

# Gold King Mine Spill

## One Year Later

### Reflection Newsletter

#### The Spill and Response



One year ago today, excavation work was underway to initiate improved treatment and control of impounded drainage water trapped within an old tunnel at the abandoned Gold King Mine of Silverton, Colorado, when the waste rock plugging the tunnel unexpectedly gave way. The contaminated water flowed, unimpeded, into the nearby Cement Creek, a tributary of the Animas River. While it would take several days for the magnitude of the spill to be quantified and understood by federal agencies (and even months for it to be measured in terms of environmental impacts), it was soon established that over three million gallons of acid mine drainage had been released from this point of failure. This yellow plume, rich in iron oxides and other metals, soon reached the San Juan River – a river system which travels through Navajo lands in New Mexico and Utah.

Having strong ties to tribal community groups and a long-standing research presence in the region, Dr. Karletta Chief, University of Arizona (UA) Superfund Research Program (SRP) Principal Investigator for the Community Engagement Core and UA Extension Specialist, received questions regarding the impact of the spill and led the writing of a fact sheet with assistance from UA SRP director, Dr. Raina Maier, and other UA investigators (see references). Addressing the research need, Dr. Chief and her collaborator, Dr. Paloma Beamer, professor of Environmental Health Sciences in the Mel and Enid Zuckerman College of Public Health, and with the support of several UA, Northern Arizona University (NAU), Diné College, and Fort Lewis investigators *and* the Navajo Nation, began a year-long mission to explore the environmental impacts of the spill. This work was conducted in collaboration with the Navajo Nation and the impacted communities.

Over the last year, the two researchers have secured several research grants to support environmental sampling, formal exposure assessments, biomonitoring, community teach-ins, listening sessions, a University-community dialogue, citizen science, collaborative training of community and tribal college students, and have shared their work at various conferences.

#### Dr. Karletta Chief – A passion to work with indigenous communities

*SRP Lead Investigator for the UA Gold King Mine Spill Response  
Team reflects on growing up in a mining community*



Growing up on Black Mesa on the Diné Nation, my family was severely impacted by the contamination of coal strip mining by Peabody Coal through the loss of livestock by wash contamination, burning of our sheep corral due to mining explosions, and relocation due to mining activities.

The environmental degradation and lack of access to running water and electricity motivated me to go to college as a first generation college student, and I eventually received a PhD in hydrology and water resources. The desire to help my family, community, people, and Native America is a passion that has driven me to do the work I do today. The Gold King Mine spill devastated the lives of my people and through my work, I am honored that my people have given me the opportunity to give back through my research expertise. In Dinék'ejí, our elders say *"Nihaa atchini nihaa nidoodaa"* which means *"One day our children will return"* implying that Navajo children will return to help their people after pursuing Chief Manuelito's directive to climb the ladder of education. Working with Diné communities to address environmental injustices is my opportunity to fulfill my grandmother's wish for me to return and help my people. This past year held tears, sadness, anger, motivation to act, teamwork to consider solutions, and training of my younger brothers and

sisters at the tribal college to do environmental monitoring. Our project is successful due to the guidance and advice of Diné elders, Diné community visionaries, Diné scientists, and Diné linguists. Our team recently started sampling and we look forward to completing the analysis, reporting back to the community, and working with our community partners to contribute to the resiliency of the Diné Nation. Ahé'hee for allowing me to work with you!

## Reflections one year after the water turned yellow – How the Gold King Mine Spill changed my life

*A Perspective by Principal Investigator, Dr. Paloma Beamer*



**Agua es la vida...** The first week of August 2015, I was excited to go back to work after a minority women's faculty retreat in the mountains. In just a few days I had written most of a scientific paper, caught up on month of emails, and come up with a detailed plan for data collection, additional papers to write, and grants to submit over the upcoming academic year. But then, on August 5<sup>th</sup>, the Gold King Mine spill occurred and I (along with the rest of the world) watched the news as the Animas River turned a dramatic shade of yellow and traveled downstream towards the Navajo Nation and the state of Arizona. My life forever changed as I quickly became involved in collaboration with Dr. Karletta Chief to develop a time-sensitive proposal for the National Institute of Health (NIH).

