

Native Environmental Health Equity Research

A Center for Excellence in Environmental Health Disparities Research based at the University of New Mexico

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Newsletter

UNM HEALTH SCIENCES CENTER

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Native EH Equity Addresses Mining Impacts on Native Lands in the West

The Center for Native Environmental Health (EH) Equity Research, based at the University of New Mexico, aims to address the pervasive environmental health disparities posed by hardrock mining wastes to Native American communities in the West. Nearly half of the Native American population of the U.S. lives in 13 western states where an estimated 161,000 abandoned hard rock mines are located. More than 4,000 are abandoned uranium mines.

The Native EHEquity Center includes three University research programs and communities from three tribal nations, and is in the planning stages to expand to a fourth tribal region in later years of the project.

Our **Native Partners** include tribal community members and officials from the Navajo Nation, Crow Nation and the Cheyenne River Sioux Tribe (CRST), with future expansion to tribes in the Pacific Northwest (see map below). Our Academic Partners include Montana State University (MSU) and the University of Washington (UW).

The **Center's Cores and Projects** emphasize Native-focused community engagement around environmental and biomedical research. Our Career Development Interns work closely with the Cores and Projects to learn research skills, work with communities, learn research translation, interpretation and use of environmental and biomedical results across the communities.

Native EHEquity strives to build research capacity and increase interpretation and use of environmental and biomedical results across the communities. These objectives provide a framework to characterize the unique exposure pathways in Native communities and define health from a perspective not only reflective of tribal perceptions, but ultimately useful in informing regulatory decisions to reduce environmental health disparities.

Center co-Directors:

Johnnye Lewis, Ph.D.
Melissa Gonzales, Ph.D.

Community Engagement Core:

Chris Shuey, MPH (SRIC); John Doyle (MSU, Crow), Marcia O'Leary (MBI, CRST), David Begay, and Malcolm Benally (UNM, Navajo).

Environmental Monitoring Core:

Jose Cerrato (UNM), Lucia Rodriguez (UNM), Cherie DeVore (UNM, Navajo), Carlyle Ducheneaux (CRST).

Research Project 1 - DNA Repair:

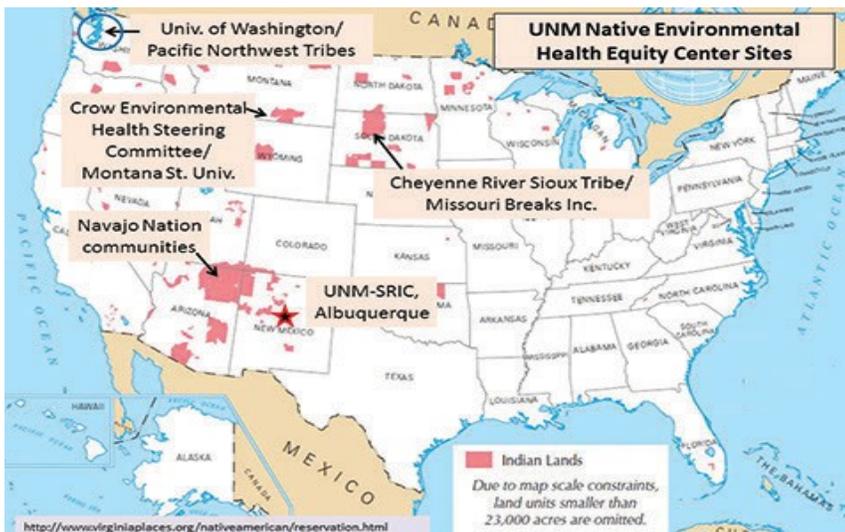
Laurie Hudson (UNM).

Research Project 2 - Auto-immunity:

Deborah MacKenzie, Esther Erdei (UNM)
Deborah Keil (MSU).

Career Development Interns:

Margaret "Mari" Eggers (MSU), Clarita Lefthand Begay (UW, Navajo), Joseph Hoover (UNM), Ranalda Tsosie (Univ. Montana, Navajo), Lucia Rodriguez-Freire, Ph.D., UNM



Native EH Equity Partners Sample Water and Plants to Fill Data Gaps

As summer arrived in the Northern Plains, partners in the Native EH Equity gathered to work on common environmental health concerns in Montana and South Dakota tribal communities.

In late May, Native EH Equity co-director Dr. Johnnye Lewis and Project 1 co-lead Dr. Debra MacKenzie from UNM toured the Little Big Horn River (LBHR) on the Crow Nation with John Doyle, member of the Crow Environmental Health Steering Committee - a Native EH Equity Center partner - and instructor at Little Big Horn College. He is working with Dr. Mari Eggers from Montana State University to assess water quality in hundreds of private wells that have been used for drinking by tribal members for decades.



