Overview of PFAS Research Conducted by the U.S. Geological Survey's Dakota Water Science Center

North Dakota PFAS Conference

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North Dakota State University

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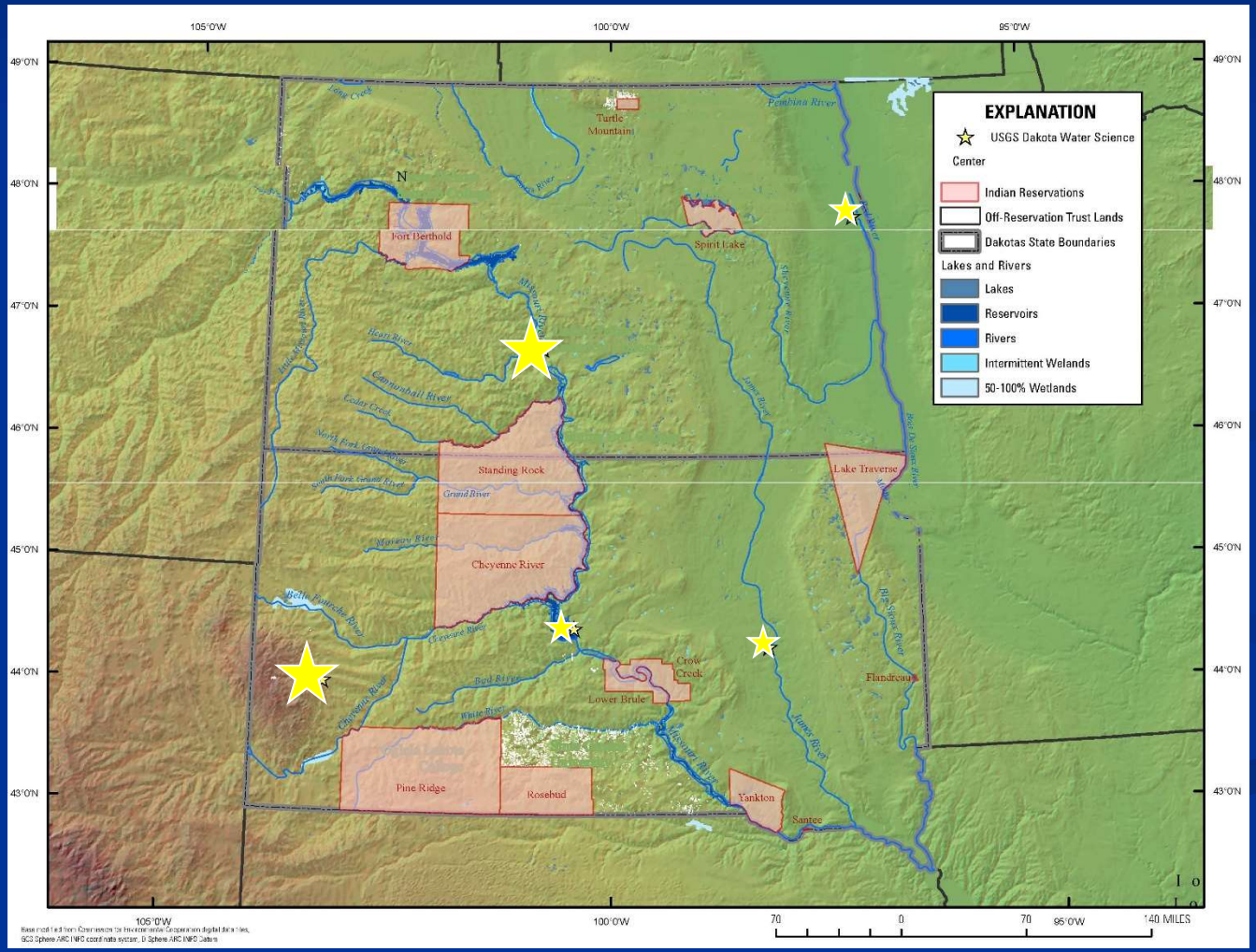
USGS