All of a sudden, I had to reach back into those years of technical training in environmental fate and transport as an engineer and my experience conducting exposure assessments with vulnerable populations in order to develop this interdisciplinary proposal to assess short-term exposures and risk perceptions among the Diné in a culturally respectful and meaningful manner.

Over the last year, we were fortunate to have both this and another related proposal funded. But more



importantly, I have learned several invaluable lessons. First, even though there are tens of thousands of abandoned mines across the western United States, there is

almost no long-term data on exposures and health consequences in impacted communities following a catastrophic mine spill. Both the Gold King Mine spill and the 2014 Río Sonora Cananea Mine spill, that was three

times the size, underscore the need for data to *more effectively communicate potential health risks and mitigation strategies*. Last year while developing our fact sheet for the communities impacted by the Gold King Mine spill, we found ourselves grappling with the complete absence of long-term data.

Second, compared to other populations, communities like the Diné have more complete exposure pathways due to their deep connection with the natural environment, unique cultural practices, and subsistence



livelihoods; thus likely leading to a disproportionate impact of health risks and exposures. For example, the US EPA risk assessment following the Gold King Mine spill estimated

risk based upon a hiker who drinks filtered water from the river. While this recreational scenario may be conservative for some populations, it is of little relevance to the concerns of the Diné, who have lived along this river for generations. Not only do they use the San Juan River for farming and ranching, but our focus groups have identified over 40 potential river-associated activities. This work has highlighted for me the importance of seeking community expertise in order to make sure we understand their unique exposure pathways.



Finally, our work has highlighted the challenges that we will face in communicating our results. How will we communicate lead and arsenic risk assessment in a language and

culture that does not have words for those concepts, in a culture that has a different understanding of how the world works, an understanding that does not involve atoms or the periodic table of elements? I truly felt the importance of this when attending a farm board meeting at which an outside scientist alarmingly told the community that he detected vanadium in their water. This scientist provided no information on vanadium, its natural occurrence, and the fact that it is the amount of vanadium measured in the water that matters. Clearly, it is essential to make effective and culturally-relevant environmental health literacy materials.

Not knowing whom to trust, many Diné communities chose not to irrigate their fields and lost their entire harvest last fall. On a reservation the size of West Virginia with very few grocery stores, locally produced food is crucial for these communities. However, the effects of the spill cut even deeper. **Over the past year through my interactions with the Diné, I have learned that there is a great sense of responsibility to speak for and protect the voiceless.** This includes taking responsibility for Mother Earth and Father Sky, and the rest of the natural world that are considered equal yet voiceless members of a universal democracy. It also includes taking responsibility for future generations ('The Seventh Generation') and ensuring their environment is protected just as the ancestors protected it for today's generation. The decision to not irrigate fields with water from a contaminated river was larger than a concern for this year's harvest; this decision comes from a fear of irreversibly contaminating the heirloom seeds that have been passed down for generations, and for assuming responsibility if these seeds can no longer be passed down.

How can I, as a Western scientist, understand the full weight of that responsibility and determine what constitutes a "safe" level? **I can't.** But my role over this next year is to understand both the pre- and post-spill exposures and communicate, as transparently as I can, potential changes in health risk.

The Diné are a matrilineal society. My knowledge of my matrilineal line ends with my great-grandmother who said that she came from a family that has lived in the Sonoran Desert of Northern Mexico for as long as anyone has any documentation. She also instilled in all of us the belief that "*agua es la vida* (water is life) *y sagrada* (sacred)." This last year spent with the Diné in the wake of the Gold King Mine spill has made me experience this belief on a much deeper level. While this has helped me feel a greater connection to my work, it has also filled me with a sense of loss for not knowing more about my likely indigenous matrilineal line, where they come from, or what other traditions and beliefs have been lost. I feel an essential piece of me is missing...but the Diné do know their history. They know the sacred stories that talk about the confluence of the Animas and the San Juan Rivers. They have continued in their traditional interactions with these rivers for thousands of years, and hope to pass them down to future generations. We will never fully be able to understand, nor should we expect to, the anguish they must have felt the day the water turned yellow.

