



NC Department of Health and Human Services

Current and Emerging Contaminants in Private Wells

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Branch Head
Occupational and Environmental Epidemiology

July 31, 2019

Overview of Presentation

- **Occupational and Environmental Epidemiology Branch**
- **Well Water and Health Program**
- **Current and Emerging Contaminants in Private Wells**

Occupational and Environmental Epidemiology

- Our **mission** is to identify and evaluate occupational and environmental health concerns and provide unbiased evidence-based recommendation to reduce or prevent the incidence and severity of harmful exposures and their health outcomes

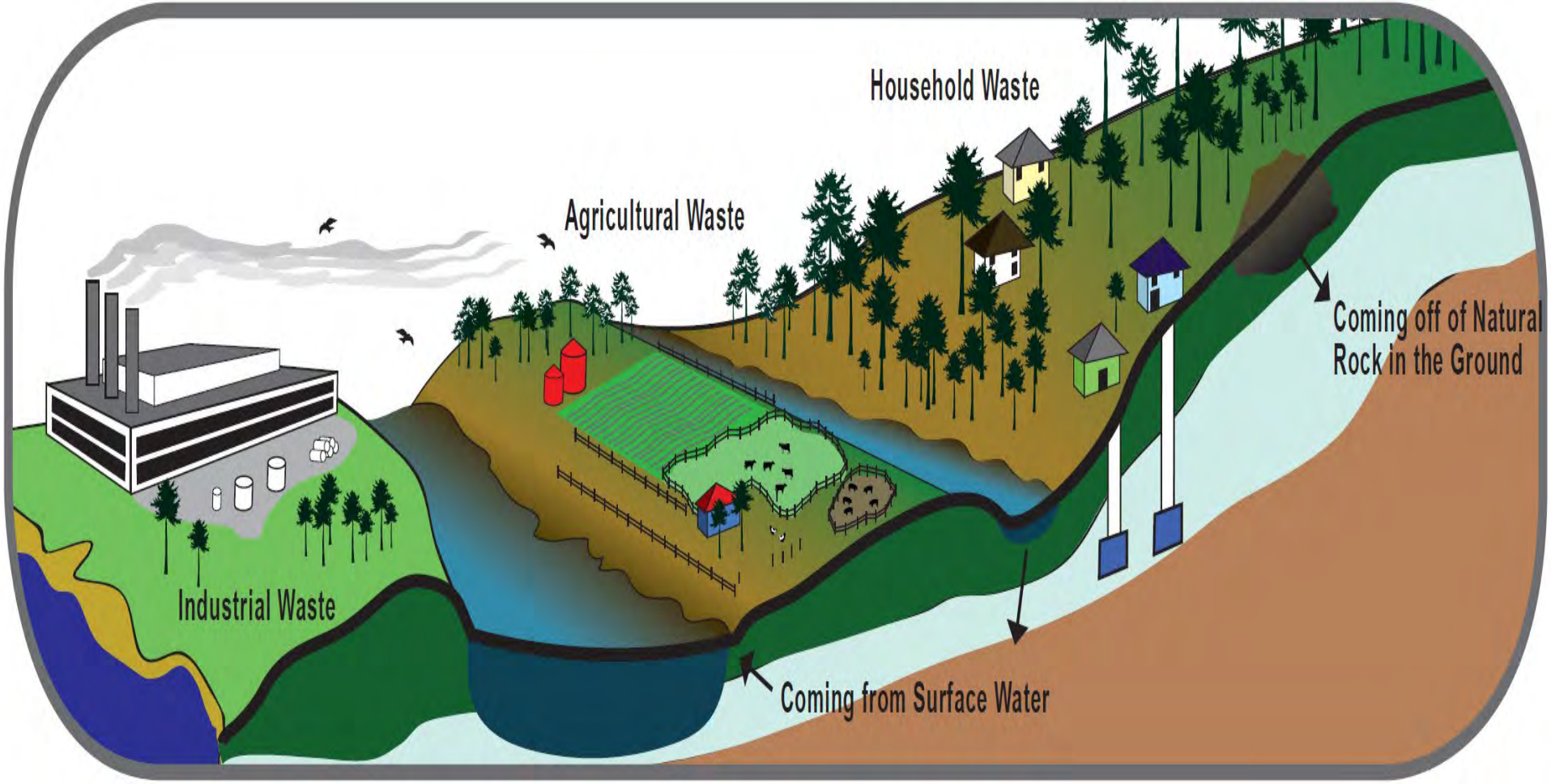
- In a nutshell
  - **Work to reduce or prevent exposure to harmful agents in the environment or that may be present at work**

Well Water and Health Program

- **Work to reduce or prevent exposure to harmful agents found in private wells**

- **OEE Staff:**
  - Crystal Lee Pow Jackson, Environmental Toxicologist
  - Phoebe Shurtleff, Environmental Health Specialist
  - Kennedy Holt, Chemical Risk Assessor

Contaminants in Private Wells



Current and Emerging Contaminants

Groups of Contaminants

- **Monitored Contaminants**

- **Unmonitored Contaminants**

Groups of Contaminants

- **Monitored Contaminants**

- **Unmonitored Contaminants**

New Well Testing

15A NCAC 18A .3803 SAMPLE ANALYSIS

(a) Water samples shall be analyzed in the North Carolina State Laboratory of Public Health or a certified laboratory.

(b) A water sample shall be tested for total coliform bacteria and if present, further analyzed for the presence of fecal coliform bacteria or E. coli.

(c) A water sample shall be analyzed for Arsenic, Barium, Cadmium, Chromium, Copper, Fluoride, Lead, Iron, Magnesium, Manganese, Mercury, Nitrate, Nitrite, Selenium, Silver, Sodium, Zinc and pH.

(d) Testing protocols shall follow EPA methods as published in the applicable sections of the most recent 40 CFR 141 and 143, Federal Register updates and the North Carolina Drinking Water Laboratory Certification rules of Section 10A NCAC 42D. Copies may be obtained from the National Archives and Records Administration through their website at http://www.gpoaccess.gov/cfr/index.html.

History Note: *Authority G.S. 87-97;*
Eff. July 1, 2008.