DWSC Offices and Tribal Reservations in North and South Dakota



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Ellsworth Air Force Base

- Ellsworth AFB – 6 miles east of Rapid City
- Similar to many military bases, history of fuel spills
- Focus switched to PFAS in recent years
- Projects conducted in cooperation with AFCEC beginning ~2020
- Coordinate closely with EAFB environmental staff

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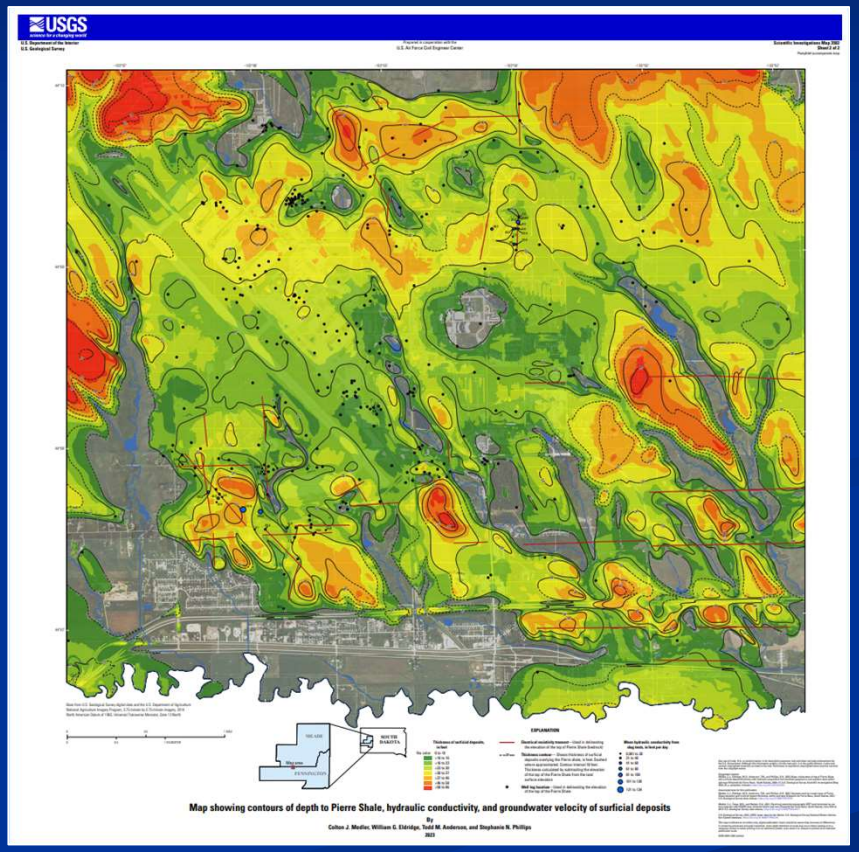
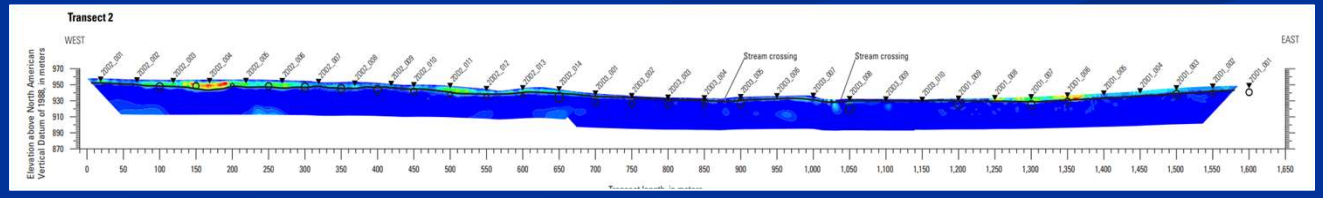
Electrical Resistivity, Passive Seismic Data, and Borehole

- Geophysical data used to better delineate groundwater flow directions
  - Depth to the Pierre Shale





