NAVAJO NATION EPA
AIR QUALITY CONTROL PROGRAM
INDOOR AIR QUALITY

MICHAEL KING, SR. ENVIRONMENTAL SPECIALIST
NNEPA AIR QUALITY CONTROL PROGRAM OVERVIEW

- Section 105 Clean Air Act Grant
  - Ambient air monitoring
  - Open Burn of Household Waste
- Indoor Air Quality (IAQ)

- Operating Permit Program
  - 12 Title V Facilities
  - Developing Minor Source Program

To protect and enhance the health and livelihood of Navajo people
To protect and preserve the natural beauty and environment on the Navajo Nation
To ensure the air emissions from the industries operating on the Navajo Nation are regulated
2010 study performed by USGS “Navajo Coal Combustion and Respiratory Health Near Shiprock, NM.”

Over 130 homes surveyed.

Stoves in one-quarter of homes surveyed were found to be inappropriate for coal combustion.

Study found high levels of respiratory diseases within communities. Residents appear to be at greater risk for respiratory disease than in other communities in the Four Corners region.
INDOOR AIR QUALITY ON THE NAVAJO NATION: USGS STUDY

- Hospital admissions/outpatient visits to Northern Navajo Medical Center increases during winter months

- Indoor PM$_{2.5}$ 24-hour concentrations exceed PM$_{2.5}$ NAAQS with spikes in PM$_{2.5}$ concentrations coincides with activities such as adding chunks of coal to the stove.

**Figure 1:** Total unadjusted raw numbers of hospital admissions/outpatient visits to NNMC for all seven diseases/conditions by month over the time period April 1997–December 2003, with residents of Shiprock in red and all other communities included in the study in blue.

**Figure 4:** Average concentrations of winter (2005, 2006, and 2007) indoor PM$_{2.5}$ over 24 hours at 20 homes. Home numbers 1–19 were burning coal during sampling periods; home number 20 had an alternate heating source. Red dotted line indicates the 24-hour ambient US Environmental Protection Agency standard of 35 μg/m$^2$ for comparison.

**Figure 5:** Representative display of PM$_{2.5}$ concentration hourly averages over a twenty-four hour sampling period in one home (site Nav135). On the basis of interviews with residents, spikes in PM$_{2.5}$ concentrations coincided with activities such as adding chunks of coal to the stove (red arrows).
INDOOR AIR QUALITY ON THE NAVAJO NATION: USGS STUDY

- **Indoor Homes Assessment**
  - Homes specific
  - Poor ventilation
  - Mold
  - High levels of PM
  - Homes not weatherized for the climate
  - High levels of Radon
  - Improper use of cleaning products

- **Wood & Coal Stoves**
  - Old outdated stoves
  - Burned wet wood
  - Burned coal
  - Burned trash
  - Stoves with cracks and gaps
  - Poorly ventilated stoves
  - Improperly installed stoves
INDOOR AIR QUALITY ON THE NAVAJO NATION

- Identified Wood/Coal Stove Problem on the Navajo Nation
- How We Started to Address the Problem
  - Indoor Air Quality Component added to CAA Section 105 Grant Work Plan
  - Outreach Material development
  - Conducted Indoor Air Quality Measurements
  - Developed Partnerships with Universities to Support IAQ Studies on Navajo Nation
    - University of Montana - Residential Wood Smoke Intervention Study (on-going)
    - University of Tulsa – Home to School Study to Reduce Asthma Triggers (on-going)
    - University of Colorado & Dine College – Impact of Heating Stove Replacement on Indoor and Outdoor Air Pollution in Shiprock, NM, Navajo Nation (proposed start date Jan. 2018)
- Mitigation project – Wood/Coal Stove Changeout
IAQ HOME ASSESSMENTS ON THE NAVAJO NATION

- Utilized Tribal Air Monitoring Support Center IAQ equipment loan program and loaner equipment from CU-Boulder and Univ. of Tulsa
- Identified what we wanted to monitor
  - PM$_{2.5}$, Particle Counts, Temperature, Relative Humidity, CO, CO$_2$, and Radon
- Developed an Indoor Air Quality Project Plan
  - IAQ assessment checklist
- Navajo Nation Radon Program: make sure homes were below EPA action level
  - Radon canisters
- Selected homes in each tribal agency
  - 10 homes in Fort Defiance Agency (FY16)
  - 10 homes in Shiprock Agency (FY17)
  - 10 homes in Central Agency (FY18)
  - 10 homes in Western Agency (FY19)
  - 10 homes in Eastern Agency (FY20)
Where to Place the Home Radon Test Canister

Place at least 2 feet above the floor exposed to open air.

Place in lowest floor of the house, such as a basement.

