

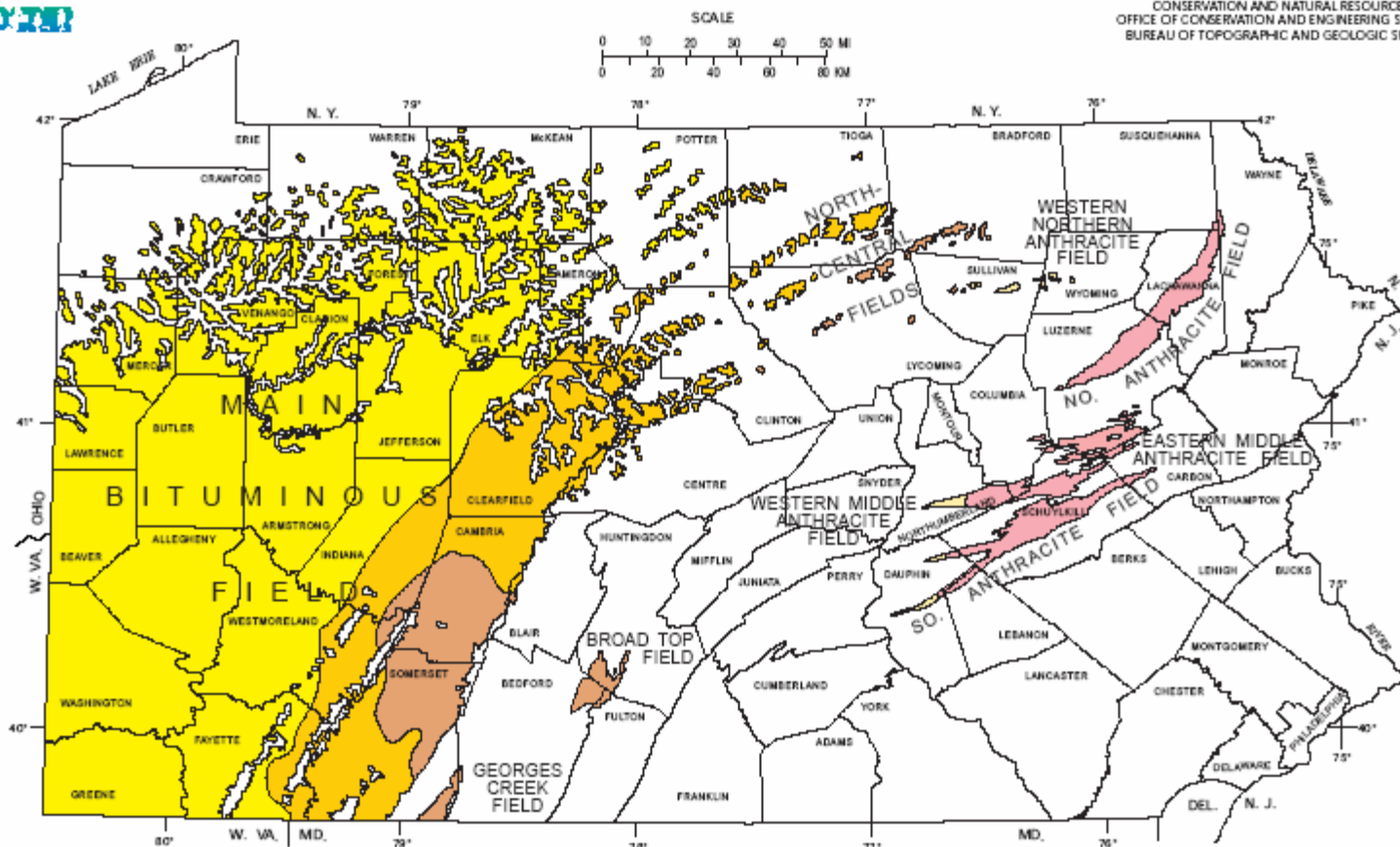
**A whirlwind tour through
Anthracite mining, AMD &
treatment**

MAP 11



DISTRIBUTION OF PENNSYLVANIA COALS

COMMONWEALTH OF PENNSYLVANIA
 DEPARTMENT OF
 CONSERVATION AND NATURAL RESOURCES
 OFFICE OF CONSERVATION AND ENGINEERING SERVICES
 BUREAU OF TOPOGRAPHIC AND GEOLOGIC SURVEY