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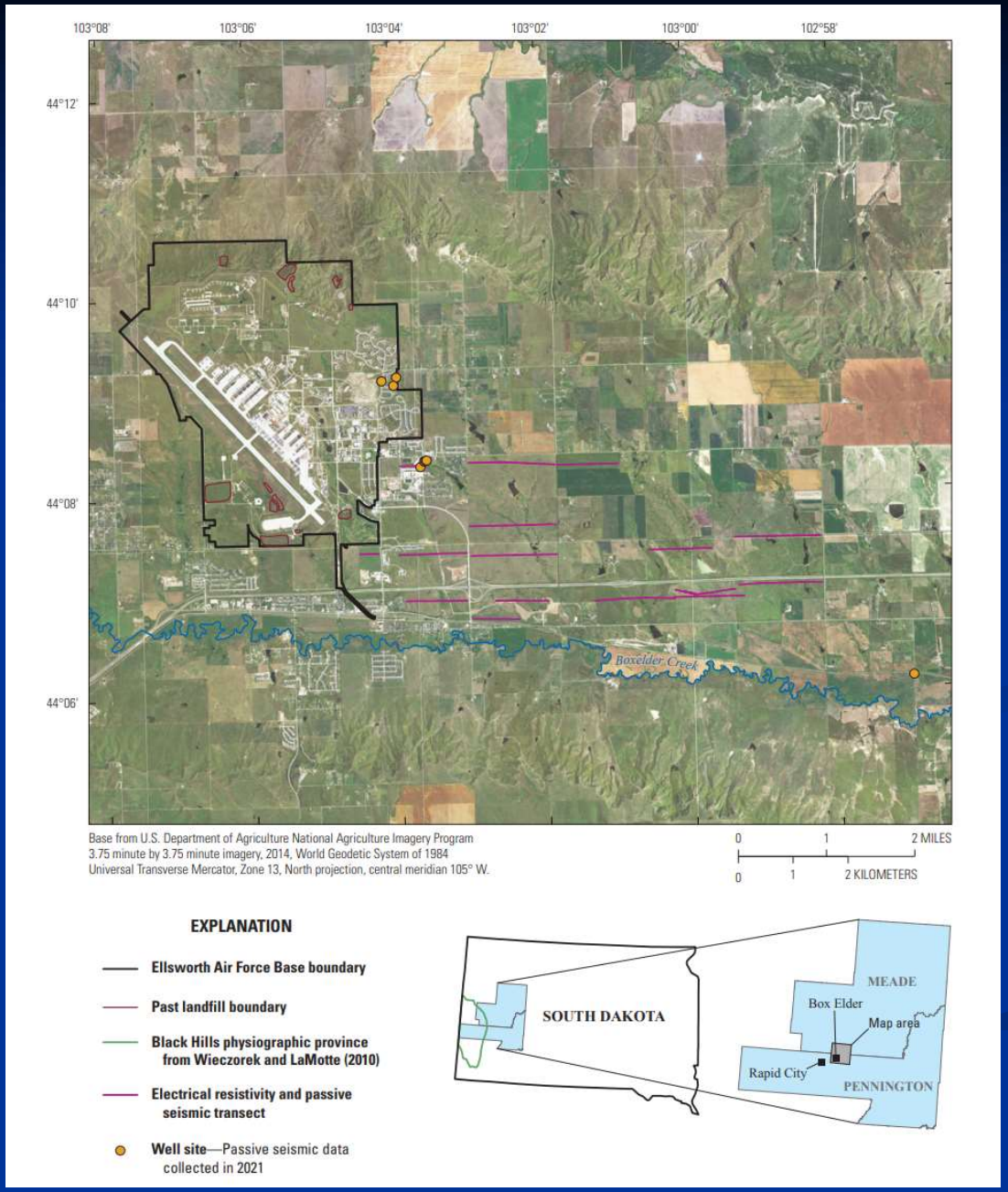
Ellsworth AFB drains south towards Boxelder Creek

Concerns about water quality impairment migrating downstream to Cheyenne River



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Stream Sampling

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Groundwater Sampling

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PFAS Challenges

- No Teflon materials in equipment
- DoD-specified method (1633. Limited lab options)
- Evolving / complicated regulatory status
  - How to communicate results?

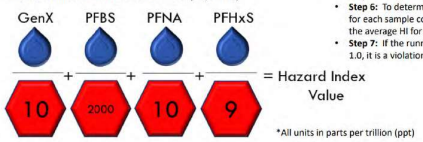
Compound	Proposed HBWC (ppt)
PFHxS	9.0
PFNA	10
PFBS	2000
HFPO-DA (commonly referred to as GenX Chemicals)	10

How do I calculate the Hazard Index?

