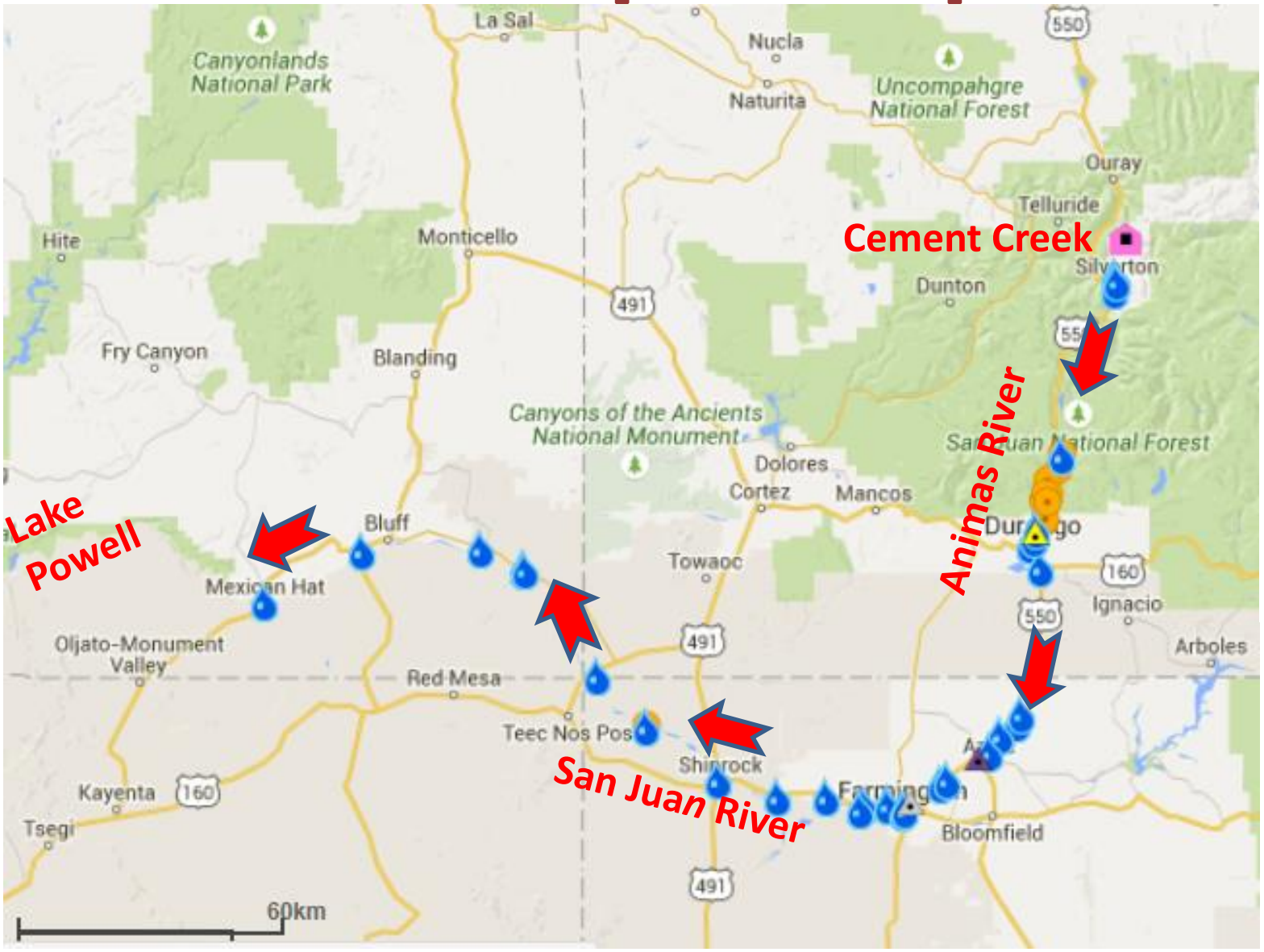
# Animas River Mine Water Spill

## Briefing Report

**For the Water and Natural Resources Committee**

**August 31, 2015**

# Spill Map




**EPA Operations**

Release Location

Incident Command Post

- Region 6
- Region 8
- Region 9

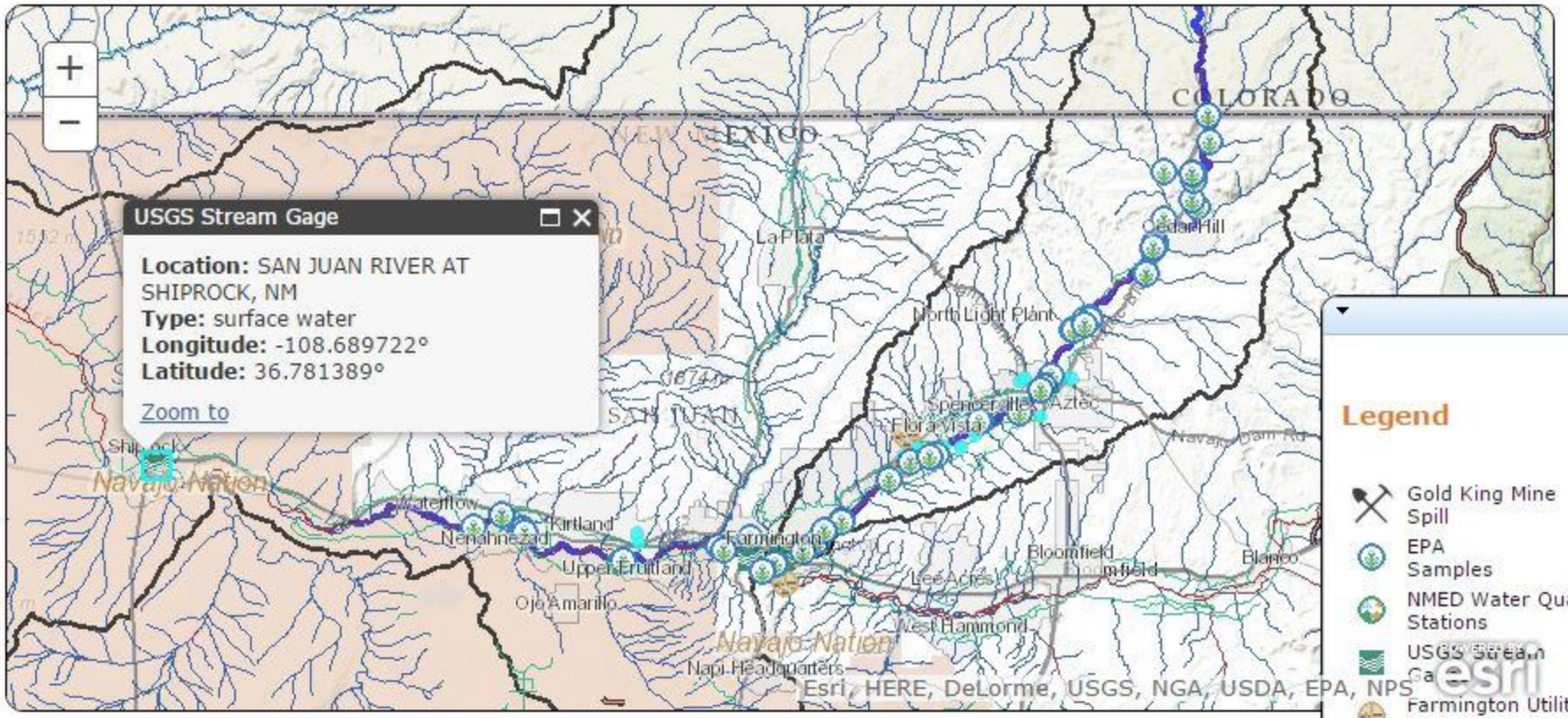
**EPA Sampling**

Surface Water

Sediment

# NMED's Interactive Spill Map

https://www.env.nm.gov/riverwatersafety/



# Executive Directives


**Governor Martinez has:**

- **Declared an emergency and authorized up to $750,000 in expenditures;**
- **Ordered NMED to lead the spill investigation; and**
- **Created a Long Term Impact Team consisting of NMED, NMDOH, NMOSE, NMDA, and NMDGF**

# New Mexico's Response

**The following New Mexico organizations are working together to protect water quality, public health and the environment.**

New Mexico Department of Agriculture

San Juan County New Mexico

New Mexico Water Resources Research Institute
A State-Wide Consortium for Water Research, Education, and Outreach

The University of New Mexico

NM State
All About Discovery!
New Mexico State University

# Acid Rock Drainage (ARD)

- Some metal mining areas contain sulfide minerals like pyrite (fool's gold).
- Sulfide minerals can oxidize and release sulfuric acid and metals into water.
- Undisturbed ore bodies can generate ARD, and mine workings create more potential for ARD.
- ARD can pollute ground and surface water and kill fish.
- Some ARD sites in New Mexico have been abated.

