THE AMLU

- WHO we are
- WHY our work is important
- WHEN (key dates)
- WHERE abandoned mines are located
- WHAT we do
- Key Challenges
WHO

10 AMLU STAFF
3 Engineering Geologists
2 Environmental Scientists
1 Research Program Specialist I (GIS)
1 Research Program Analyst II (GIS)
1 Associate Governmental Program Analyst (AGPA)
1 Environmental Planner
1 Environmental Program Manager (Managerial)

Front row (left to right): Greg Marquis, Cy Oggins, Sarah Reeves

Back row (left to right): Dave Tibor, Sam Hayashi, Craig Turner, Jon Mistchenko, and Douglas John.

Missing (New): Debbie DuVall and Stephanie Taylor
WHY

- Every year, people die or are injured in California abandoned mine accidents (>200 reported incidents: 1952-2009).

- Liability ($ spent on lawsuits not remediation).

- Abandoned mines provide habitat/shelter for bats & other wildlife.

California leaf-nosed bat
(© Merlin D. Tuttle, Bat Conservation International)
Tens of thousands of mines dug in California.

1848+  

1997  
AMLU created to:
- Evaluate existing data.
- Inventory AML sites.
- Compile AML database.
- Report to Legislature on magnitude & scope of AML issues in CA (issued 2000).

2002  
Begin physical hazard remediation (use of Gold & Silver Fees for physical hazard remediation began in 2006).

2009  
Received U.S. Bureau of Land Management (BLM) Fix A Shaft Today! award.

2008-10+  
Awarded >$4M by BLM & National Park Service for AML inventory and remediation on federal lands.
WHERE

California’s estimated 47,000 abandoned mines

- San Bernardino 26%
- Inyo 21%
- "Mother Lode" * 12%
- Kern 10%
- Mono 5%
- Riverside 5%
- Others 21%

* Sierra, Nevada, Placer, El Dorado, Amador, Calaveras, Tuolumne, Mariposa, Plumas, and Madera counties.

Ownership by Agency
- Federal 67%
- State or Local 31%
- Private 2%

AML Hazard Type
- Physical Safety 84%
- Environmental 11%
- Neither 5%

Commodity Mined (%)
- Gold 48%
- Aggregate/Stone 13%
- Copper 5%
- Silver 2%
- Mercury 2%
- Others 30%
ACID ROCK DRAINAGE (ARD)

- Commonly associated with precious and heavy metal deposits.
- Occurs when sulfide minerals are exposed to water and air creating acidic conditions.
- Acidic water can dissolve heavy metals such as lead, zinc, and arsenic, which can be more hazardous to people and animals than the acidic water.
- Dissolved metals in runoff may kill fish, other aquatic life, birds, and plants for miles downstream.
- Leached heavy metals may accumulate in the food chain.
ENVIRONMENTAL HAZARDS

ARSENIC

- Most commonly associated with gold and silver deposits.
- Concentrated during milling process.
- Soluble in water (can contaminate surface and ground water supplies).
- May bioaccumulate in plants.
- Affects drinking water, sportfishing industries and other recreational activities (dust inhalation).
- Onsite contact with contaminated soil (Mesa de Oro).

Child playing in arsenic-laden tailings from Lava Cap Mine, Nevada Co. Photo courtesy of Dan Ziarkowski, DTSC.
ENVIROMENTAL HAZARDS

MERCURY/METHYLMERCURY

- 90% of mercury mined in the U.S. was mined in California.
- Mercury mined in Coast Ranges used at gold mines in Sierra Nevada.
- ~5-6 million kilograms (kg) of mercury lost from Sierra Nevada gold mines and ~30 million kg lost from Coast Range mercury mines (Churchill, 2000).
- Thousands of miles of streams, rivers, the Delta, and San Francisco Bay are potentially contaminated.

Warning sign at Sulphur Bank Mercury Mine Superfund site, Lake Co. (source: http://www.epa.gov/region09/annualreport/07/land.html)
Sulfate reducing bacteria can convert mercury into a more bioavailable form called methylmercury, which readily accumulates in the food chain.

High levels of methylmercury in fish can cause neurological and reproductive problems in humans when consumed.

More than two dozen streams, rivers, lakes, bays, and the Delta have fish advisories limiting the size, type and quantity of fish that should be eaten from these waterbodies.
ENVIRONMENTAL HAZARDS

OTHER CHEMICAL HAZARDS

LEAD, ZINC, OTHER HEAVY METALS

- Mined as a product and is also a byproduct of processing (slag, assay process, etc.).

ASBESTOS

- Can be found in 42 California counties; commonly associated with serpentine rocks.
- Used in high temperature and strength applications, such as fireproofing and building materials.
- Inhalation of asbestiform minerals over long periods of time can cause lung cancer.
Over-steepened highwalls can be unstable.

