COLLEGE OF PHARMACY
METAL EXPOSURE AND TOXICITY ASSESSMENT ON TRIBAL LANDS IN THE SOUTHWEST

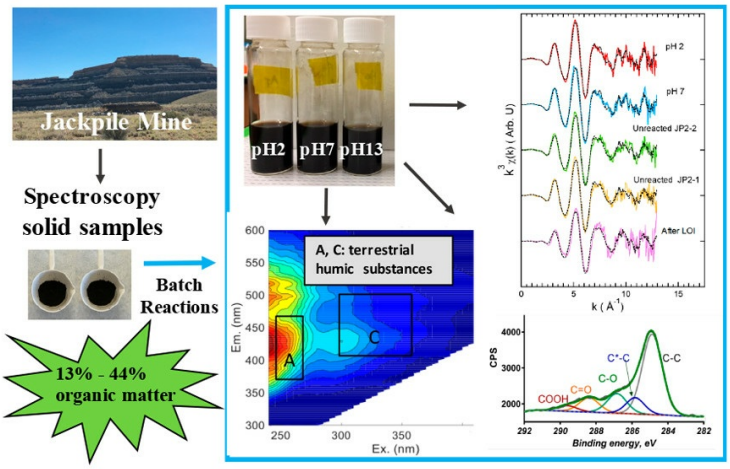
University of New Mexico

METALS Superfund Center

Metal Exposure Toxicity Assessment on Tribal Lands in the Southwest

Fall 2019

Research Project Highlights



[Environmental Project 1]

Principal Investigator:

Jose Cerrato, PhD

* Image from *Velasco, C.A., et al. Environ. Sci. Technol.* 2019 53, 10, 5758-5767

Mineral phases influence toxic transport from mine wastes

Dr. Jose Cerrato's METALS research team at the UNM School of Engineering is developing cost-effective remediation strategies to immobilize toxic metals *in situ* to prevent degradation of community water sources.

The team is investigating how naturally abundant metal mixtures of ubiquitous secondary mineral phases and the adsorption of locally abundant minerals (e.g., limestone, iron oxides) and plants as means of reducing exposure risk.

In collaboration with tribal communities and other METALS scientists, the team is producing new knowledge that can be applied to remediation strategies for thousands of other existing abandoned mine waste sites. Results from the project will have a valuable impact on the Native American communities that live in close proximity to abandoned mine sites and metals-containing mine waste.

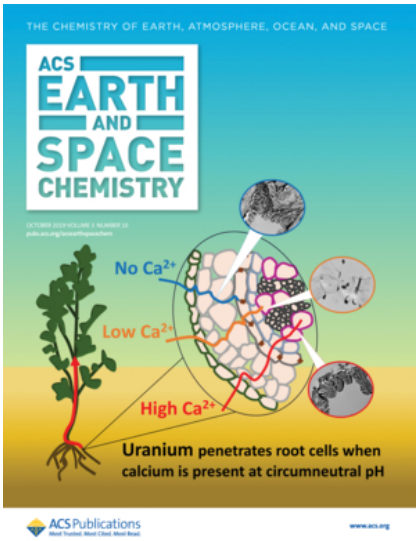
To date, the group has published 7 scientific articles the *ACS Earth and Space Chemistry (see Trainee Highlight below)*, *Chemical Geology*, *Environmental Science and Technology*, and *Toxicological Sciences.*

Learn more about the Publications and Presentations by Environmental Project 1.

Current Trainees
Cherie DeVore, Doctoral Candidate Carmen Velasco Rivera, Doctoral Candidate
Isabel Meza, Doctoral Student Tybur Cause, Doctoral Student
Eliane El Hayek, Post-doctoral Fellow
Distinguished Alumni Trainees
Nabil Shaikh, Ph.D. Postdoctoral Researcher, University of Illinois at Chicago
2019 KC Donnelly Externship Award Recipient
Jorge Gonzalez-Estrella, Ph.D. Research Assistant Professor, UNM
Lucia Rodriguez-Freire, Ph.D. Assistant Professor, NJ Institute of Technology
Sumant Avasarala, Ph.D., Postdoctoral Researcher, UC Riverside

Learn more about Dr. Cerrato's research team

Trainee Updates



Calcium enhances uranium transport inside plant root cells

It is generally known that uranium accumulates in plant roots and crosses cell structure barriers. However, the underlying mechanisms of uranium transport and translocation in plants remains unclear.

According to Dr. Eliane El Hayek, the study lead and METALS Center Trainee, the presence of calcium and carbonate, at circumneutral pH, increases the concentration of neutrally charged Ca-U-CO_3 complexes in the rhizosphere.

In this the narrow region of soil, directly influenced by the root and the root microbiome, the neutrally charged Ca-U-CO_3 complexes appear to increase the affinity of uranium to cross the cell membrane of roots, thus facilitating translocation toward the shoots.

This finding provides insight into the mechanisms by which uranium is transported and accumulated in plants, and highlights the synergetic chemical and physiological effects of calcium in these processes.
The root-to-shoot translocation of uranium has significant implications for human exposure and phytoremediation.

This research shows the importance of taking into consideration the aqueous complex form of uranium in addition to the pH and range of uranium and calcium concentrations in the rhizosphere.

