Azurite Mine Overview

- Abandoned Underground Gold Mine, Located in North-Central WA on USFS-Administered Land
- Northwest of Mazama, Near Harts Pass Recreation Area & Pacific Crest Trail
- Remote with Poor Access, Steep Terrain
- Several RTE Species – Aquatic and Terrestrial
- Inventoried Roadless/Non-Motorized Management Area
- High Value for Potential Wilderness Area in Future
Azurite Mine Location
OVERVIEW OF AZURITE MINE FROM TINSON ADIT

TAILINGS
~55,000 CY
~4 acres

WASTE ROCK
~22,000 CY
~1 acre

MILL CREEK

WENATCHEE ADIT

CASY PASS

MILL AREA

OFFICE BUILDING
Azurite Mine – Early History

- 1915 – 31 Claims Staked
- 1916 – Azurite Copper Company (renamed Azurite Gold)
- 1918 to 1931 – Underground Development
- 1934 – ASARCO Leased Mine
- 1934 to 1936 – 100 TPD Mill and Infrastructure
- 1936 to 1942 – Development, Production
  - ~73,000 tons @ 0.38 opt gold
- 1942 – ASARCO Removes Equipment
Historic Photos - 1936
Azurite Mine – Recent History

- 1995 – Discovery Assessment (USFS)
- 2002 – IAM Open File Report (WA DNR)
- 2004/2005 – CERCLA Site Inspection (USFS/CES)
- 2005 – Reprocessing Study (USFS/CES); PRP Report (USFS)
- 2006 to 2008 – EE/CA & Risk Assessment (ASARCO/MFG)
- 2008 – ASARCO Settlement with USFS ~$5.5M
- 2007 to 2010 – Data Gaps/Removal Design (USFS/CES)
- 2011 – Removal Action Activities
Final Removal Action Alternative

- Access Road Improvements / Bridge Replacement (2010)
- Temporary Access Road Across Mill Creek (2011)
- Mill Creek Diversion Away from Waste Rock Pile (2011)
- Onsite Covered Repository (2011)
  - Reinforced Stabilized Slope/Repository Toe Berm
  - Waste Rock and Mill Area Soil Blended with Tailings
  - Multi-Layer Cover, HDPE Membrane, and Talus/Rock Cover
- Physical Hazard Closures (2011)
- Revegetation (2011) – USFS Lead
Construction Challenges

- Weather Conditions (rain, snow, heat)
Construction Challenges

- Weather Conditions (rain, snow, heat)
- Typical Construction Window (late June – early October)
- Steep Slopes / Difficult Terrain
- Limited Onsite Staging Areas
- All Borrow Material from Onsite
- Remote Access/Logistics/Communication
2011 Removal Action Summary

- Turnkey “Design/Build” Contract Structure
  - CES – Prime Contractor
  - Palm Construction – Main Subcontractor (Local)
- Mobilization – July 11, 2011 – 3 weeks late (weather)
- Demobilization – September 26, 2011 – 1 week early
OVERVIEW OF AZURITE MINE REMOVAL ACTION

STABILIZED SLOPE
Construct to retain Repository

WASTE ROCK
Excavate and Haul to Repository

TAILINGS PILE
Contour with WR/Mill Soils, and Construct Repository

MILL AREA
Excavate and Haul to Repository
Camp, Equipment and Manpower

- Remote Camp (internet, phones, running water, flushing toilets, showers, washer/dryer, cook, tents/campers)
- 3 Excavators
- 2 Loaders
- 3 Dozers
- 2 Off-Road, Articulated Haul Trucks
- Roller Compactor, Water Truck, Misc. Work Trucks
- Bear Proof Storage Containers
- Manpower – 10 to 20 (Palm/Subs) / 1 to 3 (CES)
Erosion and Sediment Control

- Run-On Ditches
  - Waste Rock / Tailings
- Silt Fence
  - Borrow Area / Waste Rock
- Filter Berms
  - Borrow Area / Waste Rock
- Sedimentation Pond
  - Tailings / Repository
Mill Creek Crossing and Diversion

- Access Waste Rock Pile, and Transport to Repository
- Three, 48-inch CMPs
- Temporarily Divert Mill Creek Away From Waste Rock Pile
Mill Creek Crossing
Borrow Area Development

- Onsite Source for Screening / 3 Products
  - 2-inch minus
    - Stabilized Slope Fill, Road Bed/Base, Fill Material
    - 40,000+ cubic yards used, more remains onsite
  - 2-inch to 36-inch
    - Repository cover, rocked diversion ditches
    - ~20,000 cubic yards
  - 36-inch plus
    - Misc. Placement, armoring
Borrow Area Development
Borrow Area Development
Underground Working Closures

- Planned for 5 Closures (4 Adits / 1 Vent)
- Pre-Cut Steel and Culverts Delivered to Site
- Final Onsite Fabrication
- Installation with Helicopter and Onsite Welder
- 4 Closures
  - Burnham, Tinson, and Discovery Adits
  - Discovery Vent
- Wenatchee Adit
  - Collapsed - No Bat Gate Installed
Reinforced Stabilized Slope