The HI is used to understand health risks. For the PFAS NPDWR proposal, the HI considers the combined toxicity of PFNA, GenX Chemicals, PFHxS, and PFBS in drinking water.

What is a Hazard Index?

The HI is made up of a sum of fractions. Each fraction compares the level of each PFAS measured in the water to the level determined not to cause health effects (i.e., HBWC).



*All units in parts per trillion (ppt)

Steps:

- **Step 1:** Divide the measured concentration of **GenX** by the health-based value of **10 ppt***
- **Step 2:** Divide the measured concentration of **PFBS** by the health-based value of **2000 ppt**
- **Step 3:** Divide the measured concentration of **PFNA** by the health-based value of **10 ppt**
- **Step 4:** Divide the measured concentration of **PFHxS** by the health-based value of **9.0 ppt**
- **Step 5:** Add the ratios from steps 1, 2, 3, and 4 together
- **Step 6:** To determine HI compliance, repeat steps 1-5 for each sample collected in the past year and calculate the average HI for all the samples taken in the past year
- **Step 7:** If the running annual average HI greater than 1.0, it is a violation of the proposed HI MCL

- EPA evaluated technologies and has studies that demonstrate effective removal of all regulated PFAS. EPA has identified the following as best available technologies:
  - Granular activated carbon(GAC)
  - Anion Exchange (AIX)
  - Nanofiltration (NF) and Reverse Osmosis (RO)
- Some water systems may be able to reduce PFAS levels without installing treatment by using an alternative source of water that does not have PFAS contamination.

Hazard Index MCL Calculation Examples

GenX Chemicals PFBS PFNA PFHxS HI

- **Example 1** – Exceedance of proposed Hazard Index MCL

$$\left(\frac{[5\ ppt]}{[10\ ppt]}\right) + \left(\frac{[200\ ppt]}{[2000\ ppt]}\right) + \left(\frac{[5\ ppt]}{[10\ ppt]}\right) + \left(\frac{[9\ ppt]}{[9.0\ ppt]}\right) = 2.1$$

- **Example 2** – Exceedance of proposed Hazard Index MCL

$$\left(\frac{[0\ ppt]}{[10\ ppt]}\right) + \left(\frac{[200\ ppt]}{[2000\ ppt]}\right) + \left(\frac{[2\ ppt]}{[10\ ppt]}\right) + \left(\frac{[7\ ppt]}{[9.0\ ppt]}\right) = 1.1$$

- **Example 3** – Exceedance of proposed Hazard Index MCL

$$\left(\frac{[12\ ppt]}{[10\ ppt]}\right) + \left(\frac{[0\ ppt]}{[2000\ ppt]}\right) + \left(\frac{[0\ ppt]}{[10\ ppt]}\right) + \left(\frac{[0\ ppt]}{[9.0\ ppt]}\right) = 1.2$$

- **Example 4** – Meets proposed Hazard Index MCL

$$\left(\frac{[0\ ppt]}{[10\ ppt]}\right) + \left(\frac{[100\ ppt]}{[2000\ ppt]}\right) + \left(\frac{[4\ ppt]}{[10\ ppt]}\right) + \left(\frac{[3\ ppt]}{[9.0\ ppt]}\right) = 0.8$$

EPA's Proposed Action for the PFAS NPDWR

Compound	Proposed MCLG	Proposed MCL (enforceable levels)
PFOA	0 ppt*	4.0 ppt*
PFOS	0 ppt*	4.0 ppt*
PFNA		
PFHxS	1.0 (unitless) Hazard Index	1.0 (unitless) Hazard Index
PFBS		
HFPO-DA (commonly referred to as GenX Chemicals)		

The Hazard Index is a tool used to evaluate potential health risks from exposure to chemical mixtures.

*ppt = parts per trillion (also expressed as ng/L)

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Project Timeline

- Data collection 2020 – 2024
- Early work (2020-2022) focused on delineation of groundwater flow directions
- Reporting 2024 – 2025

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