# How Did Cement Creek Get It's Name?

**Iron and other metals in ARD can precipitate and cement near-surface sediments into ferricrete. Geologic deposits of ferricrete in Cement Creek demonstrate that ARD has been occurring in this mineralized area long before mining began in the late 19th century.**

**Ferricrete**

**Bog Iron**

**Pictures from USGS**

# Mining, Milling and Smelting

- **Hundreds of miles of mine tunnels in the Silverton area provide even greater opportunity for oxidation of sulfide minerals and release of sulfuric acid and metals. ARD has been seeping out of mine workings and into Cement Creek for more than a century.**

- **A number of mills and smelters in the Silverton area also discharged waste into the Animas watershed.**

- **Significant flood/spill events occurred on October 5, 1911, in June 1975 (tailings pond breach and fish kill in the Animas River), and on June 6, 1978 (Lake Emma drained through mine workings and carried contaminants into Cement Creek and the Animas River).**

# The August 5, 2015 Blowout

- **Bulkheads installed to plug up ARD caused the impoundment of mine water in abandoned workings, and a 1,000 foot rise in the water table.**
- **Gold King Mine Adit #7 (mine tunnel entry) had collapsed and impounded water inside the mine.**
- **An EPA work crew digging into Gold King Adit #7 triggered the blowout and spill.**

# Initial Timeline

**Aug. 5, 2015 – Mine water began spilling into Cement Creek which flows into the Animas River near Silverton, Colorado**

**Aug. 6, 2015**

- **NMED was notified of the spill by the Southern Ute Indian Tribe**
- **NMED advised public water systems to stop taking water from the river, and provided notice of the spill to public sewer systems, the Navajo Nation, Arizona and Utah**
- **OSE staff advised ditch users to close river diversions**
- **NMED mobilized field teams and sampling equipment**

**Aug. 7, 2015**

- **Secretary Flynn, State Engineer Blaine, and NMED technical staff arrived on site**
- **NMED began monitoring and water sampling**
- **NMED issued additional precautions to stakeholders**
- **Secretary Flynn authorized up to $500,000 in emergency expenditures**
- **NMED created a dedicated webpage for spill info and data**