Reporting Well Water Data

15A NCAC 18A .3804 REPORTING

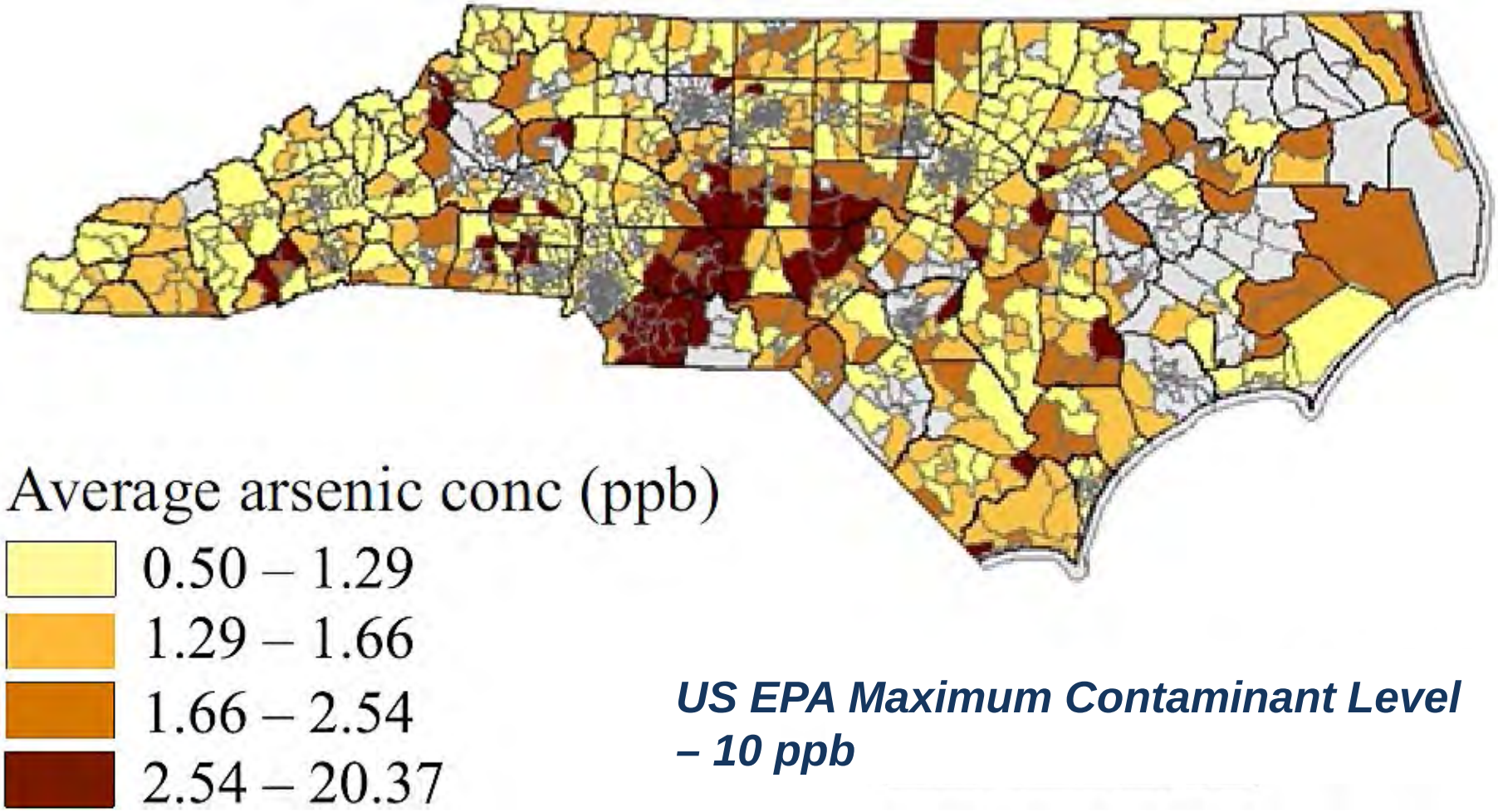
(a) Laboratories shall report results of chemical and bacteriological water sample analyses for each new private drinking water well to:

(1) the local health department;
(2) the DENR Private Water Supply Protection Branch; and
(3) the DHHS Division of Public Health, Epidemiology Section, Occupational and Environmental Epidemiology Branch.

(b) Certified laboratories reporting results of sampling required by the rules of this Section shall use the reporting format developed by the North Carolina State Laboratory of Public Health for reporting private well-water sample results and shall include well identification information and a guide for interpreting sample results.

(c) For the purposes of any notices required pursuant to the rules of this Section, notice shall be mailed to "Division of Environmental Health, On-Site Water Protection Section, North Carolina Department of Environment and Natural Resources," 1642 Mail Service Center, Raleigh, NC 27699-1642.

Arsenic



US EPA Maximum Contaminant Level – 10 ppb

SOURCE: Sanders, A. P., Desrosiers, T. A., Warren, J. L., Herring, A. H., Enright, D., Olshan, A. F., ... & Fry, R. C. (2014). Association between arsenic, cadmium, manganese, and lead levels in private wells and birth defects prevalence in North Carolina: a semi-ecologic study. *BMC Public Health*, *14*(1), 955.

Arsenic

33

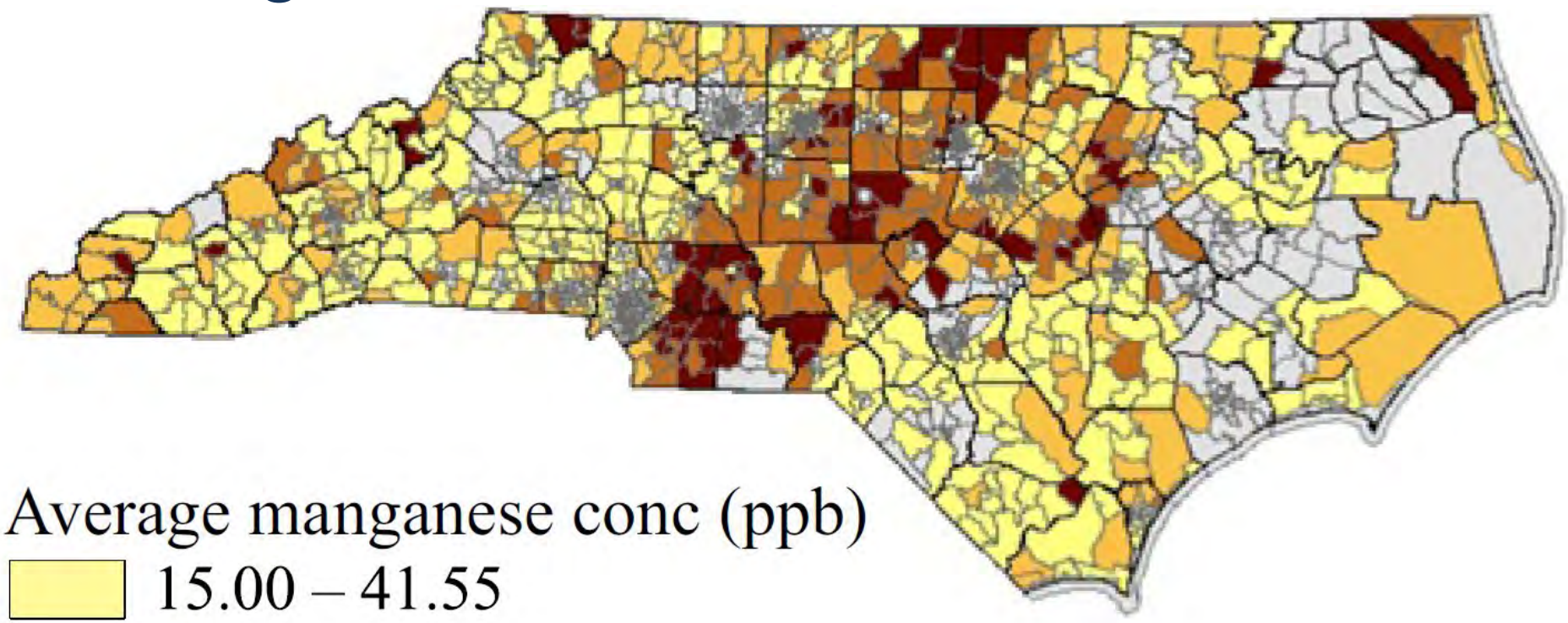
As

Arsenic

74.922

- What is it?
  - Metal found in certain rocks and soil
  - Used in some industrial and agricultural activities
- How can it affect your health?
  - Short term: Drinking high amounts of As can lead to
    - Nausea, vomiting
    - Irregular heartbeat, cramping and weakness
  - Long term: Drinking lower amounts may increase risk of skin, liver, bladder and lung cancer
- How to mitigate exposure in well water?
  - Several treatment options
  - Point of use System
  - Whole house treatment (for high levels of As)

