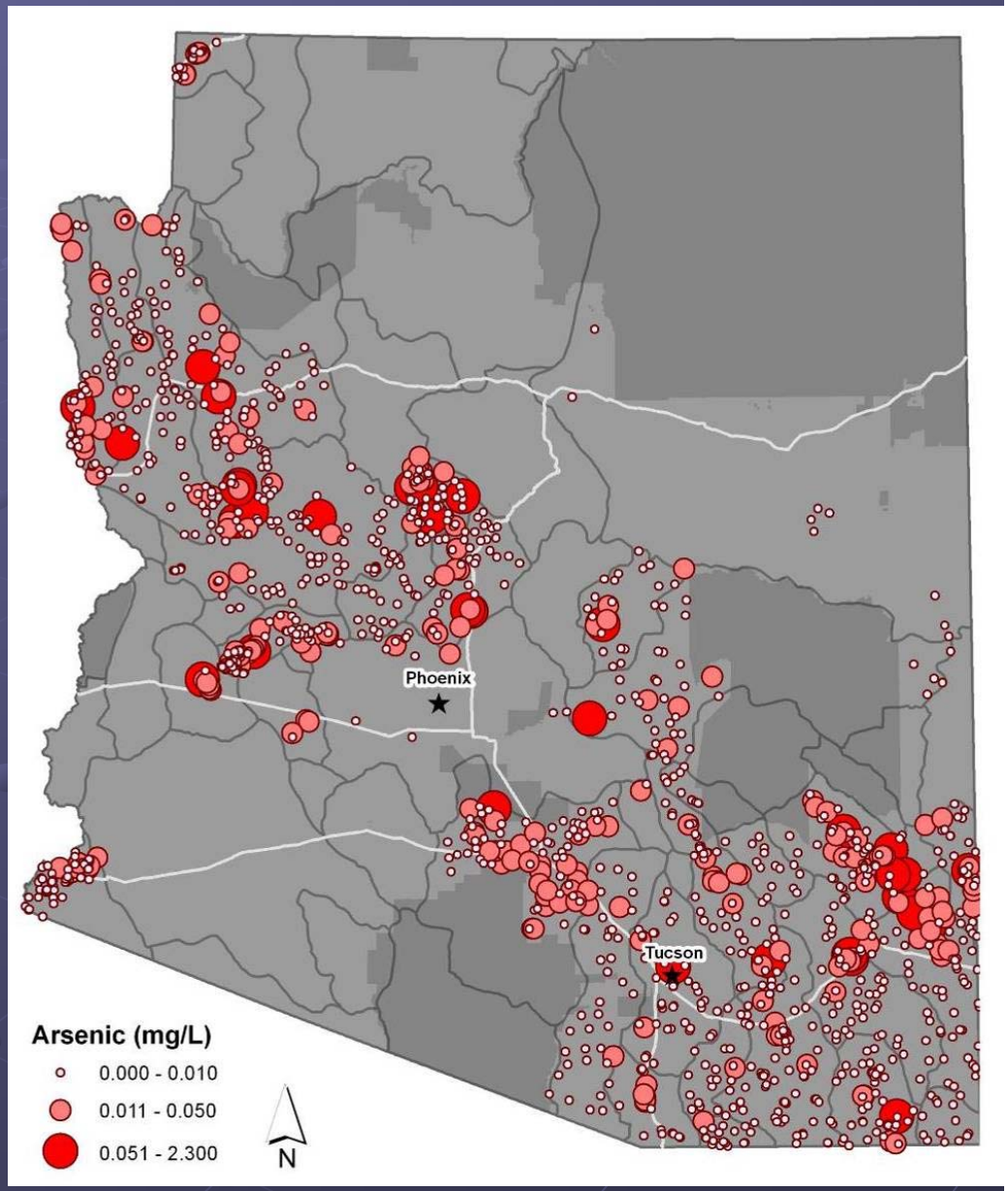




- Doesn't add up to 100% because 29% of sites had multiple exceedances

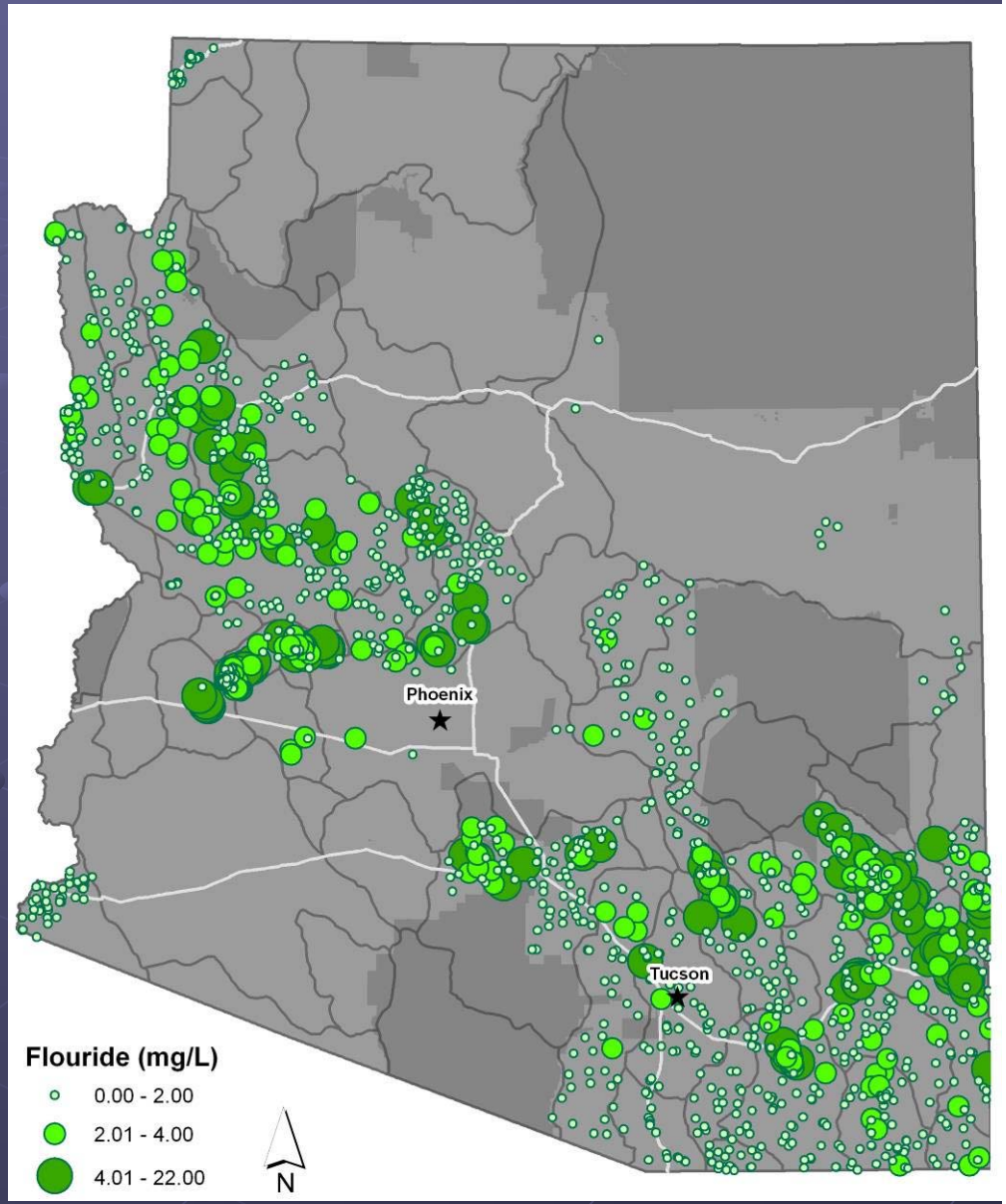
Arsenic Concentrations in Arizona

- 19% sites exceeded the 0.01 mg/L standard that took effect in 2006
- 2% exceeded the previous 0.05 mg/L standard
- This allows easy comparison of the huge impact of lowering arsenic standards in Arizona