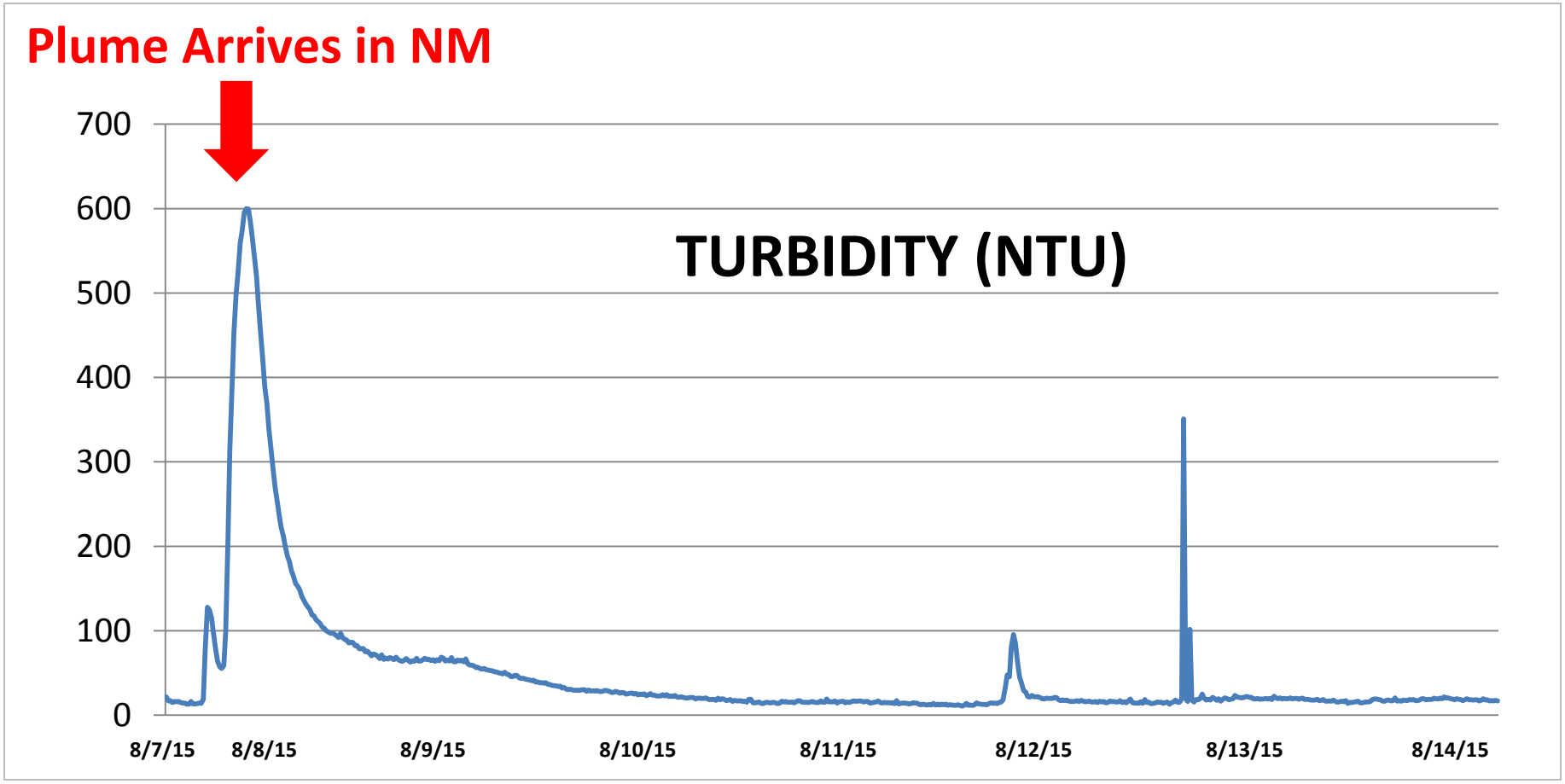
**Aug. 8, 2015**

- **Contamination plume entered New Mexico**

**Aug. 10, 2015**

- **NMED had 25+ staff on site**
- **Governor Martinez declared an emergency and authorized up to $750,000 in expenditures**

# Animas River near Aztec, NM (above Estes Arroyo)



# Heavy Metals in Surface Water

Plume Arrives in NM

| µg/L | Drinking Water Standard | 8/5/15 Cement Creek | 8/5/15 Animas in CO | 8/7/15 Animas in N.M. | 8/8/15 Animas in N.M. |
|---|---|---|---|---|---|
| Arsenic | 10 | 8,230 | 1,080 | ND | 21 |
| Cadmium | 5 | 165 | 28 | ND | ND |
| Lead | 15 | 179,000 | 25,600 | 3 | 350 |

Total (unfiltered) metals in micrograms per liter (µg/L)

# Information Available on August 6-7

- Surface water samples near the spill area had high concentrations of metals that exceeded standards for groundwater and drinking water
- Anecdotal report from Colorado of a private domestic well near the Animas River that was pumping water similar in color to the spill
- Concern about a weather system and possible flooding in the Animas River and inundation of private domestic wells near the river
- Concern from technical reports and news stories that the nature of the spill might be different from historical spills and long-term seepage

# Precautions Issued on Aug. 6

- **NMED advised public water systems to stop taking water from the Animas River.**
- **NMED and OSE advised all other water users to stop taking water from the Animas River.**

# Precautions Issued on Aug. 7

**NMED advised residents to refrain from:**

- **Using Animas floodplain level wells for cooking or drinking;**
- **Drawing river or canal water for domestic supply; and**
- **Watering livestock with river water.**

**N.M. Department of Game and Fish also advised anglers not to fish in the Animas River and not to eat fish caught in the watershed.**

# Public Drinking Water Protection[1]

- **NMED was in daily contact with system operators to share information and provide consultation and assistance**
- **Intakes from the Animas River were closed prior to arrival of the plume**
- **NMED and water systems conducted extensive testing of public drinking water**
- **Water storage was calculated and water sharing efforts were initiated**
- **No customers received contaminated drinking water or lost water service**

[1] NMED has been granted primacy by EPA to administer the Drinking Water Program (NM Drinking Water Regulations, 20.7.10 NMAC). The Code of Federal Regulations Part 141 National Primary Drinking Water Regulations and Part 143 National Secondary Drinking Water Regulations are adopted by reference.

# Private Domestic Well Protection

- NMED tested samples from ~580 private domestic wells during a Water Fair from Aug. 10-15, 2015; elevated specific conductance, iron and manganese detected in some wells; test results have been provided to well owners
- NMED and U.S. EPA sampled 144 private domestic wells located within 500 feet of the Animas River for laboratory analysis of metals and general chemistry; test results will be provided to well owners upon completion of analyses
- Test results to date, and a preliminary hydrogeologic assessment, provide no evidence that any private domestic wells have been impacted by the plume

# Irrigation Water Protection

- **Not all irrigation ditch systems could be closed prior to arrival of the plume**
- **All ditches were flushed with river water for 12 hours, without irrigation diversions, to wash mine water sediment back into Animas River**
- **Drinking water system intakes on the Animas River were not opened until after the irrigation ditches had been flushed**

# Fish, Livestock and Wildlife Protection

- **No evidence of fish kills; caged fish survived immersion in colored river water.**
- **No evidence of unusual animal mortality.**
- **Long term monitoring and assessment is needed.**