Manganese



US EPA Lifetime Health Advisory – 300 ppb

SOURCE: Sanders, A. P., Desrosiers, T. A., Warren, J. L., Herring, A. H., Enright, D., Olshan, A. F., ... & Fry, R. C. (2014). Association between arsenic, cadmium, manganese, and lead levels in private wells and birth defects prevalence in North Carolina: a semi-ecologic study. *BMC Public Health*, *14*(1), 955.

Manganese

- What is it?
  - Metal found in certain rocks and soil
  - Found in grains, cereal and other foods
- How can it affect your health?
  - Drinking can affect sensitive populations
    - Infants, children and pregnant women (developing fetus)
    - Neurological effects
- How to mitigate exposure in well water?
  - Several treatment options
  - Point of use System
  - Alternative Water Source during sensitive windows

Support for LHDs and Citizens

- **Monitor trends in contaminants**
- **Help understand health impacts**
- **Help determine treatment types**
- **Develop factsheet**

Groups of Contaminants

- Monitored Contaminants

- **Unmonitored Contaminants**

Dan River Coal Ash Spill

Spill spews tons of coal ash into North Carolina river

By Catherine E. Shoichet, CNN

Updated 6:29 PM ET, Sun February 9, 2014

Coal Ash Poisons Wells and Community Relations

The last year has been one of fear and distrust in Dukeville, NC, thanks to Duke Energy's coal ash

By Sara Peach, Environmental Health News on April 18, 2016

More Scuffles Over Hexavalent Chromium

NC northcarolinahealthnews.org/2017/07/13/scuffles-hexavalent-chromium/

July 13, 2017 by Catherine Clabby

Chromium VI

24

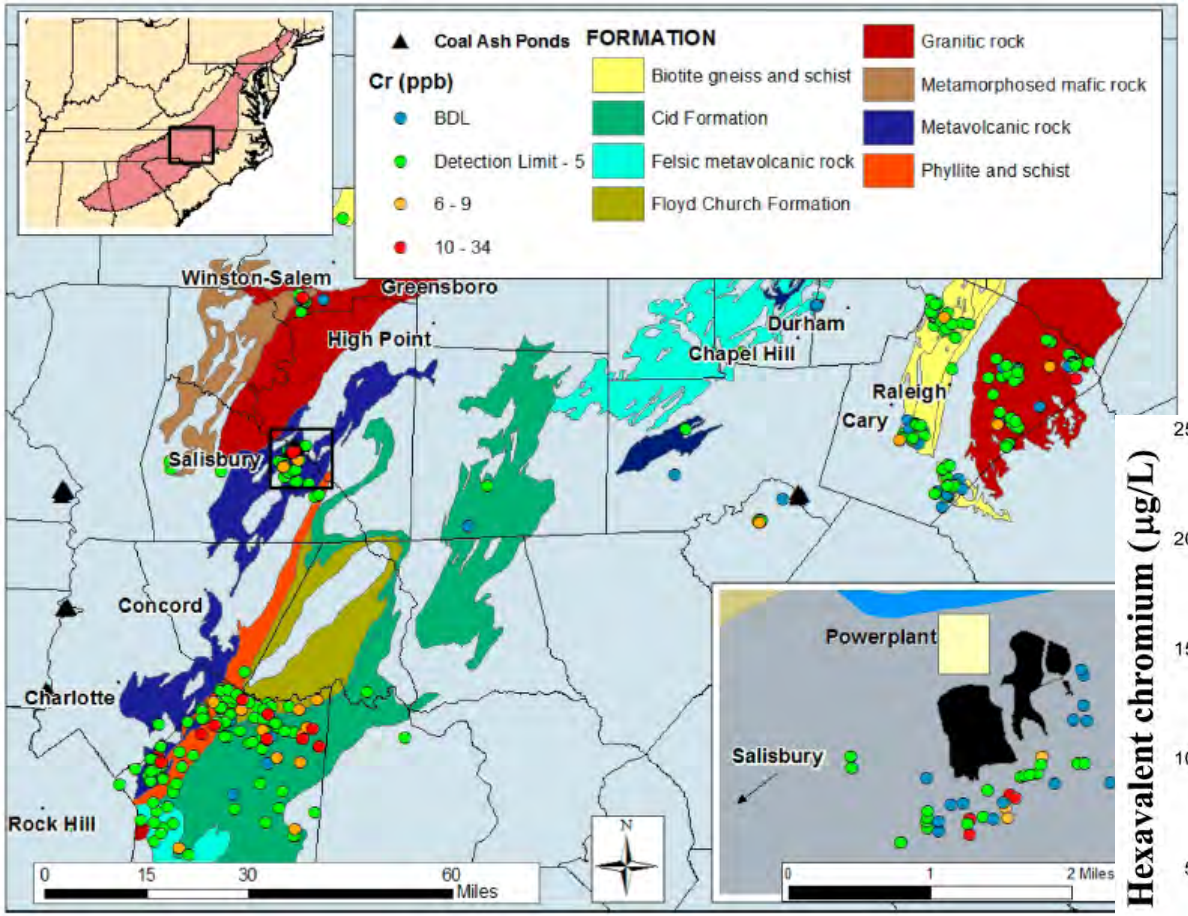
Cr

Chromium

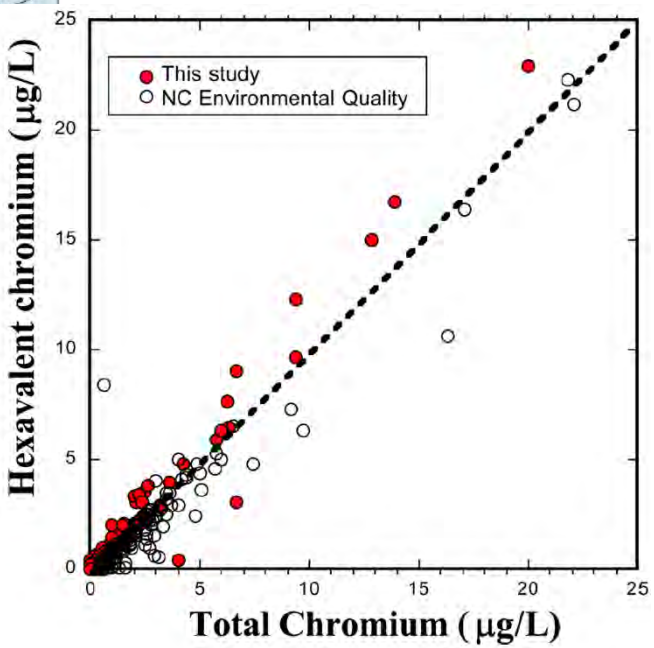
51.996

- What is it?
  - Form of Chromium
  - Metal found in certain rocks and soil
  - Used in some industrial activities
- How can it affect your health?
  - Drinking can cause stomach and small intestine ulcers
  - Chronic exposure has been linked to stomach and liver cancers
- How to mitigate exposure in well water?
  - Several treatment options
  - Point of use System typically recommended