EXPLANATION

BITUMINOUS FIELDS



High-volatile bituminous coal



Medium-volatile bituminous coal



Low-volatile bituminous coal

ANTHRACITE FIELDS



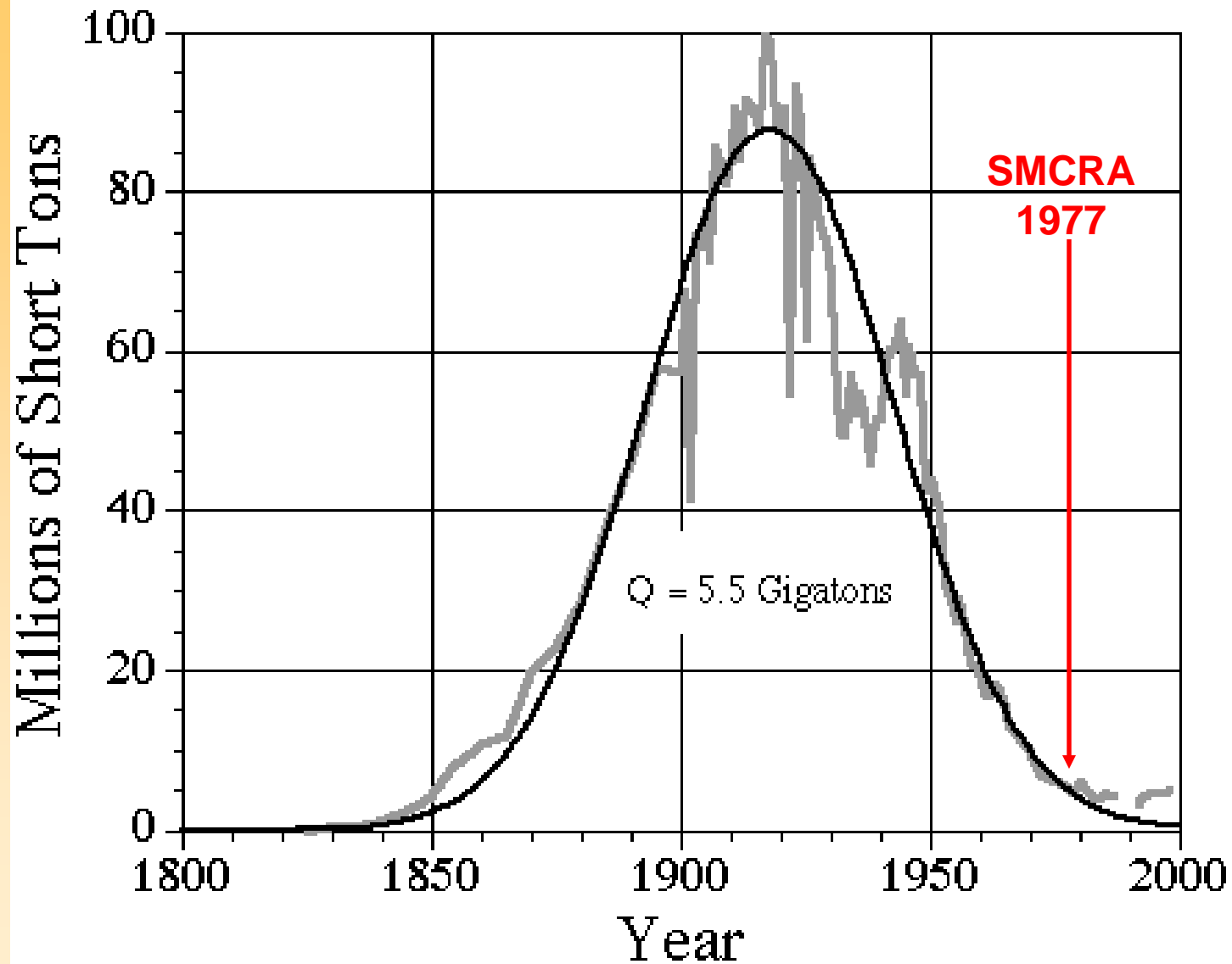
Anthracite



Semi-anthracite

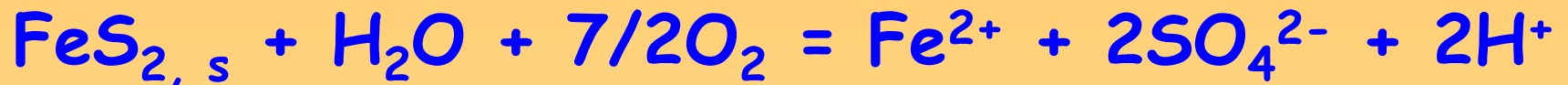
Third edition, 1992

Pennsylvania Anthracite Production

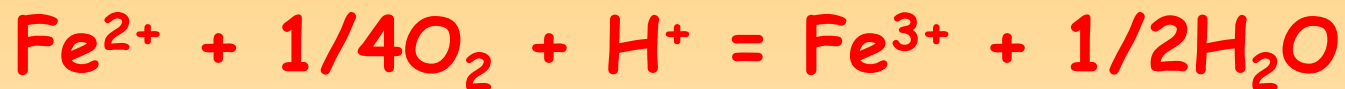


How does AMD form?