*Do not place canisters near fans and ventilation systems. Avoid kitchen areas, porches and bathrooms. While testing keep windows and external doors closed.*
INDOOR AIR QUALITY ON THE NAVAJO NATION

- Worked with contractors and EPA to develop flyer
- We didn’t want to promote methods that people on the Navajo Nation couldn’t easily follow, or carry out.
- Focused on 4 main ideas that we felt would be applicable to Navajo
  1) Clean and Repair your stove and chimney
  2) Burn the right fuel
  3) Ensure proper ventilation
  4) Use smoke detectors and carbon monoxide alarms
This project is funded by the National Institute of Environmental Health Sciences (NIEHS) and aims to reduce wood smoke/particulate matter exposure among the elderly and reduce adverse respiratory outcomes.

Test community-based exposure reduction strategies in tribal households that use wood stoves for home heating and evaluate the impact on respiratory function among the elderly.

Community based participatory research techniques are used to adopt intervention approaches to meet cultural content of each participating community.

Development of a community level wood yard.

Household level education strategies will be given to participants.

Goal is to design education based interventions that will result in sustainable strategies for reducing personal exposure to wood smoke.
PM measurements will be used to access impacts to indoor air quality.
INDOOR AIR QUALITY ON THE NAVAJO NATION: UNIVERSITY OF MONTANA STUDY

Navajo Nation EPA Air & Toxics Department
Indoor PM$_{2.5}$ 1-Hour Average Concentrations Over a 48-Hour Period
Tse Bonito, AZ

Micrograms per Cubic Meter

Time of Day

Navajo Nation EPA Air & Toxics Department
Indoor PM$_{2.5}$ 1-Hour Average Concentrations Over a 48-Hour Period
Lupton, AZ

Micrograms per Cubic Meter

Time of Day
Average 24-hour concentrations of winter indoor PM$_{2.5}$ for four tribal homes.

The red dotted line indicates the 24-hour ambient U.S. EPA NAAQS 24-hour standard for of 35 µg/m$^3$ for comparison.
INDOOR AIR QUALITY ON THE NAVAJO NATION: UNIVERSITY OF MONTANA STUDY
A 2010 EPA Settlement Agreement with Four Corners Power Plant for CAA violations is providing $3.2 million in mitigation for a stove changeout project.

750 change-outs will occur in a five year period in the Shiprock Agency.

The agreement requires both the use of Navajo workers where possible and the use of workers who are certified (or equivalent) for a safe installation of stoves (Wood Stove Training for Contractors).

EPA Certified stoves are not designed to burn coal. EPA is working with manufactures to design dual fuel stoves that will be able to burn wood and coal.

- Visited the Navajo Nation to learn more about burning habits
- Participated on calls with occupants who burn coal
- Want a stove that will create less pollution and burns efficiently to improve both ambient and indoor air quality
Stove manufacturers are partnering with US and Navajo EPA to develop 3 stove proto-types that meet the unique needs of Navajo households and can burn wood and coal.

The National Fireplace Institute, EPA, and Navajo Nation EPA trained 43 Navajo contractors to safely install stoves. We also worked with the stove testing industry and Navajo partners to develop a Navajo stove test method.

New stoves are being tested in a lab burning Navajo fuels, and using a test method designed to reflect Navajo use. This allows us to compare performance to existing stoves.

We tested 3 models of stoves commonly used on Navajo Nation to establish baseline emissions. One model was beta-tested in 5 Navajo homes.

We anticipate changeouts and weatherization will begin in 2018 and will take 4-5 years to complete. We expect approximately 600-700 homes can be completed.
MITIGATION PROJECT FOUR CORNERS POWER PLANT STOVE CHANGE OUT PROJECT

Several stoves are currently deployed on the Navajo Nation and undergoing pilot testing for EPA certification.
Day 1: Lupton, AZ

Our first day began with the replacement of a homemade barrel stove, used to burn wood and coal. The area heated was about 300 sq. ft. and uninsulated.

Stack height of 12'-13' was an attempt on our part to ensure there was no smoke spillage. After talking to our beta testers about how chimney temperature and stack height power the stove, along with the importance of adequate draft in keeping smoke and post-combustion odors out of the house, they understood and accepted our plans.

There are no elbows in these installations - the stack goes straight up through the roof. If future stoves are installed in this configuration, it is possible that a slightly shorter chimney could be specified. It is also possible that the inside pipe could be single-wall as opposed to double clearance pipe. This would result in more radiant heat and lower cost for installations.

Chimneys have a huge impact on stove performance and air quality. Questions about chimney height, construction and cost are not trivial.

We had a great welcoming committee for our first installation, including Sandy, who was our guide and a fluent Navajo speaker, and 3 members of the Navajo EPA. The group is pictured below, toward the end of our first installation.

Inside the house, close clearance pipe was installed to connect to the prefabricated chimney.
Summer Interns developed a 5 minute video focusing on wood and coal stove intervention.

Video is completely in Navajo with subtitles.

One (1) intern was funded through ITEP, and one (1) intern was funded through the NNEPA Intern program.

The video was showcased during our end of the year intern presentation.

Final edits completed and video has been uploaded to the NNEPA AQCP website.
Thank You