Chromium VI

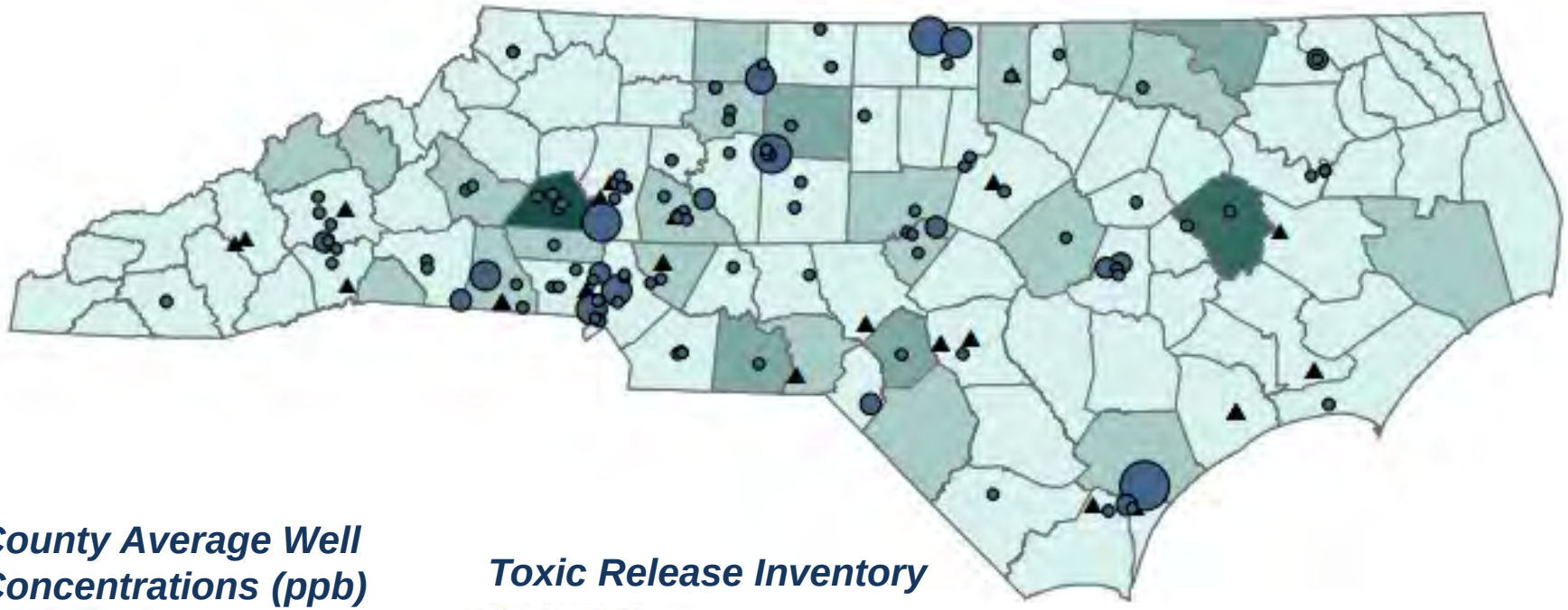


NC Public Health Goal – 0.07 ppb



SOURCE: Vengosh, A. et al., (2016). Origin of Hexavalent Chromium in Drinking Water Wells from the Piedmont Aquifers of North Carolina. Environmental Science & Technology Letters.

Total Chromium



County Average Well Concentrations (ppb)

- 4.88 - 5.50
- 5.51 - 7.00
- 7.01 - 10.00
- 10.01 - 30.00
- 30.01 - 100.00
- 100.01 - 713.60

Toxic Release Inventory

- 0.1 - 13,386
- 13,387 - 47,005
- 47,006 - 77,024
- 77,025 - 211,423
- 211,424 - 2,206,208
- **National Priorities List sites reporting chromium**

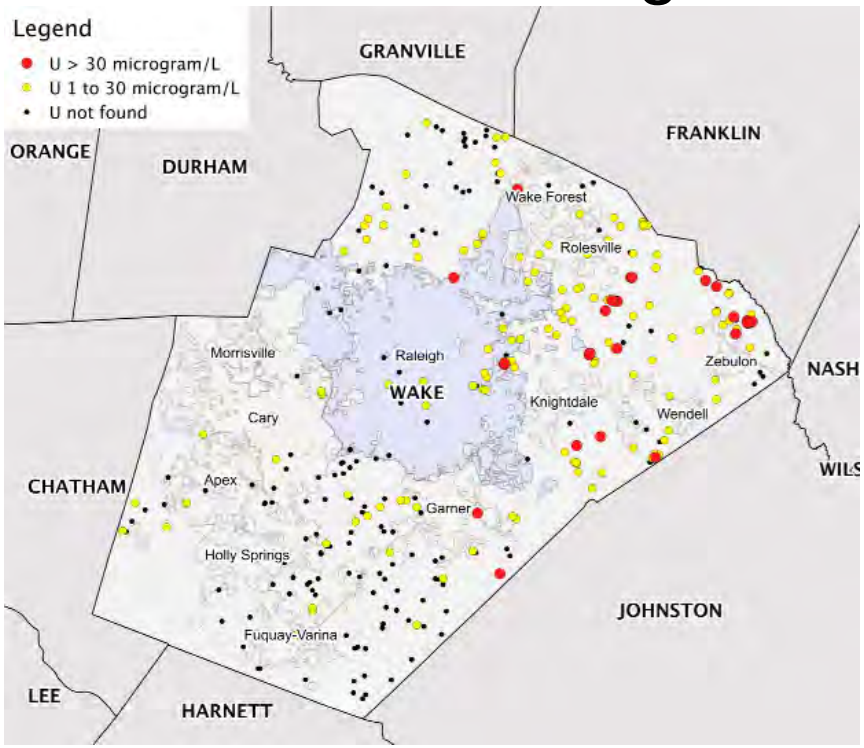
SOURCE: https://epi.dph.ncdhhs.gov/oee/wellwater/maps_A-L/chromium/chromium_allyears.pdf