# Response Summary

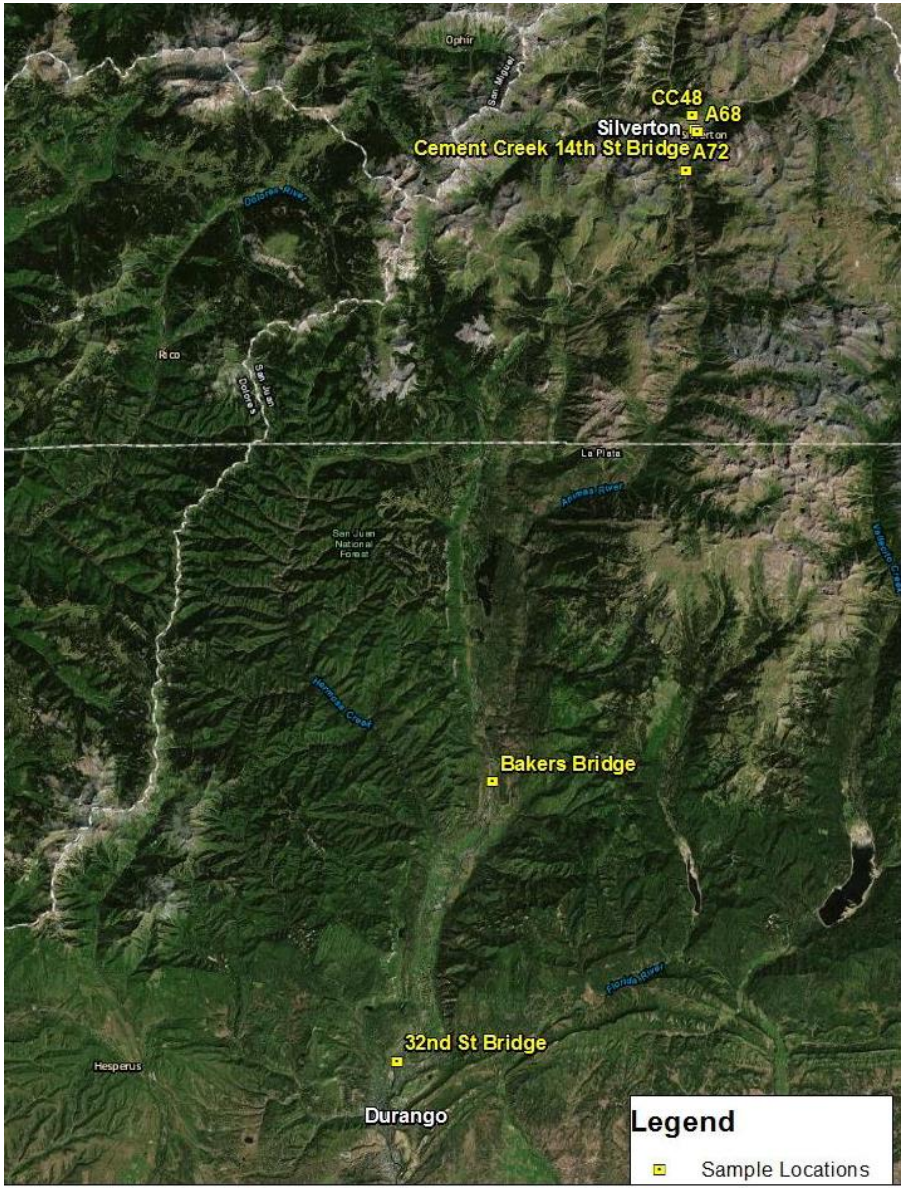
- NMED was onsite, and began testing water, before the plume arrived in New Mexico
- Public drinking water supplies were protected and monitored
- No evidence private domestic wells impacted by spill
- Irrigation ditches have been flushed
- No evidence of unusual fish, livestock or wildlife mortality
- Long term monitoring and assessment of spill impacts is needed