El Hayek E., et al. (2019) *ACS Earth and Space Chemistry,* in press.

Read the article

Community Engagement and Research Translation Updates

‘Léétsoh dooda’ 40 years after spill, 3 generations unite against uranium

UNM METALS researchers joined more than 150 community members and visitors at the 40th commemoration of the 1979 Church Rock Uranium Tailings Spill at Red Water Pond Road (RWPR) Community on the Navajo Nation on July 13th, 2019. This annual event is hosted by the RWPR Community Association, UNM METALS Center partner.

METALS RTC/CEC members, Chris Shuey, Sarah Henio-Adeky and Mallery Quetawki (METALS Artist-in-Residence) staffed two booths highlighting the environmental research findings, sharing information on the ongoing METALS zinc supplementation study in the area (Thinking Zinc), and research translation artwork developed by Ms. Quetawki. METALS Director, Dr. Johnnye Lewis, and other investigators also participated in the commemoration events.

UNM METALS invited to participate in dialogue with Navajo Trustee regarding Claim 28 Water Study

METALS researchers, trainees and RTC/CEC members were invited to meet with the Navajo Phase 2 Trustee removal site evaluation trust team to discuss the Trustee's work plan for the Claim 28 Water study in the Blue Gap-Tachee Chapter on the Navajo Nation.

The Trustee's water study at the abandoned Claim 28 mine site and surrounding area is being revised for authorization of trust funds to support the effort. The Trustees requested input from the UNM METALS researchers, trainees and community members.

The METALS Center invited Blue-Gap Tachee community leaders, including Chapter president, Aaron Yazzie, and former Navajo Nation Council Speaker Johnny Naize, from the community, in the dialogue. METALS Community Engagement Core trainee Latasha James (from the Blue-Gap area) also participated.

Phase I and Phase 2 Navajo Trustees have acknowledged the value of the input from those in the community, and the community participants indicating they had gained substantial input about the technical uncertainty issues at the site through their participation.

Learn more about the Navajo Nation Trust Mines

SRP Cross Center Collaborations

Expanding Data Integration, Interoperability & Reuse

The UNM METALS Center will be collaborating with SRP Centers across the country to expand data integration, interoperability and reuse based on the FAIR (Findable, Accessible, Interoperable, Reusable) principles of data.

METALS will be working with

MIT *to reduce variability in data analysis and interpretation of DNA damage data in animal and human studies associated with environmental contaminant exposure*

Columbia University, Dartmouth, and University of Arizona *to develop methods for standardizing Synchrotron data used to assay environmental contaminants*

University of Louisville *to identify and establish best practices and databases to share and link flow cytometry data and associated metadata in animal and human studies to evaluate the impact of exposures on immune endpoints*

Columbia University and University of California, Berkeley *to build on Columbia SRP's mass-balance model to evaluate the contribution of arsenic contamination in water sources and in dust, in biological exposure measurements in human studies*

Northeastern University and Dartmouth *to evaluate strategies for integrating raw data sets on biomonitoring, demographic, and health data to jointly study the effect of environmental exposures on multiple health outcomes.*

UNM METALS Posters at 2019 SRP

2019 NIEHS SUPERFUND RESEARCH PROGRAM Annual Meeting
November 18 – 20, 2019, in Seattle, WA

Bioproject 1

Erica J. Dashner-Titus, Jodi R. Schilz, Li Luo, Karen Simmons, Laurie G. Hudson***RNA-Seq analysis reveals that uranium modifies the impact of arsenic on CD4+ T-cell activation***

Laurie G. Hudson, Debra MacKenzie, Esther Erdei, Erica Dashner-Titus, Chris Shuey.***Thinking Zinc: A Study of Zinc Supplements on the Navajo Nation***

Environmental Project 1

Jorge Gonzalez-Estrella, Carmen Adela Velasco, Eliane El-Hayek, Maria Isabel Meza, and José Manuel Cerrato. ***Mobility of uranium and co-occurring metal mixtures in mine wastes.***

Isabel Meza, Jorge Gonzalez-Estrella, Ginger Sigmons, Peter Burns, Jennifer Szymanowski, José M. Cerrato. ***Determination of solubility product of uranyl arsenates***

Carmen A. Velasco, Abdul-Mehdi S. Ali, Jorge Gonzalez-Estrella, Juan S. Lezama Pacheco, Stephen E. Cabaniss, Adrian J. Brearley and José M. Cerrato. ***Influence of pH on the Precipitation of U(VI) and***

Natural Organic Matter in Laboratory Controlled Conditions

Environmental Project 2

Melissa Gonzales, Joe Galewsky, Chris Shuey, Paul Robinson, Savanah LaRosa-LoPresti, Adrian Brearly. ***Enrichment of Metals in Airborne Particulate Matter Originating from Mine Sites***

Research Translation/Community Engagement Cores

Carolyn Roman, Chris Shuey, Paul Robinson, Joseph Hoover, Melissa Gonzales.***Abandoned uranium mine waste clean-up and risk assessment on the Navajo Nation***

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Previous Newsletters

Summer 2018

Summer 2019

NIH/NIEHS P42 ES025589 (UNM METALS)

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