TÓ’ŁÍTSO, THE WATER IS YELLOW: WATER, AGRICULTURAL, AND SEDIMENT QUALITY RESULTS OF THE SAN JUAN RIVER ON THE NAVAJO NATION ONE YEAR AFTER THE GOLD KING MINE SPILL
WHO WE ARE

UNIVERSITY OF AZ

• Karletta Chief
  – Hydrology Professor

• Paloma Beamer
  – Environmental Health Professor

• Dean Billheimer
  – Biostatistics Professor

TÓ BEE NIHI DZIIL

• Janene Yazzie
  – Community Organizer

NORTHERN AZ UNIV

• Jani Ingram
  – Chemistry Professor

• Manley Begay
  – Indigenous Studies Professor

• Nicolette Teufel-Shone
  – Health Promotion Professor

NAVAJO CHR

• Mae-Gilene Begay
  – CHR Director

DINÉ COLLEGE

• Perry Charley
  – Director, Diné Environmental Institute

FORT LEWIS COLLEGE

• Becky Clausen
  – Sociology Professor
The Problem

• EPA released 3 million gallons of acid mine drainage into the Animas and San Juan Rivers, which flow through the Navajo Nation
• EPA hauled in water contaminated with oil for crop irrigation and live stock
• The result?
  • Very high community concern about human exposures, but also their crops, livestock and the wildlife for which there is a strong connection
  • Much community debate about using the river water again. Many are still without water and have lost their crops.
• Very high perception of risk
• Very high lack of trust in outside entities
Gold King Mine Spill Dine’ Exposure Project

EPA Perception vs Diné Reality
Gold King Mine Spill Dine’ Exposure Project

PROJECT AREA
ENVIRONMENTAL SAMPLES COLLECTED

1. Nov 2015
   - 162 soil/sediment
   - 62 water
2. March 2016
   - 183 soil/sediment
   - 37 water
3. June 2016
   - 213 soil/sediment
   - 201 water

- UA, NAU, & Diné College
- 858 samples total
WATER RESULTS
WATER GUIDELINES: DRINKING WATER FOR PEOPLE

• US EPA Primary Maximum Contaminant Level (MCL)
  – The maximum amount of a contaminant allowed in drinking water so that it is still safe for people to drink over many years

• US EPA Secondary MCL
  – The *suggested* maximum amount of a contaminant in drinking water so the water does not have bad taste, smell, or color
  – *Not related to human health or safety*
  – Both set by the US Environmental Protection Agency
WATER GUIDELINES: PLANTS AND ANIMALS IN WATER

- NOAA SQuiRTs (Screening Quick Reference Tables)
  - The maximum amount of a contaminant allowed in water so it is safe for plants and animals to live in over many years
  - Used by the National Oceanic and Atmospheric Administration (NOAA)
  - Based on levels set by the US EPA and other organizations
# AMOUNT OF ARSENIC IN WATER

<table>
<thead>
<tr>
<th>Parts of Arsenic Dissolved in 1 Billion Parts of Water (ppb)</th>
<th>Winter</th>
<th>Spring</th>
<th>Summer</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
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<tr>
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</tbody>
</table>

Where sample was taken: □ Canal  ☢ River  ▲ Well

Guidelines: ⬤ NOAA SQuiRTs  — US EPA Primary MCL

Gold King Mine Spill Dine’ Exposure Project
### AMOUNT OF LEAD IN WATER

<table>
<thead>
<tr>
<th>Parts of Lead Dissolved in 1 Billion Parts of Water (ppb)</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td>10</td>
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<tr>
<td>5</td>
</tr>
<tr>
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</tbody>
</table>

**Where sample was taken:**
- Canal
- River
- Well

**Guidelines:**
- NOAA SQuiRTs
- US EPA Primary MCL

Gold King Mine Spill Dine’ Exposure Project
AMOUNT OF MANGANESE IN WATER

Guidelines:  
- NOAA SQuiRTs  
- US EPA Secondary MCL

Where sample was taken:  
- Canal  
- River  
- Well

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SOIL AND SEDIMENT RESULTS
SOIL BACKGROUND: LEAD

- Natural background concentrations of lead that occur naturally in surface agricultural soils in the United States range from 7 to 20 ppm
- Standards and Regulations
  - EPA (residential soil) – 400 ppm (play areas) 1200 ppm (non-play areas)

ARSENIC

- Natural background concentrations of arsenic that occur naturally in soils in the United States range from 7 to 40 ppm
- Standards and Regulations
  - EPA (residential soil) – 11 ppm (depending on source)
Deposition of Lead and Arsenic Over Time

Shiprock River Sediment
Shiprock Ag Soil
Hogback River Sediment

Conc ug/g


[ Pb ] ug/g  [ As ] ug/g
OUR MAIN FINDINGS

- Amounts of arsenic in water were below the guidelines for drinking water for people and for plants and animals living in water.

- Amount of lead in 4 river samples was above the water guideline for plants and animals living in water in Spring 2016.

- Amounts of manganese were above both guidelines in Spring 2016 more than Winter 2015 and Summer 2016.

- Amounts of metals in the San Juan River and canal water were generally higher in Spring 2016 compared to Winter 2015 and Summer 2016.

- Amounts of arsenic in the river sediment and agricultural soils for Winter 2015, Spring 2016, and Summer 2016 are all at or below background levels.

- Amounts of lead somewhat increases going from river sediment to canal sediment to agricultural soils but are near background levels and do not exceed EPA regulatory levels.

- Manganese analyses are not yet complete.

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**SHEEP & CORN SAMPLES**

- 7 corn samples have been collected from families in the Shiprock and Upper Fruitland Chapters.
- 2 corn samples have been collected from the Navajo Agricultural Products Industry (NAPI) – these samples were not exposed to contaminants from the spill so they will be used for comparison to the samples collected in Shiprock and Upper Fruitland.
- Sample preparation methods were developed to enable trace element analysis of the corn.
- Analyses for lead, arsenic, and manganese in process.
- Additional corn plants, water and agricultural soil collected fall 2017 – analyses underway.
- No sheep samples have been collected – issues with sheep grazing in various locations during different seasons. Some of these areas were not affected by the Spill.
DISSEMINATION

- 3 listening sessions
- 12 focus groups
- 8 teach-ins
- Navajo Pres & VP and Community Partners visit UA & participate in a panel

STUDENT TRAINING

- Trained 71 students from UA, NAU, Diné College, U. of AR, Ft. Lewis College, Navajo Technical University, Navajo Preparatory High School, New York University, Claremont McKenna, Tohono O’odham Community College
- Students from many levels:
  - Middle School (1), High School (2), Associate (4), Bachelor (45), Masters (5), Doctoral (12)
- Students from many ethnic backgrounds:
  - Diné, Tohono O’odham, Hopi, Cherokee, Hispanic Caucasian, Asian, African American.
ACKNOWLEDGMENTS

Navajo Nation Western Agency
Shiprock, Upper Fruitland, and Aneth Chapters
Navajo Nation EPA

Navajo Nation Human Research Review Board

NIH National Institute of Environmental Health Sciences
IR21ES026948-01

Superfund Research Program
The University of Arizona
P42ES04940

Agnese Nelms Haury Program in Environment and Social Justice

UNIVERSITY LIBRARIES

SWEHSC Grant Number – P30 ES006694
Training Grant Number – T32 ES007091

Southwest Environmental Health Sciences Center

CAIR Center for American Indian Resilience

Center for Indigenous Environmental Health Research (CIEHR)
5P50ES026089-02
QUESTIONS

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