Underground - pyrite dissolves



Above ground - dissolved iron oxidizes



Above ground - "yellow boy" forms



Aluminum hydroxide

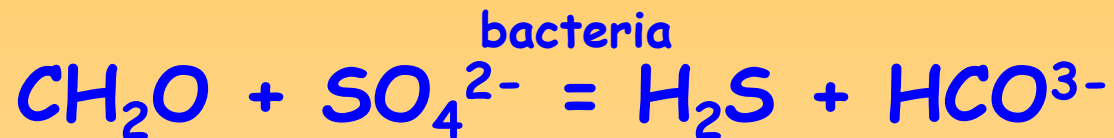


Manganese oxidation

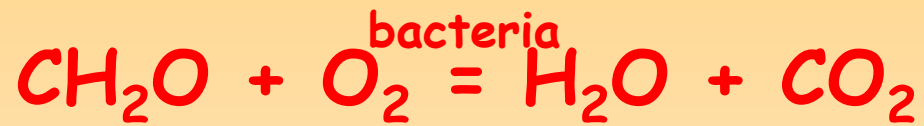


Other important reactions

Making sulfide in compost



Consuming oxygen, producing CO_2 in compost



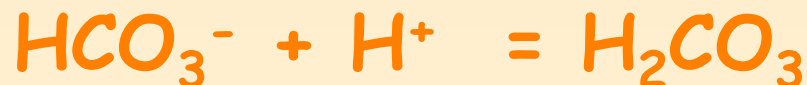
Producing alkalinity

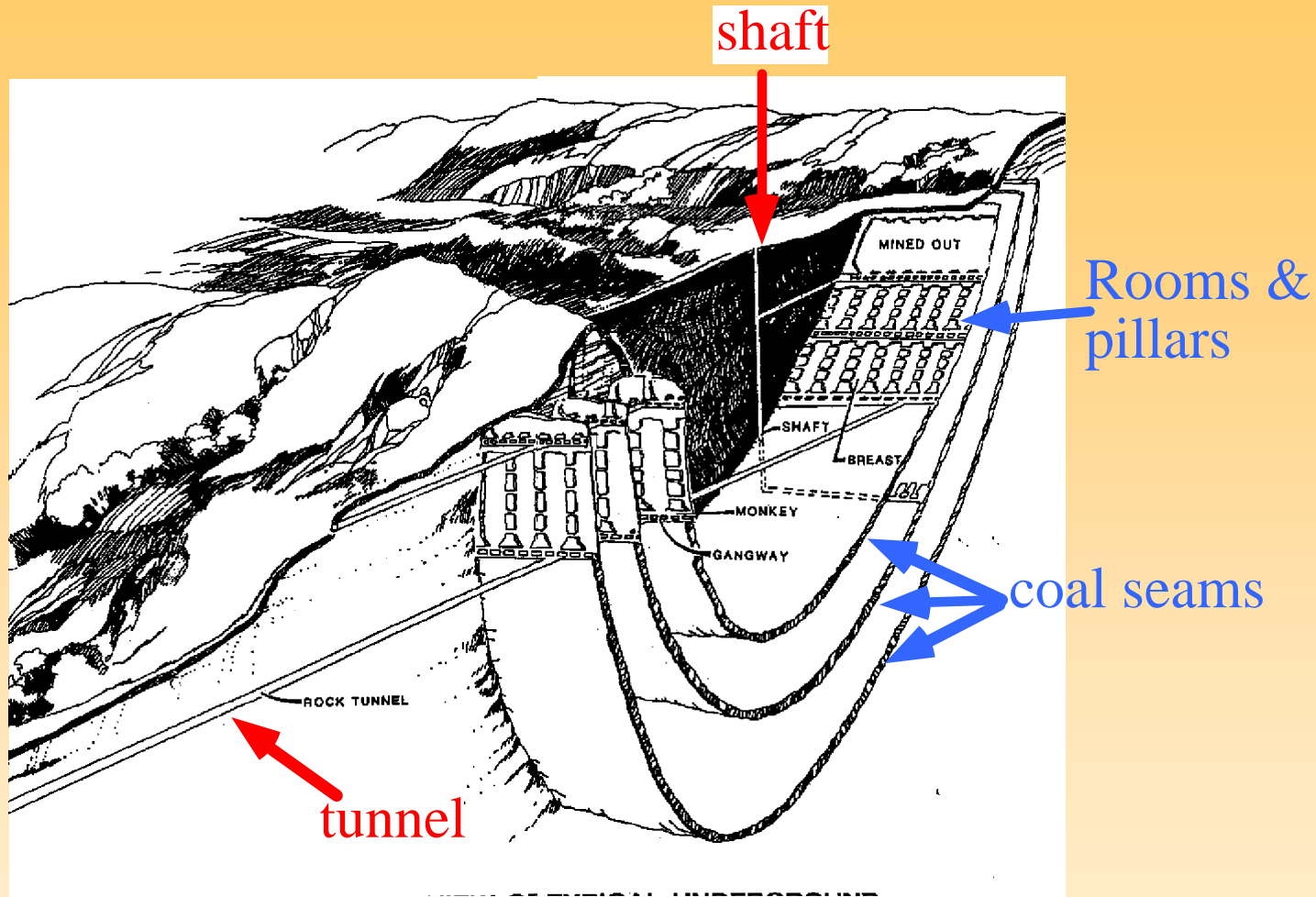


Raising pH



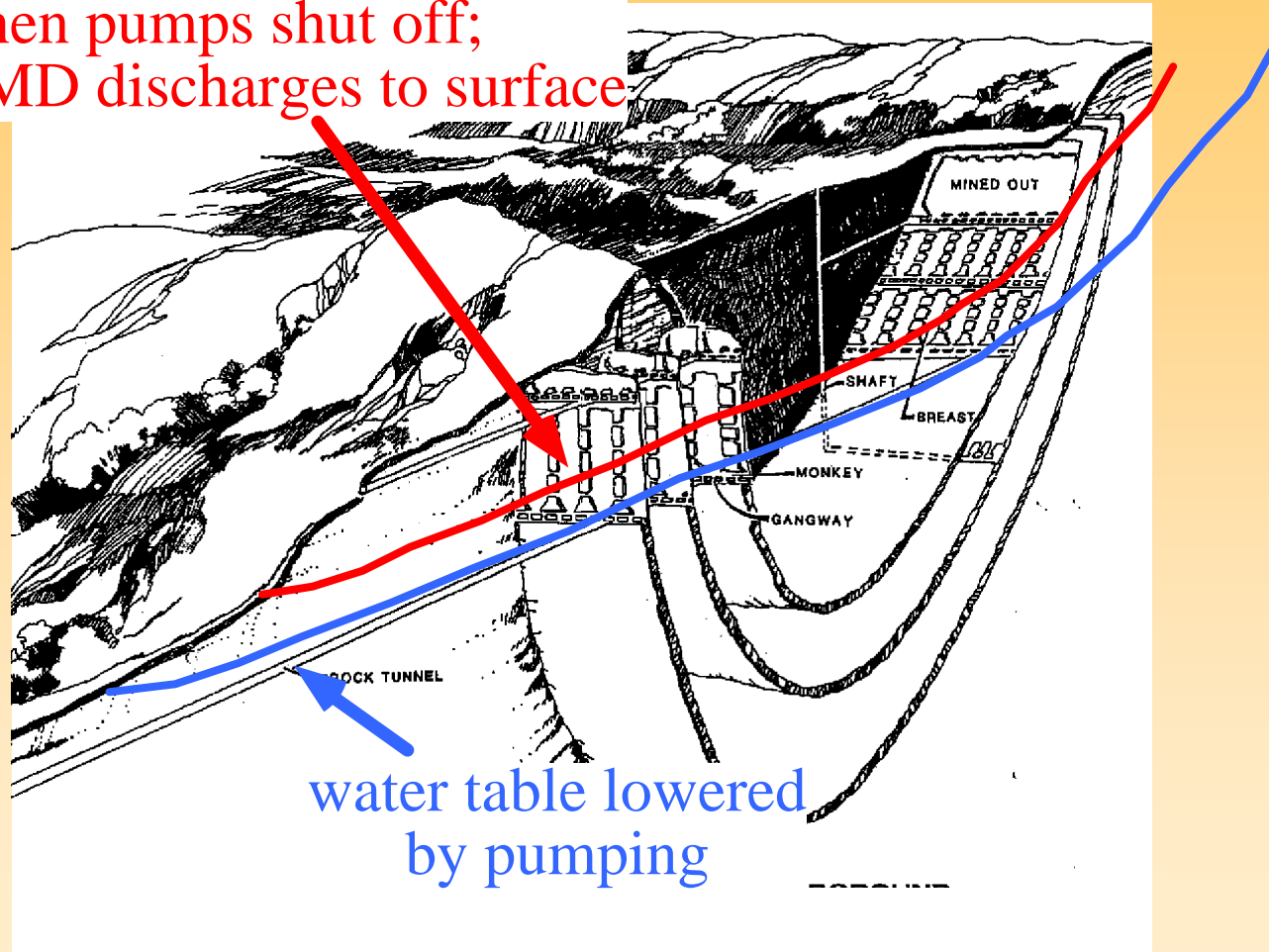
Neutralizing acid



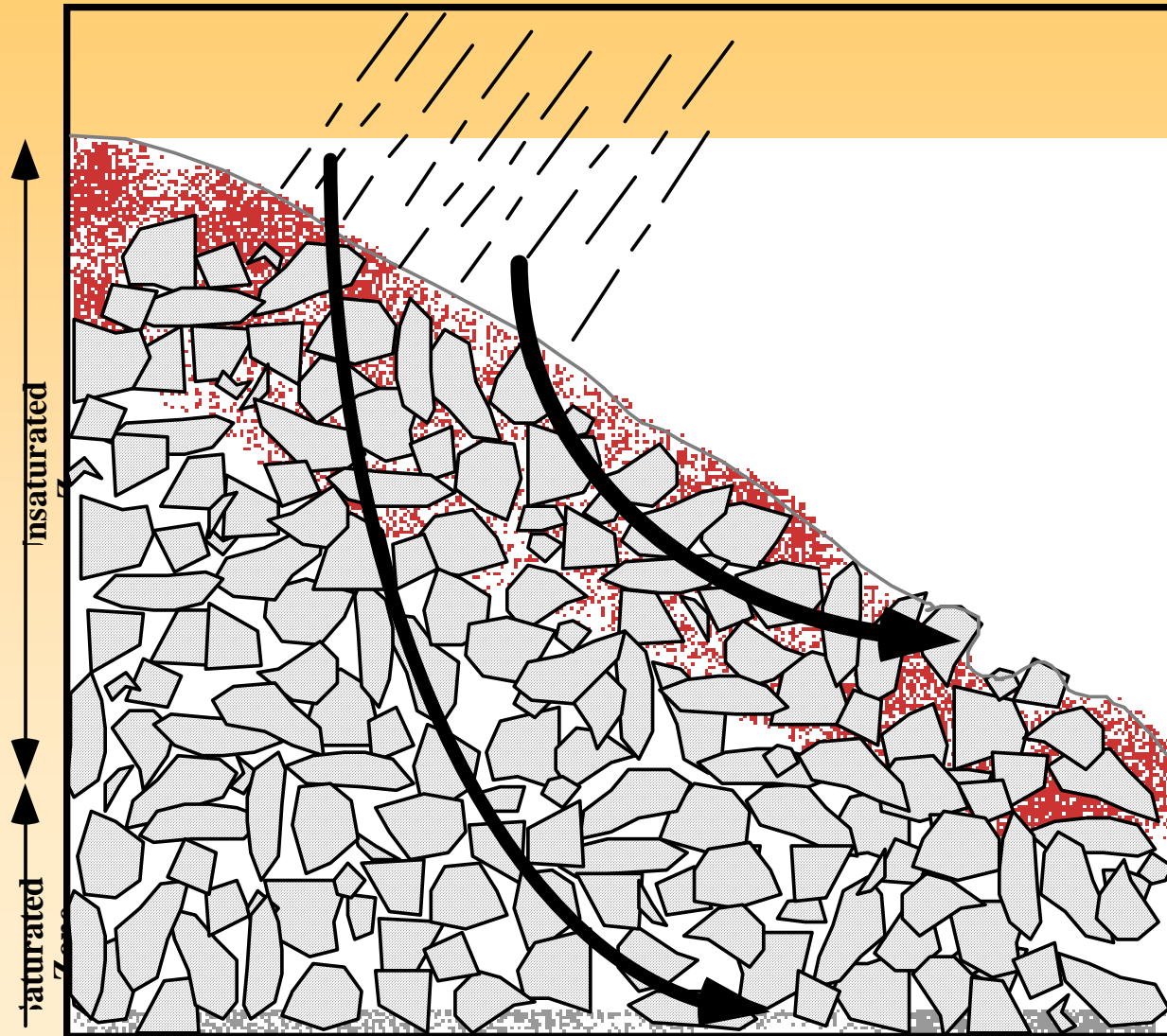


Schematic view on an underground "room and pillar" anthracite mine in a syncline (fold)

water table recovers
when pumps shut off;
AMD discharges to surface



Water infiltrates into waste rock piles on surface, dissolving pyrite (FeS_2)



Mining increases surface area, so oxidation rates speed up

2 main types of mine water.....

