Central Valley Water Board
Sacramento Office

Introduction to Mine Waste Characterization

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Mining Areas: Sacramento Office

- **Coast Range Mercury Mines**
  (mercury, pH?, salts and other metals)

- **Sierra Nevada Gold Mines**
  (arsenic, mercury, pH?, salts and other metals)

- **Copper Belt – Lower Sierra Nevada Foothills**
  (copper, pH, salts and other metals)
Mining Area Locations

- Sacramento
- Sierra Nevada Gold Mines
- Coast Range Mercury Mines
- Copper Belt Mines
- Bay Area
- Lake Tahoe
Coast Range Mercury Mines

Mount Diablo
Sulphur Bank Mine
Elgin Quicksilver Mine
Sierra Nevada Gold Mines

Yuba City

Sacramento

Stockton

LEGEND

- Principal Areas of Mine Pollution
- Topographically Occurring Mine Symbols (Point)
- Topographically Occurring Mine Symbols (Polygon)

REFERENCES

1. Principal Areas of Mine Pollution point data obtained from the California Department of Conservation, Office of Mine Reclamation. Date of data: 2000.

2. Topographically Occurring Mine Symbols (TCMIS) point and polygon data obtained from the California Department of Conservation, Office of Mine Reclamation, Abandoned Mine Lands Unit. Date of data: June 5, 2001.


NOTES

Mine and mine pollution locations are approximately located using information obtained from the geographic information system (GIS) database.

SCALE: 1:600,000

MILES
Lower Brush Creek Mine
Copper Belt Mines

Yuba City
Sacramento
Stockton

Copper Area

LEGEND
- Principal Areas of Mine Pollution
- Topographically Occurring Mine Symbols (Point)
- Topographically Occurring Mine Symbols (Polygon)

REFERENCES
1. Principal Areas of Mine Pollution point data obtained from the California Department of Conservation, Office of Mine Reclamation. Date of data: 2000.
2. Topographically Occurring Mine Symbols (TOMS) point and polygon data obtained from the California Department of Conservation, Office of Mine Reclamation, Abandoned Mine Lands Unit. Date of data: June 5, 2001.

NOTES
Mines and mine pollution locations are approximately located using information obtained from the geographic information system (GIS) database.
Copperopolis
Newton Copper Mine
Potential Mining Impacts

- Coast Range Mercury Mines
  (mercury, pH?, **salts** and other metals)

- Sierra Nevada Gold Mines
  (arsenic, mercury, pH?, **salts** and other metals)

- Copper Belt – Lower Sierra Nevada Foothills
  (copper, pH, **salts** and other metals)
What is mining waste?

Title 27 California Code of Regulations

Mining Waste Management Regulations §22470
“Mining waste” (SWRCB) means all waste materials (solid, semi solid, and liquid) from the mining and processing of ores and minerals including soil, waste rock, and other forms of overburden as well as tailings, slag, and other processed mining wastes.

(a) Definition — Mining waste is waste from the mining and processing of ores and mineral commodities. Mining waste includes:

(1) overburden;
(2) natural geologic material which have been removed or relocated but have not been processed (waste rock); and
(3) the solid residues, sludges, and liquids from the processing of ores and mineral commodities.
Mining Waste Includes:

- Overburden
- Waste Rock
- Low grade ore
- Spent ore
- Unprocessed ore
- Backfilled waste
- Mill Tailings
- Process Water
Waste Characterization

California Water Code 13260

Before any person discharges mining waste, the person shall first submit both of the following to the regional board:
• A report on the physical and chemical characteristics of the waste that could affect its potential to cause pollution or contamination.

• A report that evaluates the potential of the discharge of the mining waste to produce, over the long term, acid mine drainage, the discharge or leaching of heavy metals, or the release of other hazardous substances.
How do we get the information on the physical and chemical makeup of the waste?

Analytical testing of the mining waste

Tech Note – Mine Waste Characterization
1. Determine the Total Threshold Limit Concentrations (TTLCs) of the solid waste.

California Title 22 Metals (CAM 17) using EPA Method 6010B is generally the starting point to determine if the solid fraction of the mining waste is hazardous. (Table 1 - Tech Note)
2. Acid Base Accounting (ABA) of the solid mining waste.

ABA analysis involves determination of the acid generation potential (AGP) and the acid neutralization potential (ANP) according to EPA Method 600\2-078-54 (Sobek and others, 1978).
3. Determine the Soluble Threshold Limit Concentrations (STLCs) of the mining waste (EPA Method 6010B).

The Waste Extraction Test (WET) procedure is used to determine the soluble constituents of solid waste that could potentially migrate to waters of the State. Tech Note – Table 4
Table 4. Laboratory Constituent List for Surface Water and Groundwater Samples

<table>
<thead>
<tr>
<th>Constituent</th>
<th>EPA Method</th>
<th>Target Method Detection Limit (mg/l)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium, dissolved</td>
<td>M200.7 ICP</td>
<td>0.2</td>
</tr>
<tr>
<td>Magnesium, dissolved</td>
<td>M200.7 ICP</td>
<td>0.2</td>
</tr>
<tr>
<td>Sodium, dissolved</td>
<td>M200.7 ICP</td>
<td>0.3</td>
</tr>
<tr>
<td>Potassium, dissolved</td>
<td>M200.7 ICP</td>
<td>0.3</td>
</tr>
<tr>
<td>Chloride, dissolved</td>
<td>M325.2</td>
<td>1</td>
</tr>
<tr>
<td>Bicarbonate, dissolved</td>
<td>M2320B-Titrametric</td>
<td>2</td>
</tr>
<tr>
<td>Carbonate, dissolved</td>
<td>M2320B-Titrametric</td>
<td>2</td>
</tr>
<tr>
<td>Total Alkalinity, dissolved</td>
<td>M2320B-Titrametric</td>
<td>2</td>
</tr>
<tr>
<td>Silica, dissolved</td>
<td>M200.7 ICP</td>
<td>0.2</td>
</tr>
<tr>
<td>Sulfate, dissolved</td>
<td>M300.0</td>
<td>10</td>
</tr>
<tr>
<td>Nitrate/Nitrite as N, dissolved</td>
<td>M353.2</td>
<td>0.02</td>
</tr>
<tr>
<td>Ammonia (as N)</td>
<td>M350.1</td>
<td>1.5</td>
</tr>
</tbody>
</table>
The analytical analysis determines if the mining waste contains constituents that are:

- hazardous
- acid generating
- soluble
- above water quality objectives, or
- inert.
What do I do with this data?

- If you are only classifying the waste, you are done sampling and you should compare it to appropriate criteria.

- If you want to know if mining has impacted water quality, further surface and groundwater sampling is necessary.
Surface and Ground Water Sampling
Initial Sampling us Constituents on Table 4 from Tech Note – Mine Waste Characterization

- Calcium, Magnesium, Sodium, Chloride, Bicarbonate or alkalinity and Sulfate
- Reduce sampling after initial rounds of samples
USEPA Report

Report Results

- Same geochemical parameters defined a consistent pattern
- Results reproducible at a site
- The geochemical fingerprint distinctly different from natural groundwater
Figure 15

Gold Knoll ODS
GWM-11 & 14

Legend:
- GWM-11
- GWM-14

- Trend line

Sulfate (mg/l) vs. Date

Nitrate (mg/l) vs. Date
Groundwater Sampling

Rathburn-Petry

Do we do Groundwater Sampling?
Conclusion

Any questions?