- Designed to Stabilize/Retain the Repository
- Original Design was 15-feet (H) x 15-feet (W) – 12 lifts
- Final Layout was 22-feet (H) x 25-feet (W) – 17 lifts
  - Competent Soil Deeper Than Planned
  - Increased Quantities For Borrow Material/Geogrid
- Onsite QA/QC Testing – All Final Tests Met Compaction Requirements (95% of Proctor)
- 23 days to build
  - Bottom lifts ~ 1.5 days to complete
  - Upper lifts ~ 1 day to complete
Reinforced Stabilized Slope Typical

1. TOPSOIL SHALL BE LOAMY SAND OR FINER GRADATION WITH 10% - 15% ORGANIC CONTENT OR MATERIAL APPROVED BY A QUALIFIED SOIL SCIENTIST. VEGETATION TYPE SHALL BE SPECIFIED BY A QUALIFIED LANDSCAPE ARCHITECT.

2. IF SEEPS ARE ENCOUNTERED DURING PREPARATION OF REINFORCED SLOPE SUBGRADE, INSTALL SUBDRAINS TO COLLECT AND TRANSPORT WATER TO SUITABLE DISCHARGE POINT APPROVED BY ENGINEER.
Reinforced Stabilized Slope – Lift 1
Reinforced Stabilized Slope – Lift 4
Reinforced Stabilized Slope – Lift 8
Reinforced Stabilized Slope – Lift 12
Reinforced Stabilized Slope – Complete
Waste Rock Excavation and Placement

- Design Estimate was 22,000 bcy of Waste Rock
- Risk Assessment Cleanup Goal – 104 mg/kg Total Arsenic
- Revised Cleanup Goal – 204 mg/kg Total Arsenic
  - Additional Background Soil Sampling
  - Used MTCA Stat 3.0 to Calculate Natural Background
- In-Field Screening with Niton XRF (RPDs ≤ 33%)
- Final Quantities ~ 16,500 bcy
Waste Rock Pile – Before
Waste Rock Pile – Removal
Waste Rock Pile – Removal
Waste Rock Pile – Final
Onsite Repository

- Overall Slope = 2.5:1
- Reinforced Slope and Berm to Stabilize Repository
- Waste Rock Blended with Tailings to Achieve Slope
- In-sloped Benches Every 9 Vertical Feet

Repository Cover (Multi-Layer)
1. Talus/Rock Cover – Top
2. Geogrid
3. 12-oz Nonwoven Geotextile
4. 40-mil HDPE Membrane
5. 12-oz Nonwoven Geotextile
6. Waste Rock/Tailings – Bottom
Repository Cross Section Detail

**Notes:**
- **MIRAGRID 7XT GEOGRID OR EQUIVALENT**
- **12oz NONWOVEN GEOTEXTILE**
- **40 MIL HDPE GEMEMBRANE**
- **12oz NONWOVEN GEOTEXTILE**

**Instructions:**
- **TAILINGS**
- **WASTE ROCK**
- **6"-12" TALUS**

**Details:**
- **WRAP GEOGRID AND GEOTEXTILE AT LEAST 6 INCHES UP THE INSIDE FACE OF BENCH**
- **PROVIDE A MINIMUM 2-FOOT OVERLAP FOR GEOTEXTILES**
- **GEOMEMBRANE SHALL BE OVERLAPPED OR FIELD WELDED IN ACCORDANCE WITH MANUFACTURERS SPECIFICATIONS**

**Details:**
- **TERRACE EXISTING SLOPE IN ACCORDANCE WITH SPECIFICATIONS OR AS DIRECTED BY THE CIVIL ENGINEER**
- **IN PREPARATION FOR PLACEMENT OF WASTER ROCK**

**Measurements:**
- **22.5'**
- **12'**
- **2.5 MIN.**
- **0.5**
- **3' MIN.**

**Additional Notes:**
- **SEE BENCHING DETAIL 3**
- **SEE SHEET C-8 FOR FINAL GRADES AND DRAINAGE**
- **ANCHOR LINER AND GEOTEXTILE IN ACCORDANCE WITH MANUFACTURER’S RECOMMENDATIONS**
Tailings Pile - Before
Tailings Pile - Before
Tailings Pile – Oxidation Profile
Repository Benching / Grading
Repository Benching / Grading
Liner Installation
Liner Layers
Liner Installation
Liner Installation
Liner / Cover Installation
Repository – Final
Repository / Tailings Pile – Before
Summary

- Completed 4 Weeks Ahead of Schedule
- Field Changes Easily Made with Continuous Oversight & Communication
- No Health/Safety Concerns
- 3-Years of Long-term O&M Inspections, & Monitoring
- RA Cost - $2.5M Capital