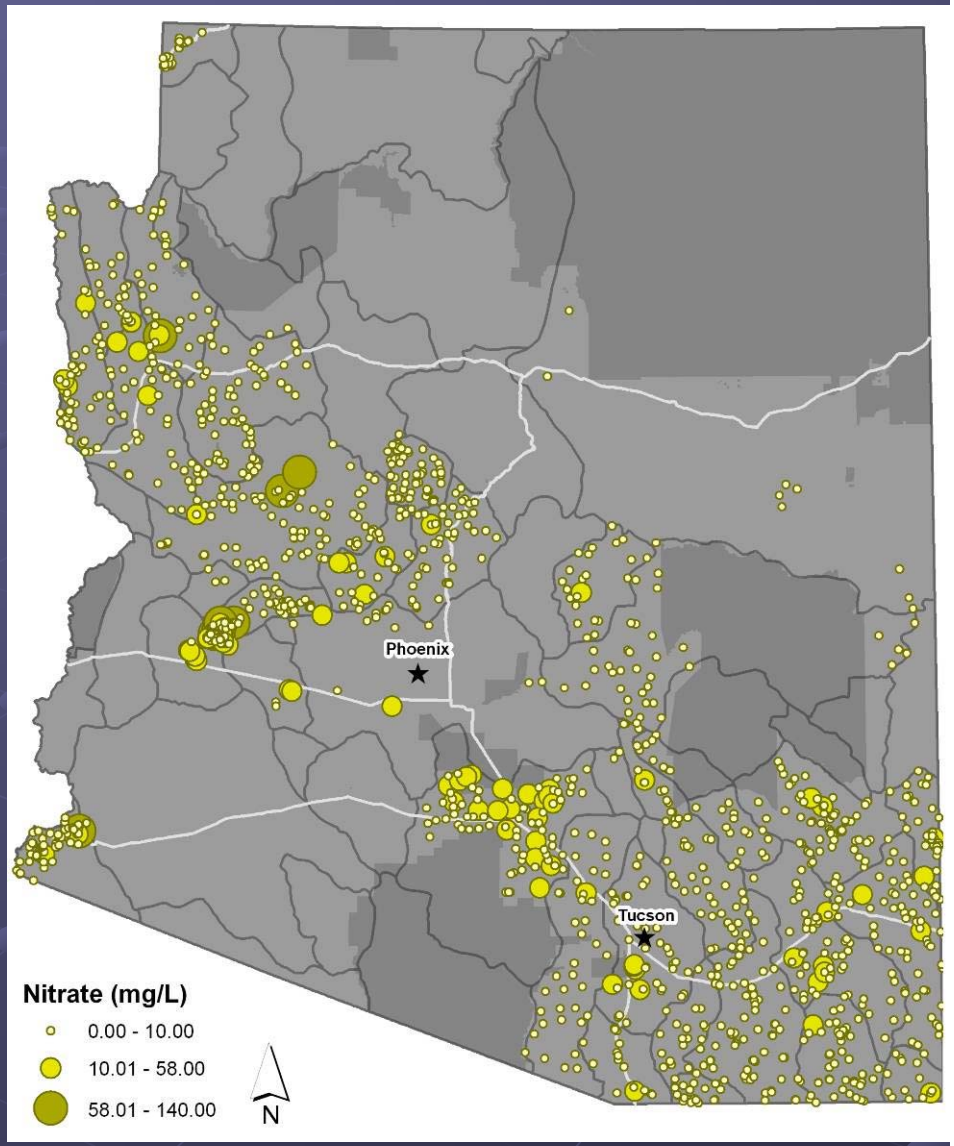
Fluoride Concentrations in Arizona

- Fluoride is unique in that it has both a health and aesthetics-based standard
- 10% of sites exceeded the health-based water quality standard
- 24% of sites exceeded the aesthetics-based water quality standard
- Artesian wells drawing from deep, confined aquifers have high fluoride levels