## Student Involvement

*Much more than a standard research experience*



The UA SRP has been actively involved in efforts to characterize environmental and human impacts of the Gold King Mine Spill through the Navajo Gold King Mine Spill Exposure

Project: [www.facebook.com/goldminespillproject/](http://www.facebook.com/goldminespillproject/).

As the complexity of these efforts has evolved, opportunities have emerged for students from multiple universities and colleges to actively participate in regional environmental sampling and community outreach efforts. It has become increasingly evident that the Gold King response effort has provided students with much more than a standard research experience. In one large-scale, multi-site sampling event which took place from June 13 to June 17, 2016, researchers and students from the UA joined with Northern Arizona



University (NAU), Diné College on the Navajo Nation, and New Mexico State University Extension to collect over 400 environmental samples from 50 sampling

locations throughout the Navajo farming communities of Upper Fruitland and Shiprock in New Mexico, and Aneth, Utah. While this sampling event will ultimately contribute to long-term studies on the impacts of the Gold King Mine spill, it also represented an exciting collaborative opportunity for students from multiple institutions, as well as various cultural backgrounds and educational levels to work side by side. Lydia Jennings, a PhD student in the UA's department of Soil, Water, and Environmental Sciences (SWES) and National Science Foundation Graduate Fellow enjoyed mentoring undergraduates in field research techniques, but was quick to emphasize that the Diné undergraduates offered critical cultural and regional expertise in the local and environmental history of the region that provided invaluable assistance for locating and identifying sampling sites. The community interaction was also an educational experience for all students involved. Lydia observed that, "We were able to talk to the community members who have been impacted by the Gold King Mine spill. Many expressed concern over the quality of water and how it may be impacting their crops. Some community members

expressed sadness in not being able to use the nearby San Juan River during these hot summer months.” Jennings emphasized that the experience reinforced that “it is critical to partner with local institutions (Diné College) and community groups when evaluating the impact of an environmental disaster”.

For Jamie Yazzie, one of Dr. Chief’s summer research interns from Diné College Tribal Colleges & Universities Program (TCUP), this sampling event was her first exposure to environmental fieldwork. Jamie reported that



she enjoyed both the nature of the outdoor work and the technical skills she learned while conducting field tests for different water quality parameters. Jaime and Tyler Begay also shadowed Dr. Chief at

community meetings, the Navajo data sovereignty conference, Navajo Human Research Review Board presentation, and project research meetings. Jamie said of her experience, “I enjoyed collaborating with University of Arizona and Northern Arizona University students. It was insightful to hear them express their



passion for what they want to do, and to see how close they are to receiving their degrees. I was inspired and motivated to pursue my own education.”

These experiences have been repeated with many additional students on sampling trips conducted in 2015 and 2016 that included both graduate and undergraduate student volunteers from multiple universities including Diné College. In addition, a trip organized during the 2016 UA Spring Break was staffed by seven undergraduate students from the UA Undergraduate Biology Research program (UBRP) directed by Carol Bender and the **NIH-funded** Environmental Health Sciences Transformative Research Undergraduate Experience (EHS-TRUE) directed by UA PI Dr. Walt Klimecki along with students from NAU. UBRP student, Alondra Harris, summarizes the full impact of this research experience on the participating students in an article that can be found here: <https://ubrp.arizona.edu/water-hogans-and-rocks/>.



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## Publicity, Grants and Presentations

### *Fact Sheets*

Chief, K., J.F. Artiola, P. Beamer, S. Wilkinson, R.M. Maier, C. Rock, and C. Sanchez. 2015. Understanding the Gold King Mine Spill. Fact Sheet. University of Arizona, Tucson, AZ. <https://goo.gl/jO25W0>.

Moreno Ramírez, D., Chief, K., and C. Arnold. 2015. Gold King Mine Spill Community Sheet. Fact Sheet. University of Arizona, Tucson, AZ. <https://goo.gl/FVm9Xr>.

### *News Article*

Beamer, P., K. Chief, N. Borrero, and B. Rivera. 2016. Water Is Our Life: How a Mining Disaster Affected the Navajo Nation. Truth Out, April 2016, <https://goo.gl/1k1Ms7>.