# Geochemistry and Metals Transport

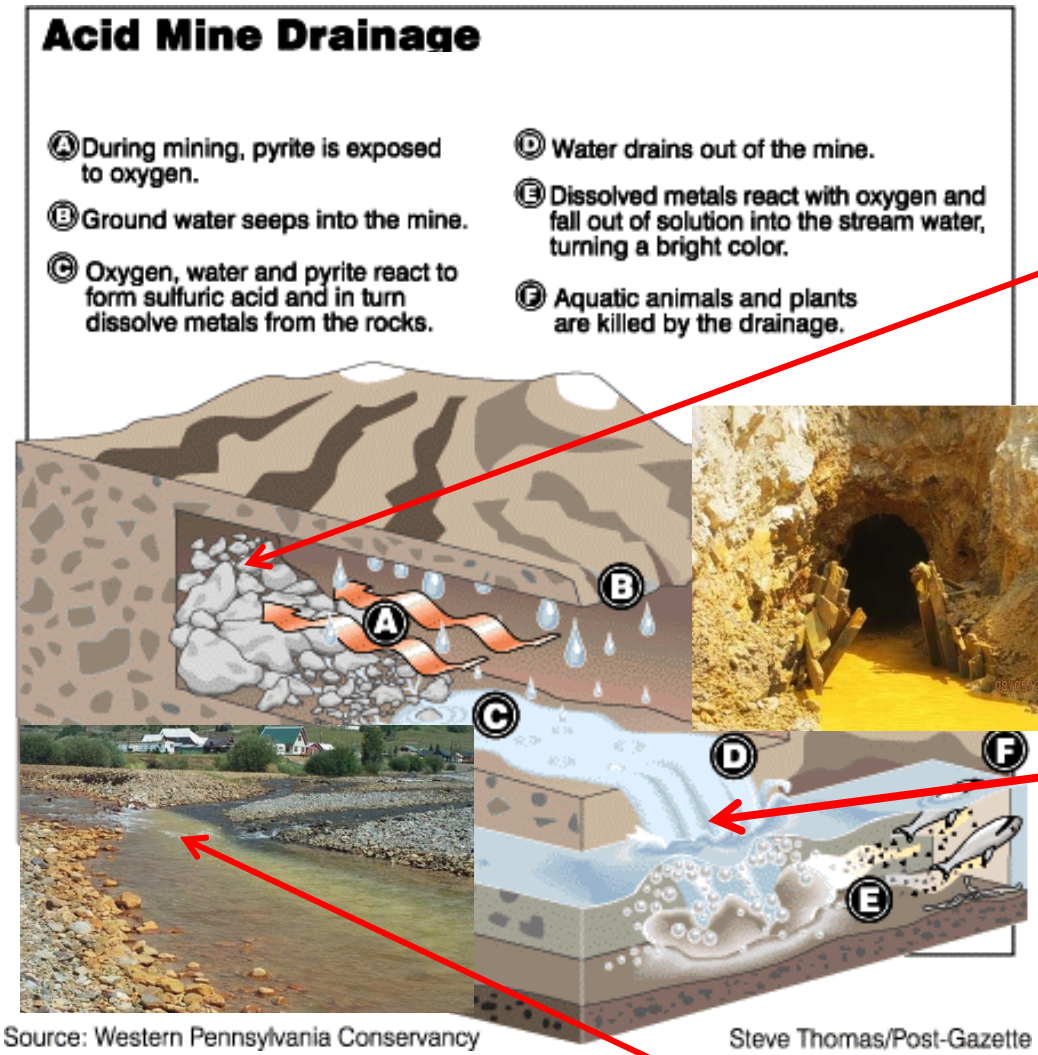
- **Heavy metal concentrations in river water were generally much higher in the suspended solids (mud), not in the dissolved phase.**
- **High contaminant levels near the spill area decreased downstream.**
- **Discoloration of river water did not necessarily mean that heavy metals were present at concentrations exceeding public health standards.**

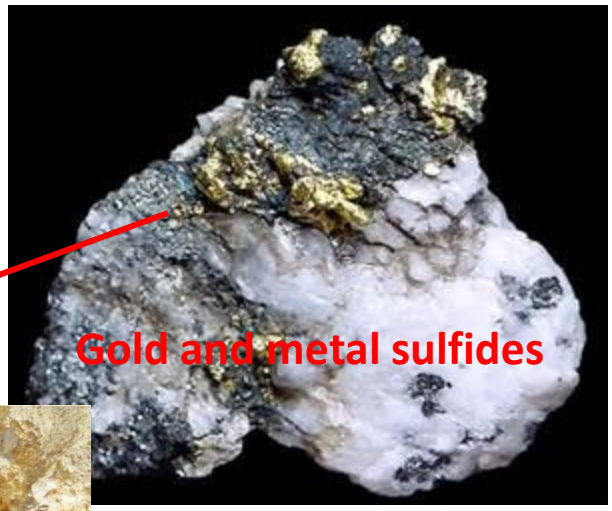
# Locations of EPA Sampling Stations in Colorado

**Cement Creek: CC**
**Animas River: A**



# Conceptual Model of the Gold King Mine and Release of Metals to Cement Creek and the Animas River, Colorado

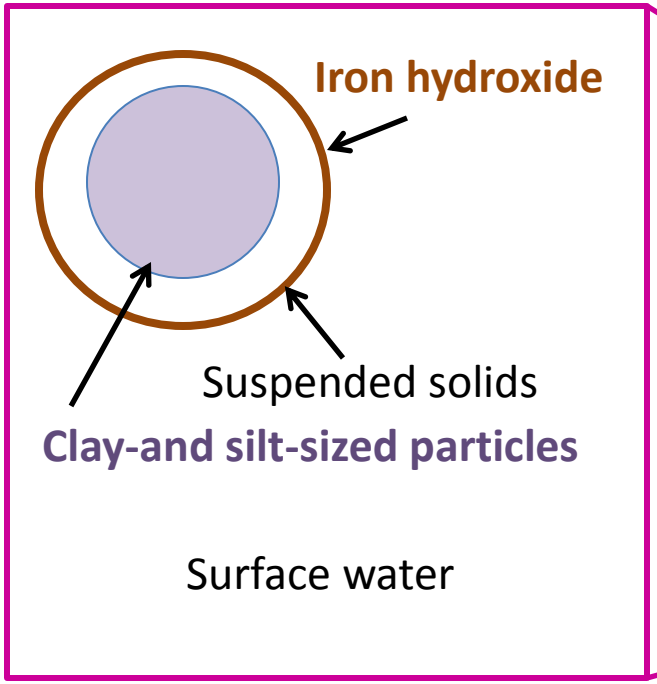



Mine adit (entrance)