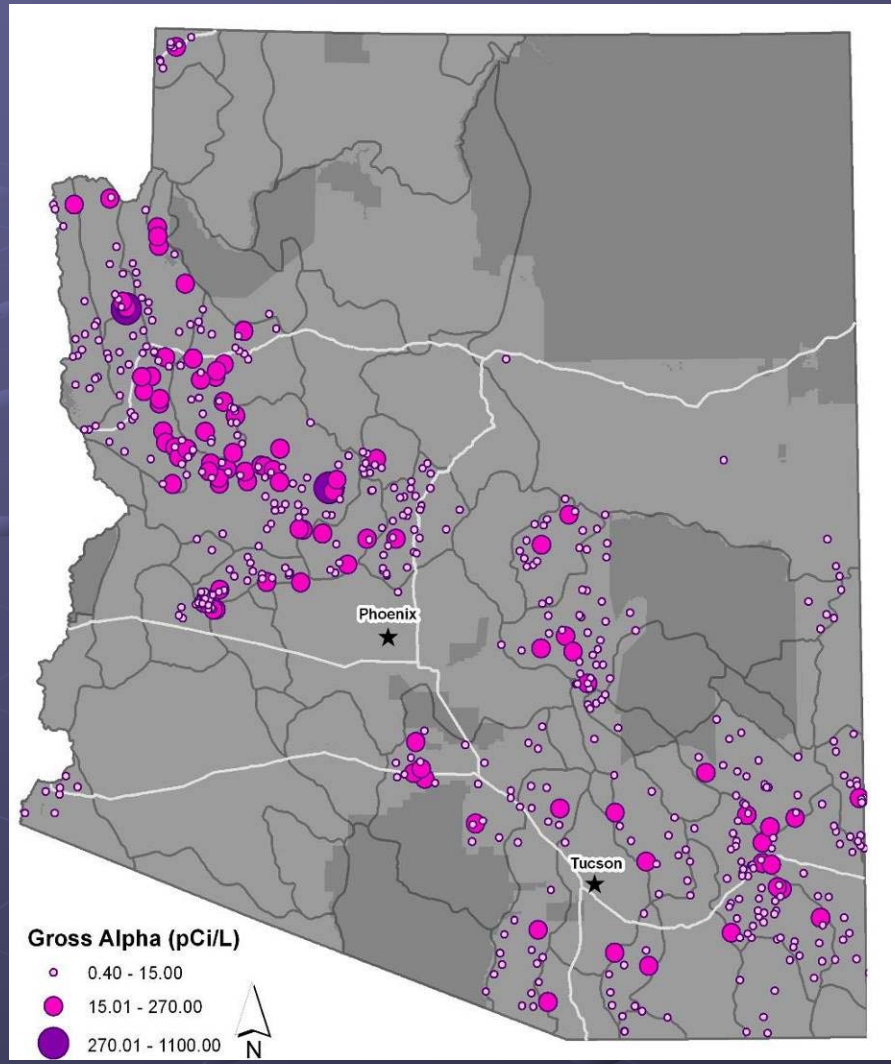
Nitrate Concentrations

- At 8% of sites nitrate exceeded health-based water quality standards
- Elevated nitrate most commonly occur in shallow wells near irrigated crops
- Elevated nitrate may occur anywhere however, septic systems are a likely source
- Elevated nitrate even occurs naturally in the Sonoran desert from nitrogen accumulated by legume plants