Clear, pH 2 to 3, high dissolved metals



N. Br. Shamokin Creek
(near Wilberton)



Source: waste rock piles

Orange sediment, pH 4 to 7; low to high dissolved metals, has alkalinity



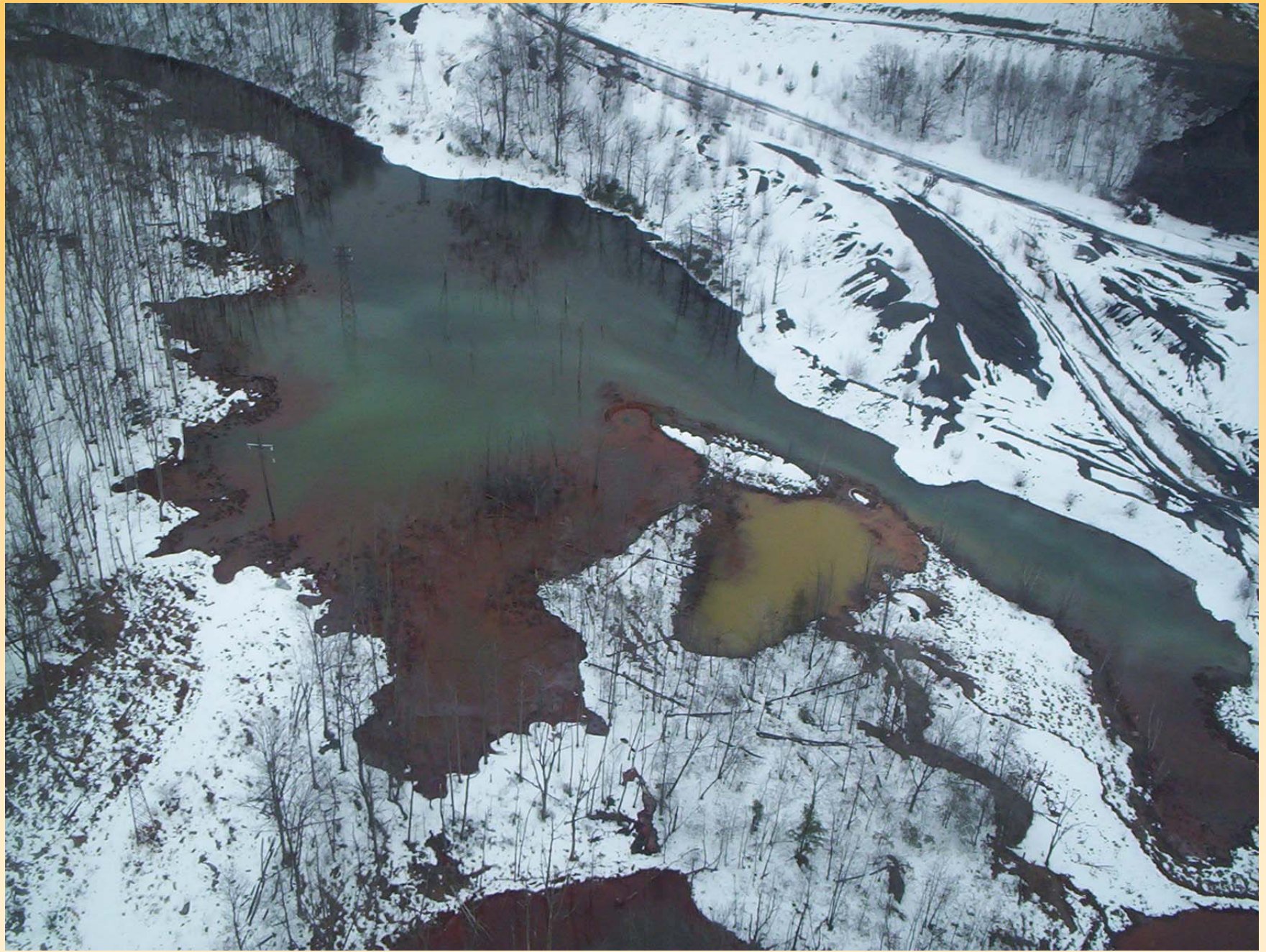
Source: deep mine pools

Not all AMD is acid!!!!



Water is clear until it reaches the surface





17% of Shamokin watershed acidity



Mike Wehr, DEP



What can be done about AMD?