Confluence of Cement Creek and Animas River

# Conceptual Model of Contaminants Released from the Gold King Mine and Their Transport Along the Animas River in Colorado and New Mexico



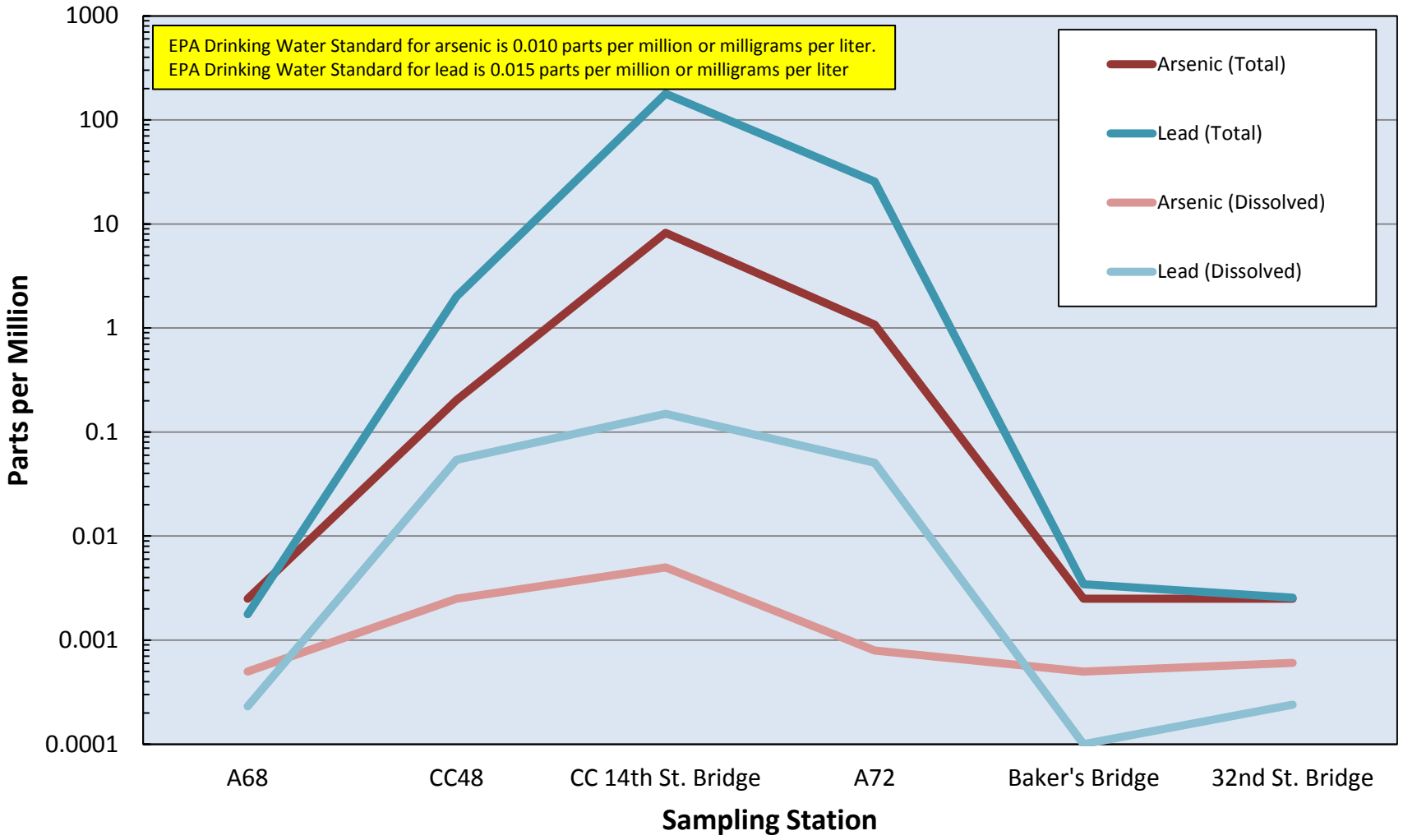

**The very high abundance of suspended particles containing iron hydroxide give the Animas River a brown color.**

**Contaminants also dissolve in surface water at lower concentrations compared to suspended particles.**

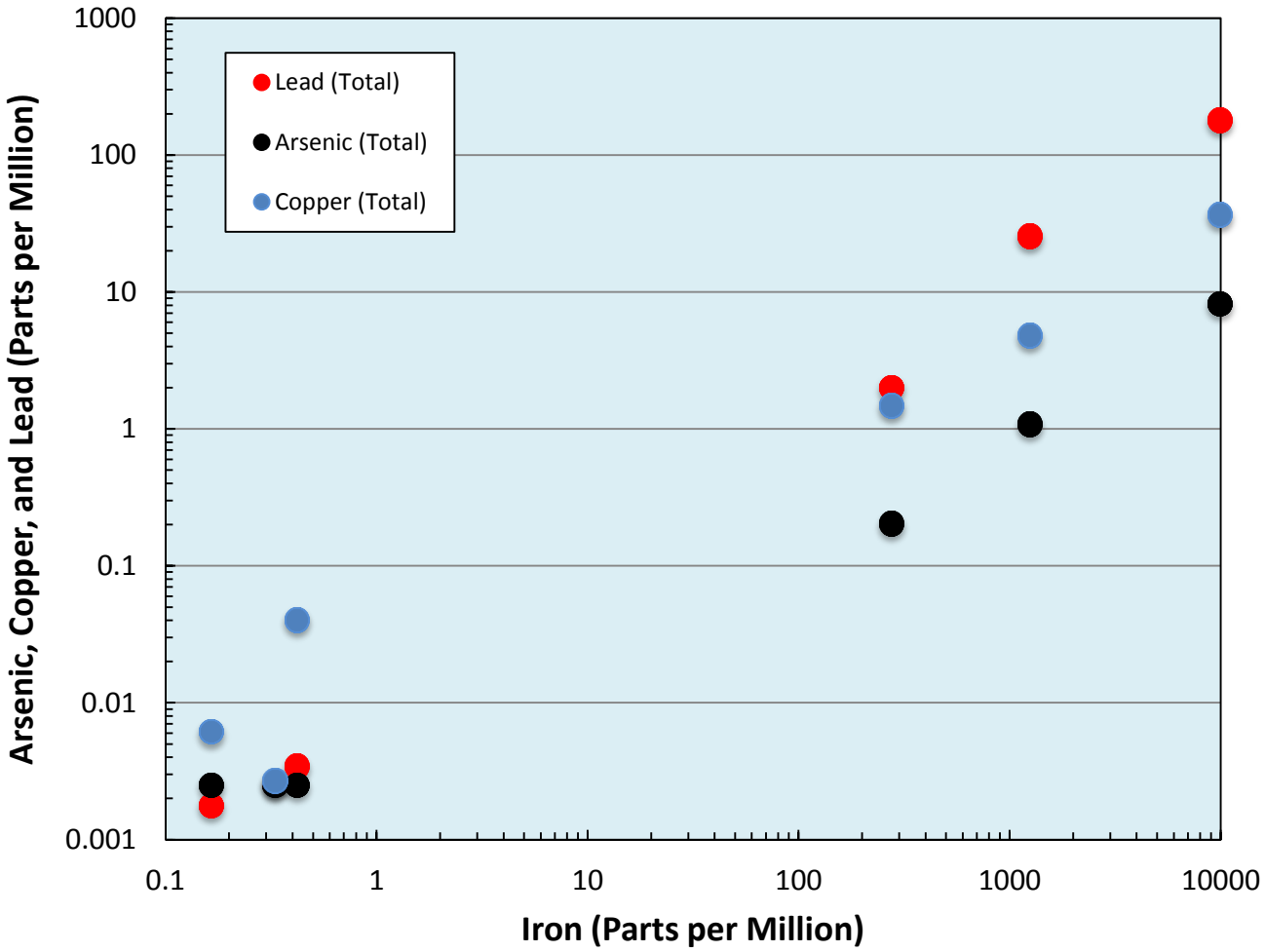
**Suspended particles of clay- and silt-sized solids**

**Iron solids (iron hydroxide) containing arsenic, lead, zinc and other metals coat clay- and silt-sized particles**

# Total and Dissolved Concentrations of Arsenic and Lead in Cement Creek and Animas River, Colorado on August 5, 2015



# Total Concentrations of Iron, Arsenic, Copper, and Lead in Cement Creek and Animas River, Colorado on August 5, 2015



# Data Gaps

- Background contaminant levels in sediment and water caused by natural geologic sources and historical mining and milling
- Distribution and mass balance of contaminants
- Complete characterization of ground and surface water (metal speciation, stable isotopes, microorganisms)
- Aquifer-river hydraulics
- Organism uptake and bio-monitoring of plants, livestock, macro-invertebrates, fish, wildlife and humans
- Toxicological and ecological risk assessment