Cherie Devore (foreground) and Clarita Lefthand Begay collect water samples from the Cheyenne River on Cheyenne River Sioux lands near Cherry Creek, SD.

Increased concentrations of uranium, manganese and other metals have been detected in those wells in sampling conducted in recent years. Possible sources are abandoned mines and mineral outcrops in the LBHR headwaters in the Big Horn Mountains of southern Montana. The team includes Dr. Joe Hoover, a UNM geographer Center Career Development Intern, to map the wells and analyze water quality data geospatially to better understand how hydrological processes may be transporting contaminants in the river system and affecting local drinking-water wells through recharge; and Dr. Lucia Rodriguez-Freire, an Environmental Engineer who has helped develop a method for processing the water samples and analyzing them for different metal concentrations.

In early June, the Native EH Center partners met on the Cheyenne River Sioux Tribe (CRST) in to help the CRST Environmental and Natural Resources Department (ENRD) collect samples of surface water, sediments, and plants on the Cheyenne and Moreau rivers in

central South Dakota. Earlier sampling showed elevated concentrations of arsenic and chromium in these media, some are used as traditional food and for cultural purposes, thereby increasing the potential for human exposures. Historic discharges from abandoned gold and uranium mines in the Black Hills are potential contaminant sources to the rivers.

Cherie Devore (Navajo), a doctoral student at the UNM Civil Engineering Department is from Crownpoint, NM. She helped to coordinate the field work with Carlyle Ducheneaux, Environmental Health Resources Protection Manager CRST, and Native EH Equity Center partner. Devore said more than 80 environmental samples were collected and sent to UNM for analysis of trace metals. Preliminary results show elevated arsenic concentrations in the sediments,” Devore reported.

Ducheneaux said the Native EH Equity Center provides a unique opportunity for Native American researchers to work across tribal boundaries to better understand how environmental contamination effects

tribal health and culture.

“The collaboration with NIH-funded programs like this allows tribes to come together to talk about the research they’re doing on their reservations. How can we mesh the cultural aspects of each one of our tribes in making not only a better study but using that information for good risk assessment” he said. “Besides getting to know other tribes, we all learn from each other, the people who are teaching us, the professors from UNM, they learn from us. It’s the idea of sharing our knowledge.”

Native EH Equity partners met with staff of Missouri Breaks, Inc., the Timber Lake, SD organization has worked with CRST to conduct environmental health and wellness studies for more than 25 years. MBI staff filmed sampling and conducted interviews with the researchers for a short educational video posted on **RED TALK - Shaping Tribal Futures** series webpage.

Visit: <https://www.youtube.com/watch?v-KTu7X9mW1kM>

Exposure Pathways of Primary Concern across the tribal nations partnering in Native EH Equity Center

Tribe	Language Group	Metals of Concern	Drinking Water	Airborne	Foodborne	Drinking Water
Navajo	Athabaskan	Uranium, arsenic, manganese	Regulated & Unregulated (30% w/o regulated)	Yes	Yes	Yes
Crow	Siouan	Uranium, manganese	Unregulated (30% w/o regulated)	No	Yes	Yes
Sioux	Siouan	Arsenic, mercury, chromium	Regulated (all on regulated water)	Yes	Yes	No

FLAGSTAFF, AZ - Dr. Johnnye Lewis, UNM Native EH Equity Center co-director, provided an overview of the Center's approach at the Tribal Environmental Health Summit at Northern Arizona University on June 20, 2016.

The summit, funded in part by the National Institute of Environmental Health Sciences (NIEHS) and organized by NAU chemistry professor Jani Ingram and colleagues, was attended by 80 researchers, students, and community members working on Native EH concerns throughout the U.S. Several members of the Native EH Equity Center attended and contributed to presentations and discussions.

Dr. Lewis highlighted how the Center plans to integrate mining-related environmental health concerns common to the three tribal community partners - Navajo, Crow, and Cheyenne River Sioux. (See table above.) Here are excerpts from her oral presentation, edited for clarity. Her presentation slides can be viewed at <http://neh.sk.edu/>.

It is not a surprise that a lot of the traditional lifestyle cultural patterns lead to differences in exposure and to potential differences in health outcomes.

Tribal communities have been left out of the general body of scientific data that people use to develop standards and risk assessment methods, and to understand exposure toxicities.

We are focusing on abandoned hardrock mines, specifically uranium mines. We initially started this work on the Navajo Nation where there are more than 500 abandoned uranium mines and 1,100 mine features. [Mine features] are the waste piles that are associated with the mines [but maybe located distant from them], and so they are another exposure source.



Dr. Johnnye Lewis, Co-Director Native EH Equity Center. Photo by Bridgette Wagner Jones

When you start looking at the toxicity of the metals [in mine wastes], many of them act in very similar ways. If they don't act in the same manner, the presence of more than one of them is likely to increase their [combined] toxicity even more.