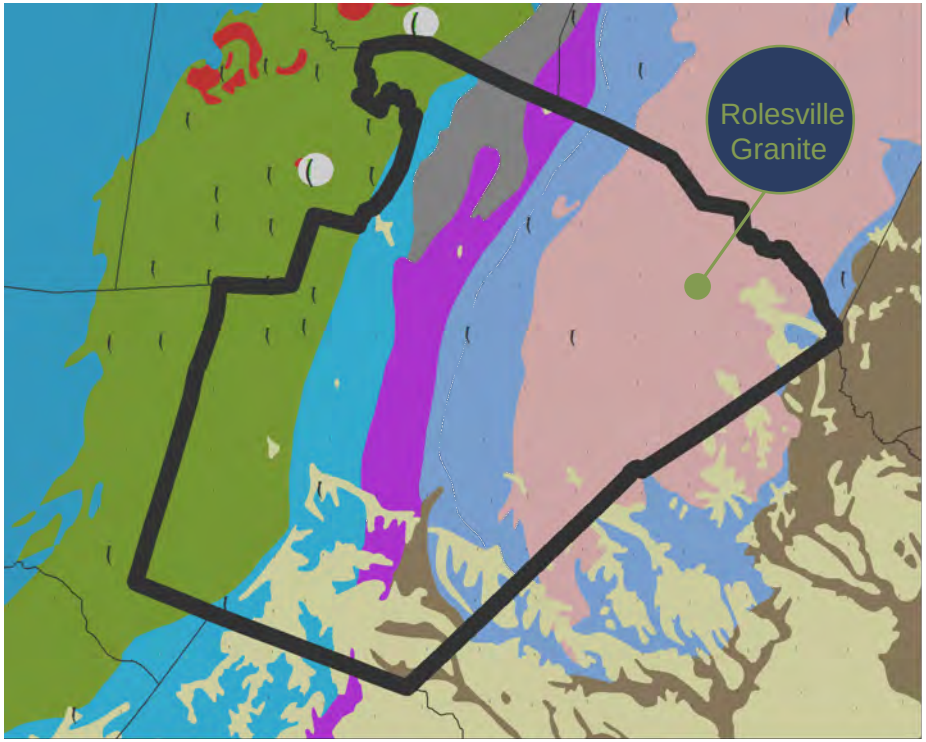
Support for LHDs and Citizens

- **Current public health goal: 0.07 µg/L for CrVI**
- **Help understand health impacts**
- **Help determine treatment types**
- **Developed factsheet**

Radionuclides

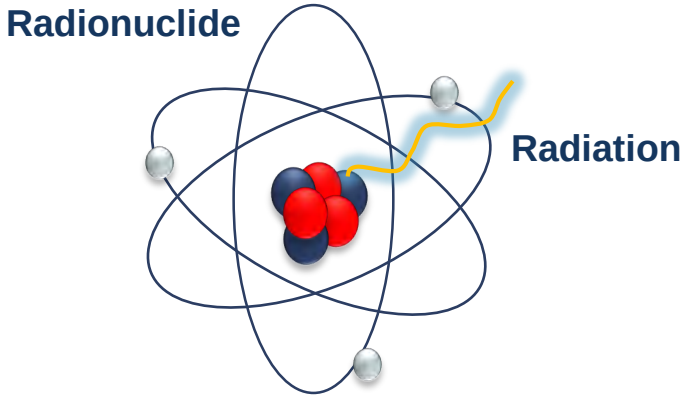
- Investigation in Wake County
- Documented high concentrations of Uranium





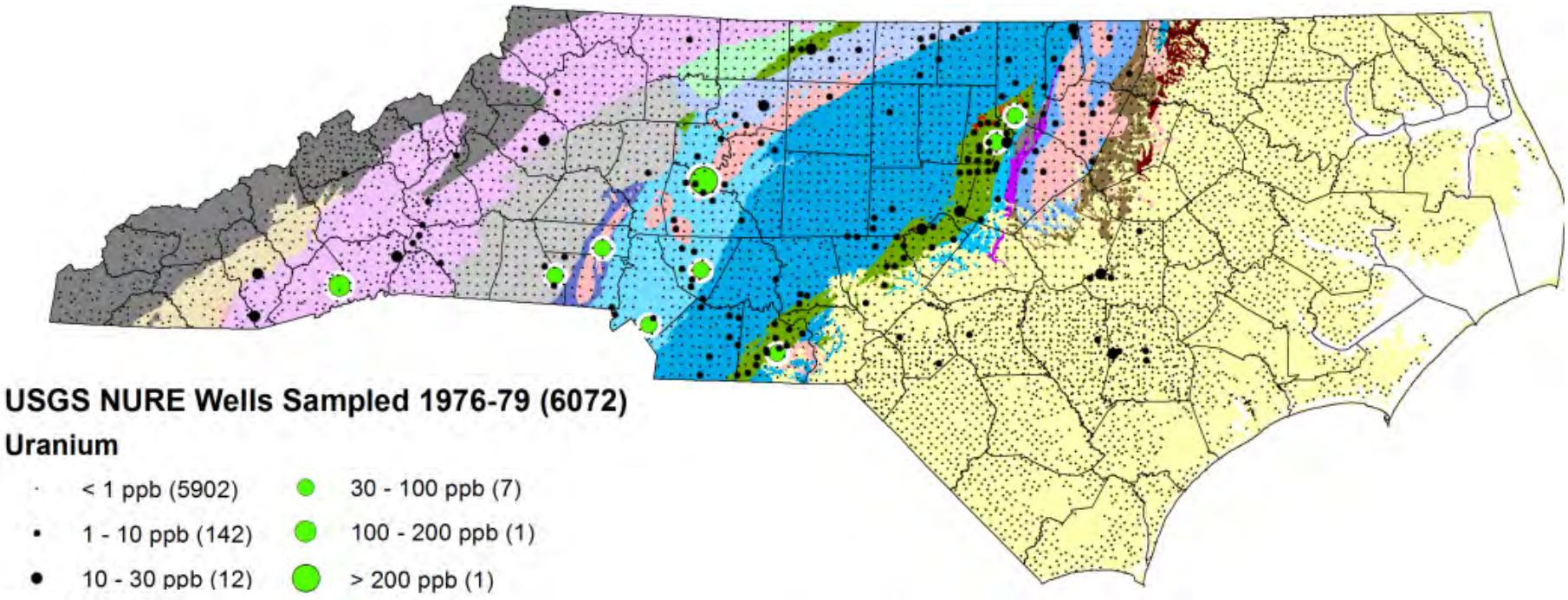
SOURCE: (left)http://insight-us.org/uranium-wake-county.html**, (right) Source:** U.S. Geological Survey, 2004, National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance data: U.S. Geological Survey, Denver, CO.