"Active" Treatment

- High capital costs
- High maintenance costs
- Can treat larger flows

"Passive" Treatment

- Usually lower capital costs
- Require sufficient area
- Require eventual rebuilding

Both produce iron oxide sludge

"Remining" can improve water quality, but feasibility depends on economics of mining

Rausch Creek Active Treatment Facility



Courtesy of DEP

- **Constructed & operated by PA DER, 1972**
- **Very effective, treats one large discharge, sludge not very useful**
- **\$4 million capital costs, \$400,000/yr operation**

AIS AMD Treatment
for removal of iron from mine drainage
(PATENT PENDING)

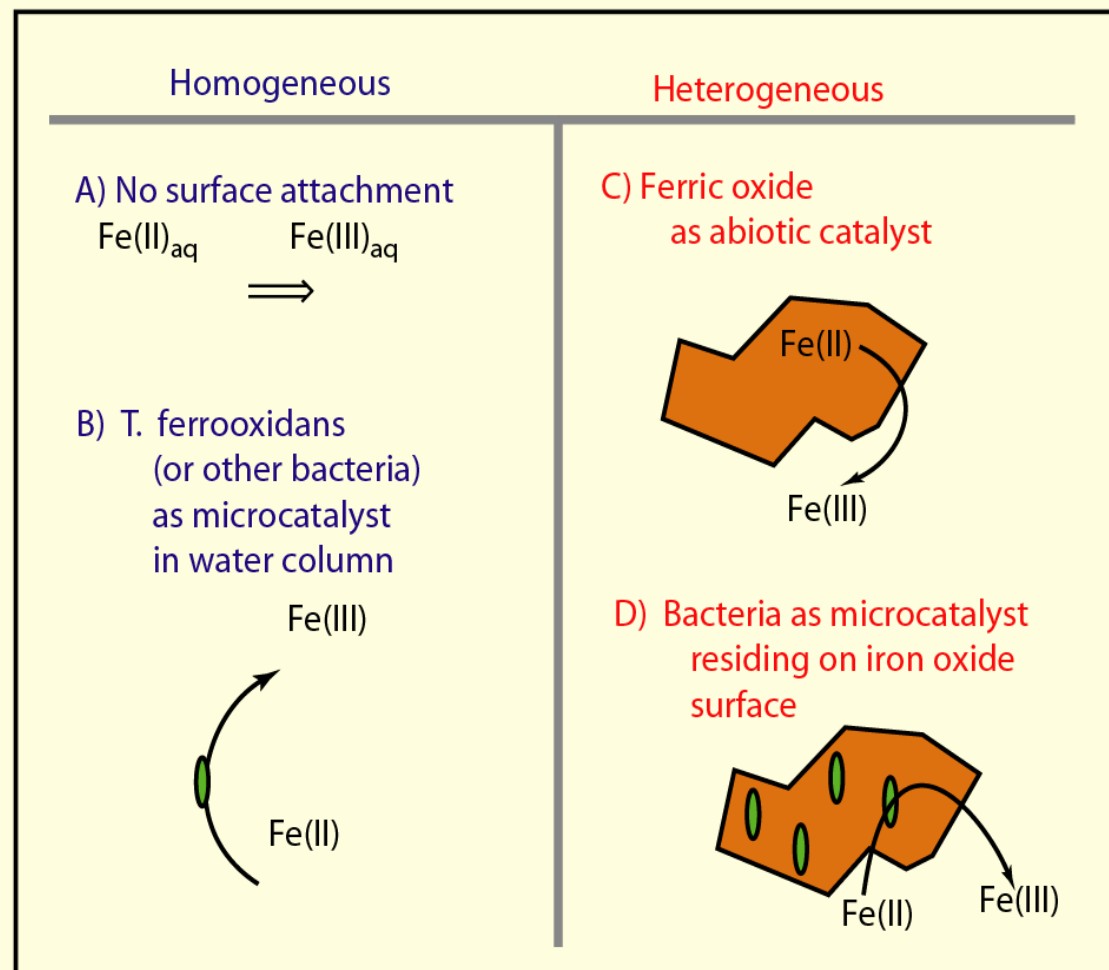
The First Full-Scale AIS AMD Treatment System