### *Grants*

**Beamer P. and K. Chief.** “Tó’Lítso, the water is yellow: Investigating short-term exposure and risk perception of Navajo communities to the Gold King Mine toxic spill”. **National Institute of Environmental Health Sciences, (NIEHS) Award No. 1R21ES026948-01, \$434,029**

**Beamer, P. and K. Chief.** Gold King Mine Navajo Exposure Project, Diné Outreach and Citizen Science. **Center for Sustainable Mining Pilot Grant, \$50,000**

**Chief, K.** Career Development Award. **UA Southwest Environmental Health Sciences Center, Award No. P30ES006694, \$5,000**

**Chief, K.** Risk perception of Navajo farming communities impacted by the Gold King Mine Spill **UA Southwest Environmental Health Sciences Center, Pilot Grant. \$40,000**

**Beamer, P., K. Chief, and D. Billheimer.** Gold King Mine spill Navajo exposure project data management plan and design, Pilot Grant. **University of Arizona Data Management and Curation, \$30,000**

**Chief, K and P. Beamer.** “K’é bee da’ahííníítą: Strength through the Navajo clan system to respond to the Gold King Mine spill,” **Agnese Nelms Haurly Foundation Challenge Grant, \$10,000**

**Chief, K and P. Beamer.** “K’é bee da’ahííníítą: Strength through the Navajo clan system to respond to the Gold King Mine spill,” **Agnese Nelms Haurly Foundation, Challenge Grant, \$600,000**

**Beamer P. and K. Chief.** **Understanding Navajo Concerns to the Gold King Mine Spill.** UA Center for American Indian Resiliency (CAIR), Award No. 1P20MD006872, **\$1,800.**

### *Presentations*

**Chief, K., P. Beamer, N. Lothrop, J. Ingram, N. Tuefel-Shone, M.A., Begay, R. Clausen, J. Yazzie, M. Begay, and D. Yazzie.** 2016. Environmental conditions of the Animas and San Juan watersheds with emphasis on Gold King Mine and other mine waste issues. **New Mexico Water Resources Research Institute Conference,** San Juan College, Farmington, NM.

**Chief, K., P. Beamer, J. Ingram, N. Tuefel-Shone, M.A. Begay, and D. Billheimer.** 2016. Building community partnerships to quickly respond to Diné concerns regarding the Gold King Mine spill. **Native Research Network Conference, 26th Native Health Research Conference,** Cherokee, NC.

**Chief, K., P. Beamer, J. Ingram, N. Tuefel-Shone, M.A. Begay, and D. Billheimer.** 2016. Tó’Lítso, the water is yellow: Investigating short term exposure and risk perception of Navajo communities to the Gold King Mine toxic spill. **Tribal Environmental Health Summit,** Northern Arizona University, Flagstaff, AZ.

**Chief, K., and C.L. Koch.** 2016. Beyond tribal consultation mining educational modules: environmental, responsible mining environmental, and social risks. **SME 2016 Annual Meeting.** Phoenix, AZ

**Chief, K., and P. Beamer.** 2016. Tó’Lítso, the water is yellow: Investigating short-term exposure and risk perception of Navajo communities to the Gold King Mine toxic spill. **Focus Group Training.** Northern Arizona University, Flagstaff, AZ.

**Chief, K.** 2016. Building community partnerships to develop a time-sensitive NIEHS proposal: Gold King Mine impacts on Navajo communities. **University of Arizona Native American Research and Training Center Institute.** University of Arizona, Tucson, AZ.

**Chief, K.** 2016. Building community partnerships to develop a time-sensitive NIEHS proposal: Gold King Mine impacts on Navajo communities. **Spirit of Eagles Spring Network Meeting.** Jacksonville, FL.

### **Five invited lectures**

Tohono O’odham Community College and High School and the University of Arizona

### **Community Extension Presentations**

Eight community extension presentations including Navajo chapter meetings, informational sessions, listening sessions and teach-ins in the Navajo towns of Chinle, AZ, Shiprock, NM, Upper Fruitland, NM, and Aneth, UT