Radionuclides



- What are they?
  - Elements found in certain rocks and soil
  - Give off radiation as they break down
  - Uranium, radium and radon are the most commonly found radionuclides in well water
- How can it affect your health?
  - Heath effects depend on the radionuclide you are exposed to. It can range from kidney damage to various forms of cancer.
- How to mitigate exposure in well water?
  - Depends of type of radionuclide
  - Point of use or Whole house system

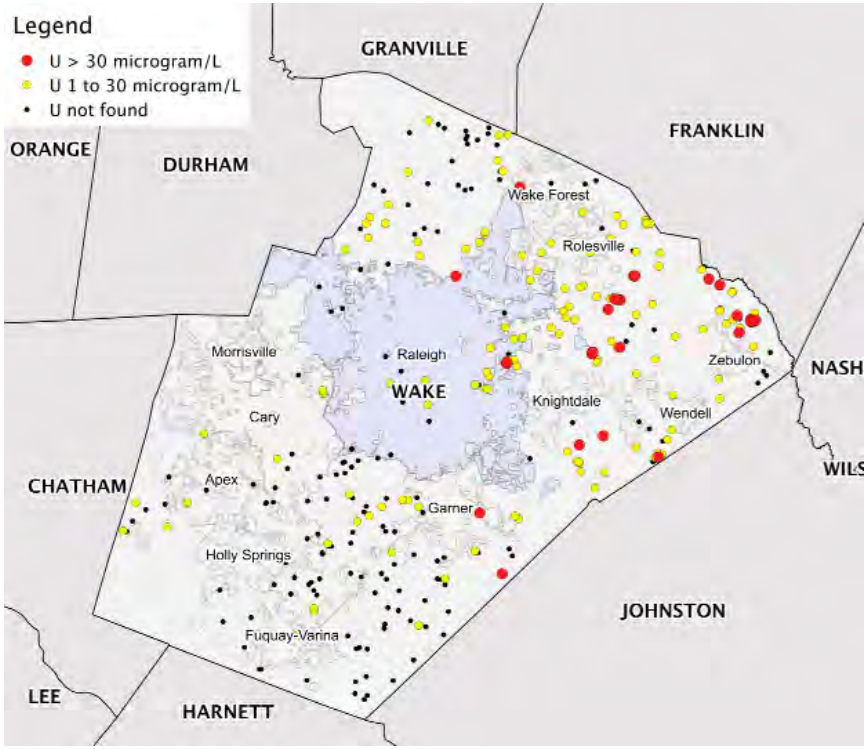
Uranium

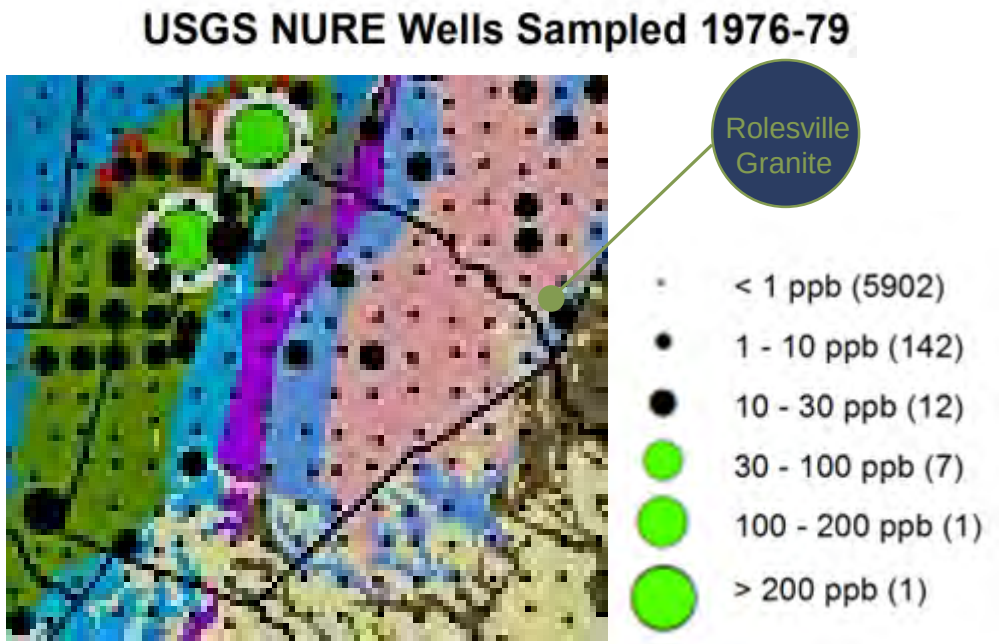


US EPA Maximum Contaminant Level – 30 ppb

Source: U.S. Geological Survey, 2004, National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance data: U.S. Geological Survey, Denver, CO.

