

# Navajo Coal and Air Quality in Shiprock, New Mexico



**Figure 1.** Typical emission plume from a powerplant near Shiprock, New Mexico, is horizontal during an inversion October 26, 2003; inversions are more common in winter than summer. Photograph copyright (2003) Diane J. Schmidt, all rights reserved; used with permission.

Among the Navajo people, high levels of respiratory disease, such as asthma, exist in a population with low rates of cigarette smoking. Air quality outdoors and indoors affects respiratory health. Many Navajo Nation residents burn locally mined coal in their homes for heat, as coal is the most economical energy source. The U.S. Geological Survey (USGS) and Diné College, in cooperation with the Navajo Division of Health, are conducting a study in the Shiprock, New Mexico, area to determine if indoor use of this coal might be contributing to some of the respiratory health problems experienced by the residents. Researchers in this study will (1) examine respiratory health data, (2) identify stove type and use, (3) analyze samples of coal that are used locally, and (4) measure and characterize air quality inside selected homes. Interim results are summarized below.

**Inversions.**—In the Shiprock area of the San Juan basin, people are exposed to poor air quality outdoors when atmospheric thermal inversions trap combustion products from two nearby large-capacity coal-fired powerplants (fig. 1). The number of respiratory incidents in the Shiprock area increases in winter (when inversions are more common) and decreases in summer. This increase may be related to inversions and to burning coal, wood, and other materials indoors for heating during the winter.

**Respiratory health data.**—Our study indicates that people living in Shiprock are more than five times as likely to be seen at the Northern Navajo Medical Center (NNMC) Indian Health Service facility for respiratory complaints as are residents of other nearby communities that are less affected by inversions. Another notable finding is that Shiprock residents under the age of 5 and over 56 are more than twice as likely to be treated at NNMC for respiratory issues as would be expected of the entire Shiprock population. The very young and the elderly spend more time indoors during winter when coal may be used for home heating, and people in these age groups may have immune systems that are compromised relative to the systems of people between 5 and 56.

**Stove type and use.**—The use of a properly operated and maintained stove designed to burn coal should not significantly lower air quality indoors. The research team surveyed 137 households that used

coal-burning stoves in 2004 and found that one-quarter of them were burning coal in stoves that were designed to operate at lower temperatures for burning wood and that many of the stoves had visible cracks or were poorly vented to the outside (fig. 2).

According to the results of this study, people can reduce their risk of respiratory disease by doing the following:

- Cleaning and properly maintaining coal-burning stoves
- Properly venting those stoves
- Using a stove designed for the appropriate fuel
- Safely handling coal and ash

**Coal analyses.**—Most of the coal used by our survey participants came from the Navajo mine at the Four Corners Power Plant. Samples of coal from Shiprock area homes, as well as from the mines and powerplants, have been analyzed for their chemical composition. No significant differences were found in the quality of coal from those various sources, and no dangerous levels of trace elements, such as mercury, were detected.

**Particulate matter.**—When coal is burned, numerous potentially harmful materials are released into the air. Of particular concern are small particles known as  $PM_{2.5}$  (particulate matter 2.5 micrometers or less in diameter). These particles, less than 1/30th the diameter of a human hair, are small enough that they can travel deep into the lungs and can directly enter the bloodstream.  $PM_{2.5}$  can then be transported to any organ in the body, and they have been implicated as a cause of heart disease among other ailments. From a human health standpoint, the composition of the particles may be even more important than their size. USGS scientists are currently measuring the amount of  $PM_{2.5}$  indoors and outdoors and analyzing that material in the laboratory to determine what chemical elements and compounds make up or are stuck to the particles.

**Results.**—This collaborative study of USGS scientists with Navajo students, residents, and health officials is providing valuable training for Navajo students in geographic information science (GIS), public health research methods, and geochemistry. Final results of the study will be provided to Tribal leaders, who can use the data in developing community practices that improve the public health effects of coal used for home heating in the Navajo Nation.



**Figure 2.** Representative of stoves used in 25 percent of homes surveyed, this stove was not designed to burn coal safely. Photograph by Veronica Francisco-Lapahie, Diné College, 2004; used with permission.

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