The anticipated benefits that we see from the Center are that by combining the perspectives of the tribal communities we are going to start to build a common data set that we can all add to. We need to be able to create a framework where specific details can be added or altered as necessary, to provide a consistent infrastructure that builds on everything that we have been doing for decades.

For many tribal communities, EH research is something of a black box: you do all this work to collect the samples and then they disappear. And later you get a report back. There is frustration with missing that middle piece

about how the samples get analyzed. And how do we interpret the results?

One of the things that we want to do with the Center is to bring people in from the tribal communities, and over the summer have hands-on-time to both analyze their samples and also to work with us on interpretation. [In this way], they will understand what the western science approach to interpretation is, and so we as researchers will understand more about how these [data should] be interpreted to have an impact on tribal policy.

All the projects we're working on have actually been ongoing for many years. The same questions [about the potential health effects of mine-waste exposures] keep coming up. These include issues around dysfunctional immune systems - people prone to infections, infections are more aggressive, there's much higher rates of autoimmunity, there's higher rates of antinuclear antibodies, which is a precursor to autoimmune response.

Uranium mine wastes



Uranium mine wastes



Photo at left courtesy Hood family; photo at right by Teddy Nez.

Uranium Legacy: Chronic Exposures over Multiple Generations

What characterizes the uranium legacy [in Native communities] is a history of chronic exposures. These two photos from the same community near Churchrock [NM] is the same family separated by 34 years and three generations. They've been captive to their exposures and to the mine waste still present in the background [in both photos].

From a cultural perspective, this family has been there raising sheep here since the 1920s. Many of the people's umbilical cords are buried in and around the community, so from the perspective of being able to move away from the contamination, move away from risk, it's not possible. And this is repeated in many indigenous communities, especially on the Navajo Nation.

The hallmark of our approach to community engagement has been that the communities that are affected by environmental health disparities largely set the research agenda because they are the ones who have to live with these long-term risks.

- Chris Shuey, SRIC
June 20, 2016
NAU, Flagstaff, AZ

Crow EHSC Sampling Water in Hundreds of Private Wells

Decades ago, the U.S. Indian Health Service (IHS) drilled hundreds of private wells on the Crow Agency in southeastern Montana for the principal purpose of providing drinking water for families. Although well water quality was tested at the time the wells were drilled, it was not standard practice in Montana to test wells for uranium and, until recently, manganese in drinking water was not known to be a health concern. To address community concerns about contaminants in well water, the Crow Environmental Health Steering Committee (CEHSC), in collaboration with Little Big Horn College and Montana State University, embarked on a water testing program. John Doyle, a CEHSC member, and member of the Native EH Equity Center, said funding from USEPA and Native EH Equity has enabled testing of about 200 wells to date.



John Doyle, Emery Three Irons, and Mari Eggers test a spring on the Crow Agency in Montana. Photo by Antonio Dvorakova

"This job is with us all the time," Doyle said. "People have become reliant on us to deal with their water problems."

Dr. Margaret "Mari" Eggers, an MSU environmental health scientist, a non-voting CEHSC member, and member of the Native EH Equity Center, said uranium and manganese are the principal inorganic contaminants of concern. About two-thirds of wells tests have detectable levels of uranium, with about 6% having concentrations exceeding the primary national drinking water standard (30 micrograms per liter, or $\mu\text{g}/\text{l}$).

About 15% of wells have manganese concentrations exceeding the EPA health advisory of $300 \mu\text{g}/\text{l}$ (based on neurotoxic effects), and a third exceed its second drinking water standard of $50 \mu\text{g}/\text{l}$, based on aesthetic considerations, like staining of fixtures and clothing.

Water samples are being shipped to the University of New Mexico, where Dr. Lucia Rodriguez-Freire is processing samples for analysis of uranium, manganese, and other trace metals.

Doyle and summer intern Emery Three Irons have been handing out water coolers to families with unsafe well water. The coolers dispense hot and cold water from refillable five gallon jugs. Participants have been very grateful to have an alternate, low cost solution for providing safe drinking water for their families.

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Carlyle Ducheneaux, director of CRST Environmental Department points to reddish lens on the river bank where arsenic has been shown to concentrate over time. Photo by Chris Shuey.

P50 Center of Excellence in Environmental Health Disparities Research

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Cheyenne River Sioux Lakota

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Centers for Excellence in Environmental Health Disparities Research

The Center for Native EH Equity Research, based at the University of New Mexico, is one of five new Centers for Excellence in EH Disparities supported by the National Institute for Environmental Health Sciences, the National Institute for Minority Health and Health Agencies. This program encourages significant burden in low socioeconomic and health disparities populations.

<http://www.niehs.nih.gov/research/supported/centers/ehd/index.cfm>