St. Vincent College AIS/SBR Demonstration Project

Importance of surfaces

Fig. 1. Aqueous Ferrous Iron Oxidation
Possible Mechanisms



Diversion Wells



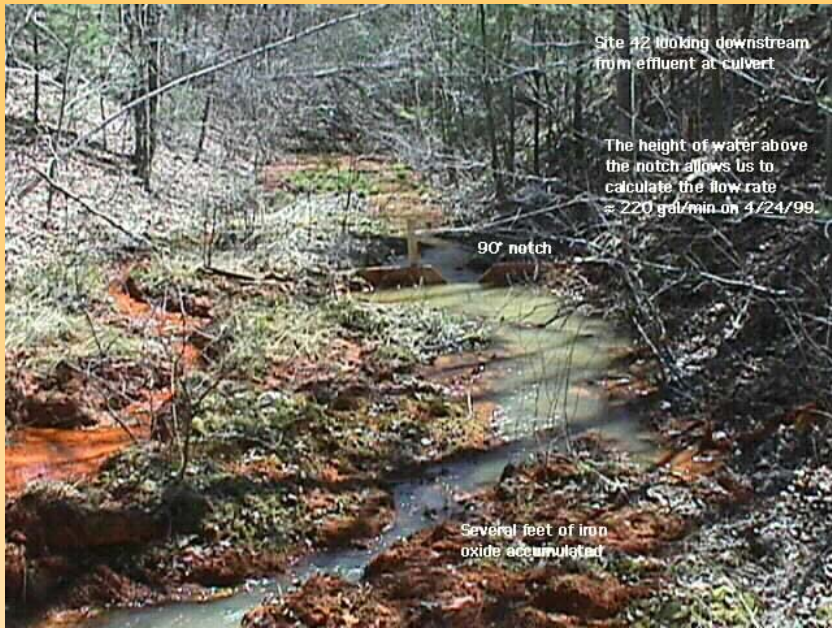
Direct Limestone Sand Addition



Limestone Gravel Bars

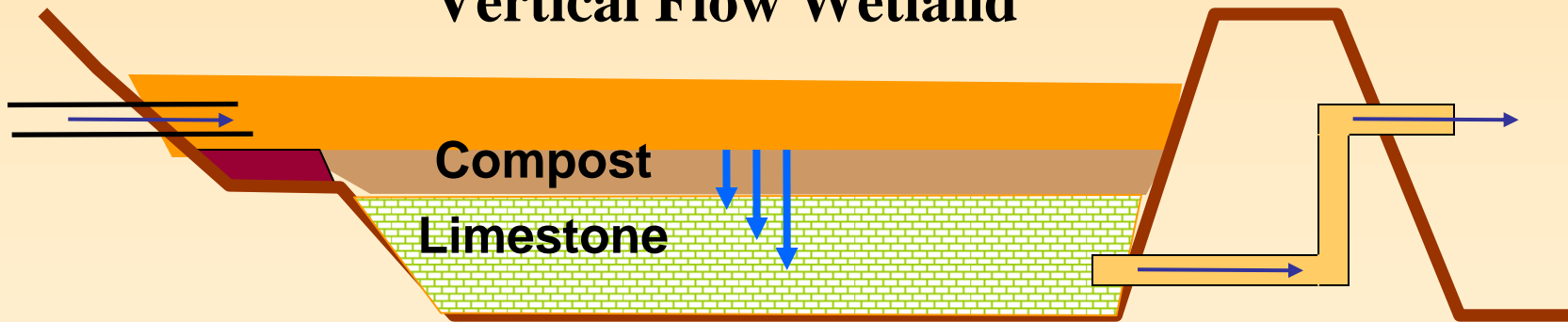


Treatment Ponds and Wetlands



X-section

Vertical Flow Wetland





Watershed group work





Watershed group work



Are all of the streams "dead?" No!

USGS electrofishing, Shamokin Creek



Catfish, Shamokin Creek



White Suckers, Shamokin Creek



Schuykill River Brown Trout



Passive Treatment



Begging for money.....

For DEP use only:



ENVIRONMENTAL STEWARDSHIP AND WATERSHED PROTECTION GRANT APPLICATION 2005

1. **Short Title:** Shamokin Creek Watershed Scarlift Site 21 AMD Treatment Design, Ranshaw PA

2. **Project Location:**

Watershed: Shamokin Creek Latitude: 404703 Longitude: 763103

County(ies): Northumberland Municipality(ies): Ranshaw

(Include an 8.5"x11" copy of a USGS 1:24000 topographic map with project boundaries and quadrangle name clearly marked.)

3. **Legislative District where the project is located:** House _____ Senate _____

4. **Application/Project Type:**

Watershed Protection (indicate size, then check only one)

Watershed size: 137 sq. mi

- a. Watershed group organization/support
- b. Develop a watershed plan
- c. Education/outreach
- d. Design
- e. Construction
- f. Operation, maintenance and replacement

Source Water Protection (check both if applicable)

- h. Wellhead (public groundwater source)
- i. Watershed (public surface-water source)

Flood Protection (check all that apply)

- j. Project improvement
- k. Non-routine maintenance
- l. Specialized equipment



**Remining to
remediate AMD**



AMD as a Resource and some fun





environoxide.com



**Thanks, meet people, share
ideas, and enjoy the symposium**