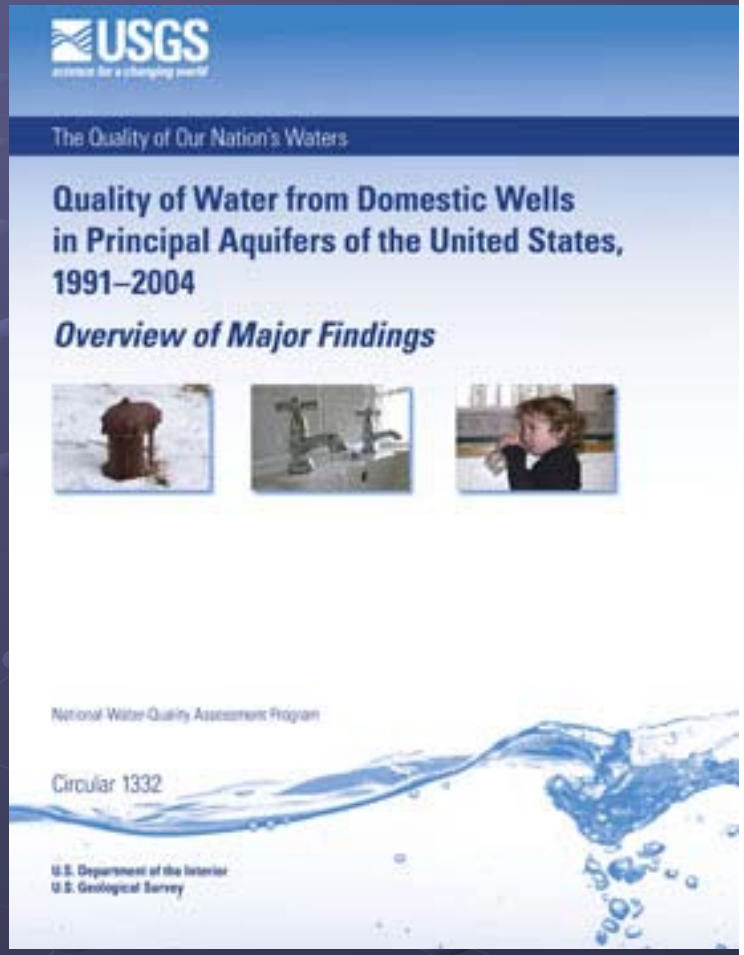
Gross Alpha Concentrations in Arizona

- Although radionuclide samples were collected at only 1/3 of sites, gross alpha constituted 22% of exceedances
- If radionuclide samples were collected at every site, there would have been more exceedances
- Uranium and radium-226+228 were also exceeded; however they only occurred at sites which had gross alpha exceedances



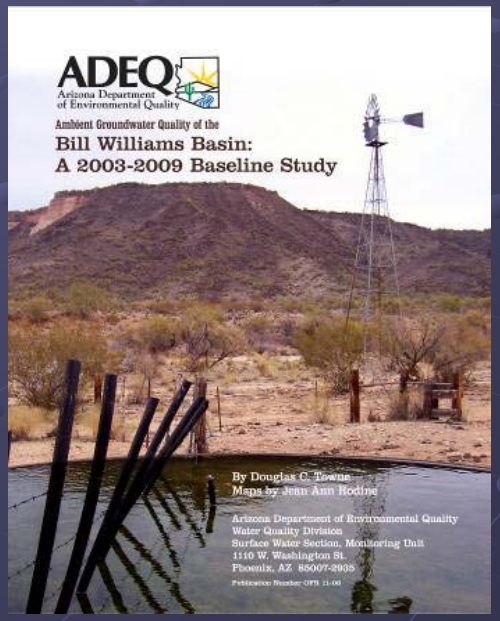
Comparison to Nationwide USGS Study

- Different indices used; not always direct comparability
- USGS includes “human-health benchmarks”
- Arsenic: AZ- 19%, US – 7%
- Fluoride: AZ – 10%, US – 1%
- Nitrate: AZ – 8%, US – 4%
- Gross alpha: AZ – 18%, US - ?
- Arizona has unique groundwater….



Goals / Limitations of ADEQ Ambient GW Program

- Broadly characterize the groundwater quality of basins in Arizona
- Limited personnel (me) and budget (40 sites per year)
- Obviously can't sample over 100,000 private domestic wells
- Publish basin-wide reports; find most well owners aren't interested in reading about their local gw quality
- As such, a simple, broad message might be most effective in protecting public health of domestic well owners



How to Best Utilize the Knowledge Gained from this Groundwater Quality Assessment?

- Who is our target audience?

- Why is it important to them?

- Need a PR campaign: introducing “the Big Four” – a tag line like a college conference

Economical Alternative for Domestic Well Owners

- Testing for inorganic and radionuclide constituents having health-based standards costs $665 at a private lab
- However, testing for the “Big Four” constituents is only $85
- ADEQ’s official policy is to have domestic well owners test for a full suite of constituents
- However, for those wanting a more economical alternative, we hope to be able to “officially” convey the “Big Four” option to private domestic well owners