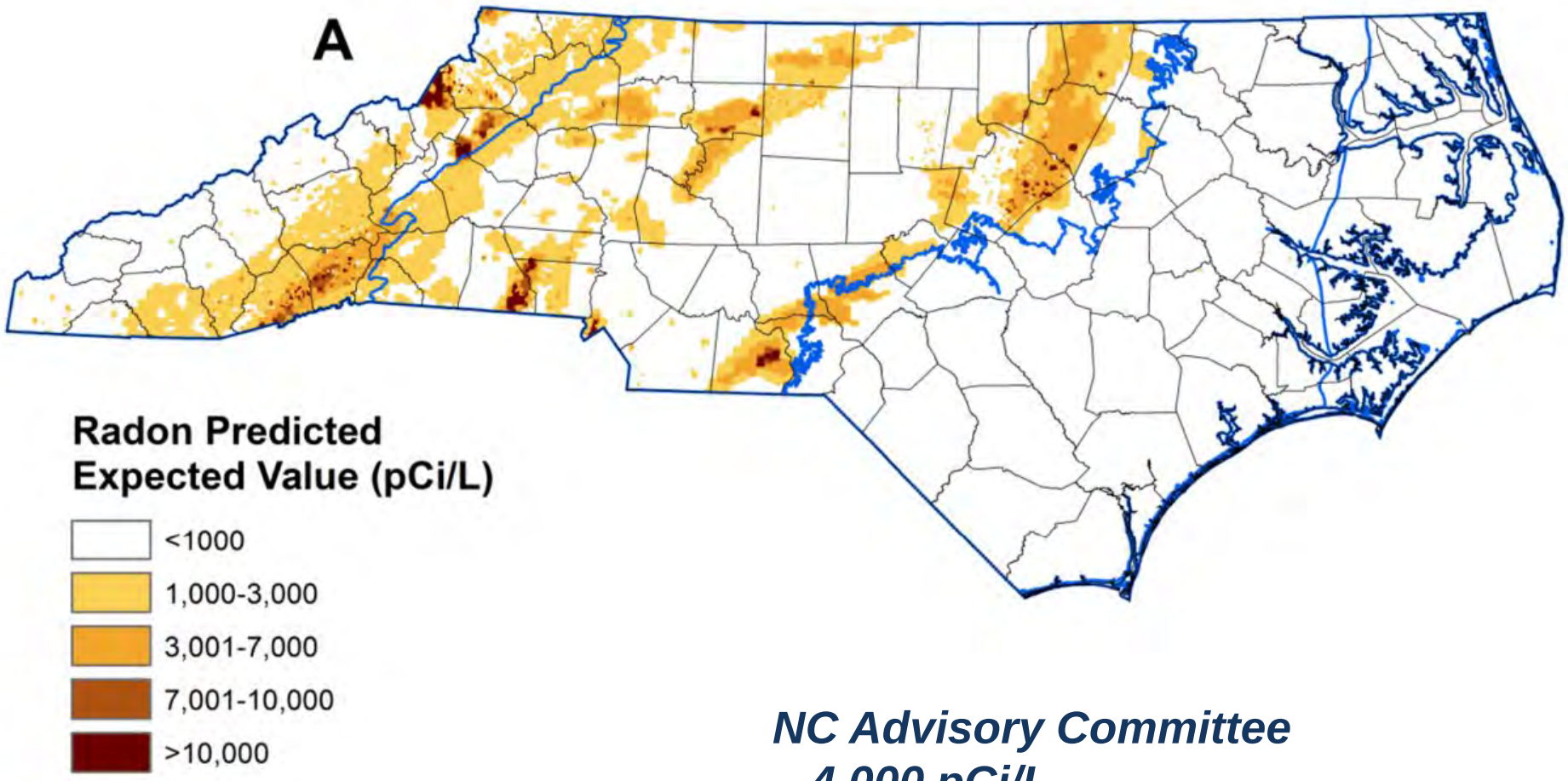
Gaps in the Data





SOURCE: (left)http://insight-us.org/uranium-wake-county.html**, (right) Source:** U.S. Geological Survey, 2004, National Uranium Resource Evaluation (NURE) Hydrogeochemical and Stream Sediment Reconnaissance data: U.S. Geological Survey, Denver, CO.

Radon



NC Advisory Committee – 4,000 pCi/L

SOURCE: Messier, K. P., Campbell, T., Bradley, P. J., & Serre, M. L. (2015). Estimation of groundwater Radon in North Carolina using land use regression and Bayesian maximum entropy. Environmental science & technology, 49(16), 9817-9825.

Support for LHDs and Citizens

- **Help understand health impacts**
- **Help determine treatment types**
- **Developed factsheets and FAQ**