The crest of the highwall can be overgrown, or have loose material or tension cracks, which could lead to falling and injury or death.

Falling rocks could injure or kill people standing at the highwall’s base.
PHYSICAL HAZARDS

ADITS & HORIZONTAL OPENINGS

- Provide easy access to underground mine workings.
- Hazards may include unstable ground, hidden or boarded over winzes, bad or stagnant air, wildlife (snakes, etc.).

Mitigation Measures
- Bat gate or bat culvert
- Polyurethane foam
- Blasting
- Backfill

Islander Mine, San Bernardino Co., before and after bat gate installed
WHAT WE DO
Physical Hazard Remediation

Clockwise from top left: fence, backfill, culvert gate, cupola, bat gate, PUF.
General Overview

- **Two-person field teams.**

- **Pre-field:** Use GIS, maps, and other sources to plan site visits.

- **In-field:** Use GPS, digital camera, & survey form to collect data on each mine “feature” (shaft, adit, tailings pile, etc.).

- **Post-Field (office):** Manipulate data in ESRI Arc 3.2 & 9.x; enter data to Access database (AMLU now has records of >41,700 features on nearly 3,528 sites).
WHAT WE DO

Physical Hazard Remediation Summary: >660 Features Remediated (2002-10)*

Average Cost

Fencing $200
Backfill $500
Culvert Gate $3,500
PUF $4,500
Bat Gate $6,000
Cupola $12,000

Projects Completed

Bat Gate, Cupola (191; 29%)
Bat Gate (160; 24%)
Backfill (185; 28%)
PUF (72; 11%)
Other: remove debris, blast, etc. (53; 8%)

* (through 4/2010)
WHAT WE DO

- Chemical remediation on state-owned land.

- Outreach: TV newspaper coverage.
  - Otter Creek cupola gate near elementary school (2006).
  - “Stay Out-Stay Alive” DVD with Mine Safety and Health Administration (2008).
  - Discovery Channel’s “Dirty Jobs” (2009).
AML Physical Hazard Remediation Partners*

* Partners as of 9/09

**STATE**
- California Conservation Corps
- California Department of Fish and Game
- California Department of Transportation
- California State Lands Commission
- California State Parks
  - Bodie State Historic Park
  - Carnegie-Tesla State Vehicular Recreation Area
  - Red Rock Canyon State Park
  - Salton Sea State Recreation Area
  - Office of Historic Preservation

**FEDERAL**
- Bureau of Land Management (California State Office & Bakersfield, Barstow, Bishop, El Centro, Folsom, Lake Havasu [BLM Arizona], Needles, Palm Springs, & Ridgecrest Field Offices)
- Bureau of Reclamation, Mid-Pacific Region (Auburn & Folsom State Recreation Areas)
- National Park Service, Pacific West Region (Joshua Tree National Park & Mohave National Preserve)
- Office of Surface Mining
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service, California and Nevada Operations
- U.S. Forest Service, Region 5 (Cleveland, Eldorado, Humboldt-Toiyabe, Inyo, Klamath, Los Padres, Plumas, San Bernardino, Sequoia, Shasta-Trinity, Six Rivers, & Tahoe National Forests)

**LOCAL AGENCIES, NONPROFITS, AND PRIVATE PARTNERS**
FUNDING

$ Mine Reporting Fees
$ Silver and Gold Fee
$ Stimulus Funds
$ Federal Contracts
SOME CURRENT CHALLENGES & THE OUTLOOK FOR THE FUTURE

PUBLIC HEALTH & SAFETY
- Population shifts and increased recreation in and around heavily mined areas.
- Need for increased public awareness and recognition of the hazards associated with AML sites.

INVENTORY
- Vast majority of sites in California have not been assessed. (The AMLU estimates that >90% of sites need field checking.)
- Thus, prioritization of hazards has been limited.

30’ wide x 30’ deep pit under home in residential development near Old Brunswick Mine, Nevada Co. (1998).
SOME CURRENT CHALLENGES & THE OUTLOOK FOR THE FUTURE

- **REMEDIATION**
  - Liability ("Good Samaritan") concerns.
  - Shortage of staff and qualified contractors for physical hazard remediation.
  - New and proven technologies.

- **FUNDING**
  - An estimated $5 billion needed to remediate all physical and chemical abandoned mine sites in California (2002 estimate).
  - Limited potential new funding sources: include appropriations to federal and state land-owning agencies and the U.S. Army Corps of Engineers RAMS Program.
  - Currently no public funding is available to help private landowners with abandoned mine remediations.
QUESTIONS