PFAS in Cape Fear

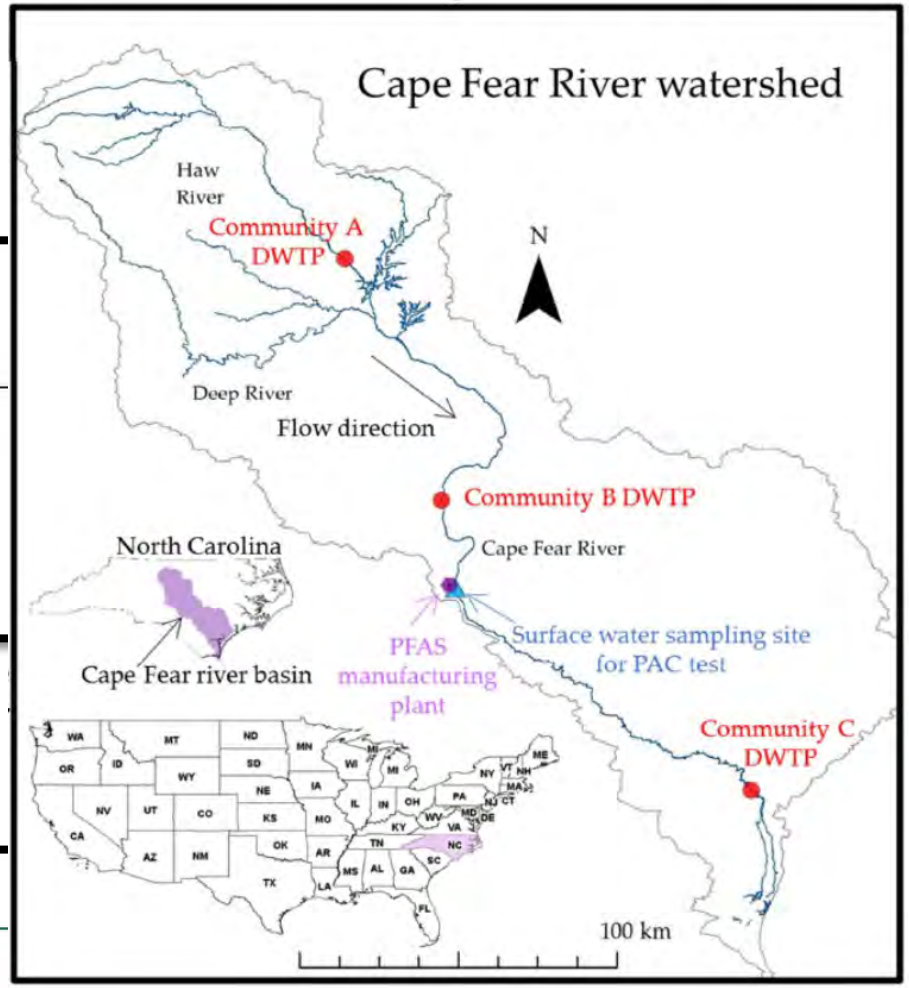
StarNews ONLINE

Toxin taints CFPUA drinking water

By Vaughn Hagerty StarNews Correspondent

Posted Jun 7, 2017 at 10:31 AM

Updated Jun 8, 2017 at 10:38 AM

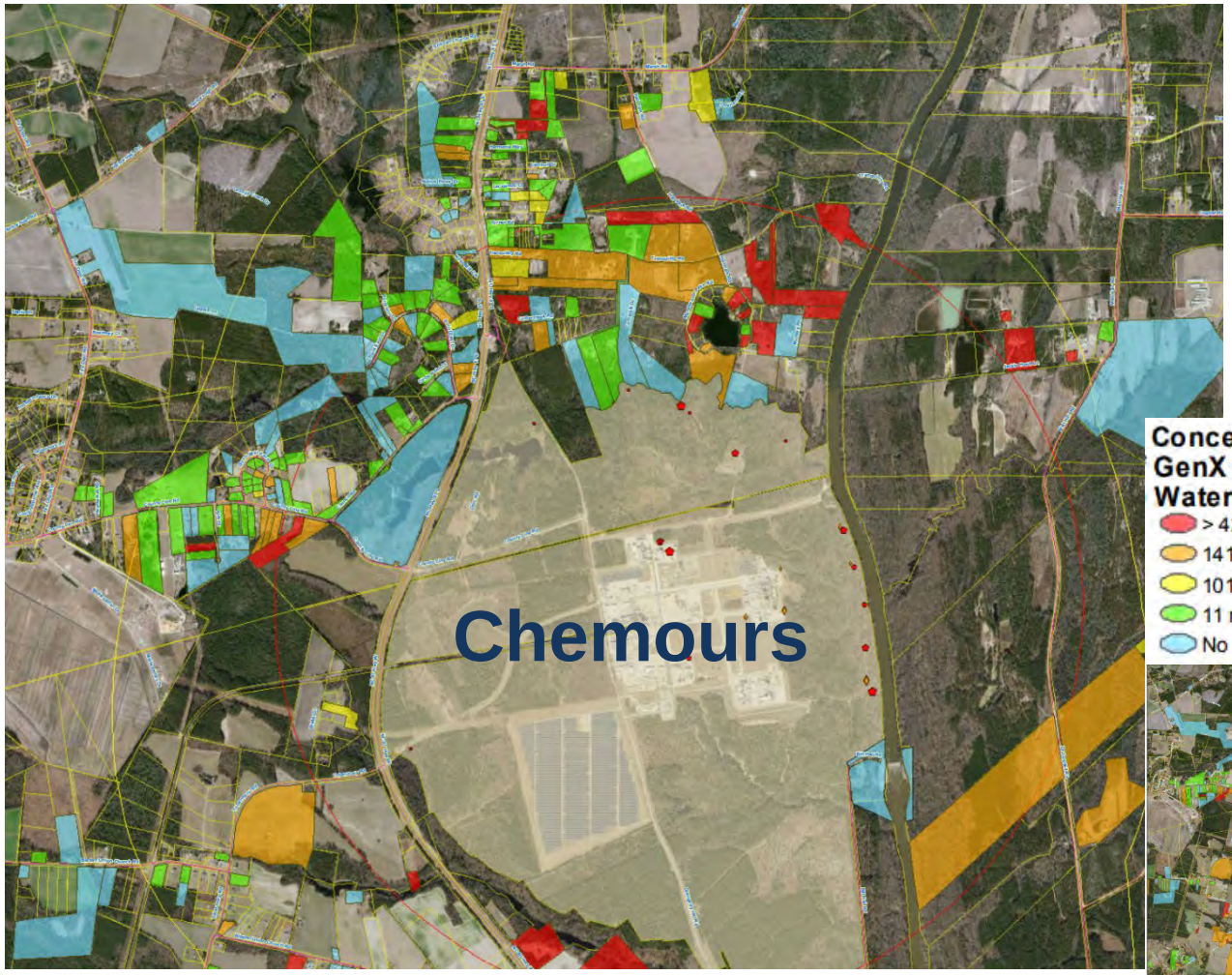


Environmental Science & Technology Letters

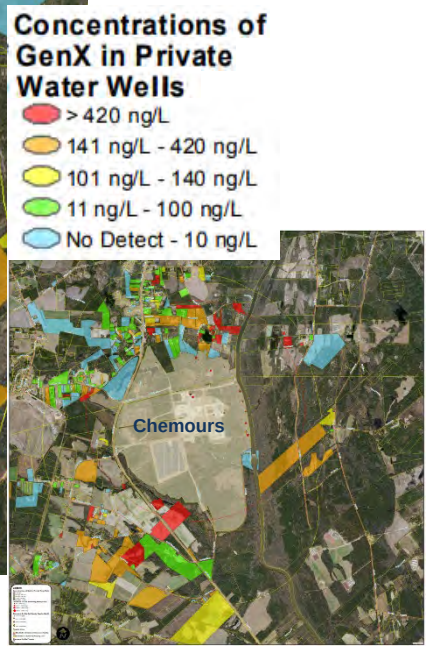
Legacy and Emerging Perfluoroalkyl Substances Are Important Drinking Water Contaminants in the Cape Fear River Watershed of North Carolina

SOURCE: Sun, M., Arevalo, E., Strynar, M., Lindstrom, A., Richardson, M., Kearns, B., ... & Knappe, D. R. (2016). Legacy and emerging perfluoroalkyl substances are important drinking water contaminants in the Cape Fear River Watershed of North Carolina. *Environmental science & technology letters*, *3*(12), 415-419.

GenX in Private Wells



NC Public Health Goal – 150 ng/L



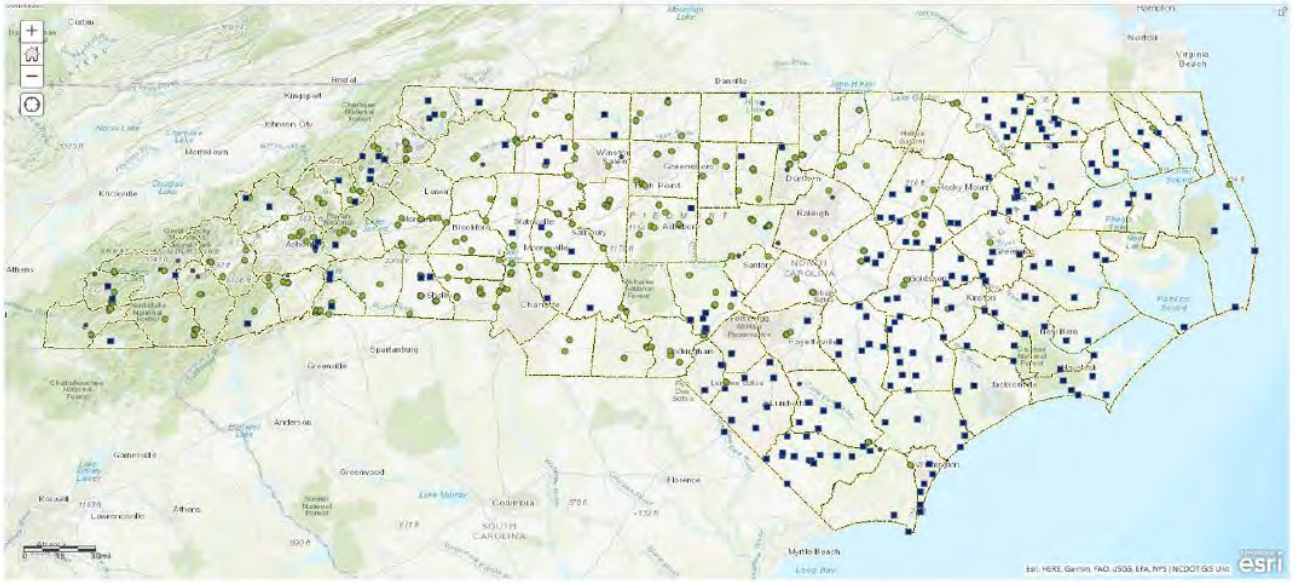
SOURCE: https://deq.nc.gov/news/key-issues/genx-investigation/groundwater

PFAS

- What are PFAS?
  - Per- and Polyfluoroalkyl Substances
  - Class of ~5,000 surfactants that are very persistent and mobile in the environment
  - PFOS and PFOA are two commonly studied PFAS
- How can it affect your health?
  - PFOS & PFOA: affect liver, immune, endocrine and cardiovascular systems, development, and reproduction. Also linked to varies forms of cancer
  - GenX: limited studies suggest liver, blood and developmental toxicity
  - Other PFAS have limited data
- How to mitigate exposure in well water?
  - Granular activated carbon and reverse osmosis

PFAST Network Activities

- 190 Municipal surface water sources
- 148 Municipal well water sources
- 57 County/regional water sources (not shown)



Surface (green circle) and groundwater (blue square) sampling sites for drinking water sources

https://ncpfastnetwork.com/

Support for LHDs and Citizens

- **Developed a public health goal for GenX: 140 ng/L**
- **Help understand health impacts**
- **Help understand current knowledge gaps and cutting edge research**
- **Developed factsheets and web resources**
  - **https://epi.dph.ncdhhs.gov/oee/a_z/pfas.html**

Questions?

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