



## EARTHWORK AND INFRASTRUCTURE DESIGN

EMC<sup>2</sup> has extensive civil engineering design, CADD, and construction management expertise relating to earthwork and infrastructure. Earthwork design expertise includes volume determination and cut/fill balance evaluation, haul road planning, borrow source development, quality control and placement specification, consolidation and settlement analysis, and geotechnical evaluation of chemically stabilized materials for use in construction. Infrastructure design expertise includes water systems, pipe systems, concrete design, fueling facilities and tank systems

**Culvert Installation, Silverdale, Washington** , – EMC<sup>2</sup> staff performed the design and installation of a 16-foot diameter arch culvert over a salmon fishery stream in western Washington state. This project included traffic control on Washington State Highway 303, stream diversion, dewatering, concrete footer construction, arch plate assembly, and road resurfacing.

**Subtitle D Sanitary Landfills** – EMC<sup>2</sup> staff designed numerous landfill projects across the United States including a 660-acre sanitary landfill converted from a former strip mine in West Virginia. Work included developing designs and plans for the liner system, leachate collection and treatment systems, gas management system, storm water management and final closure. EMC<sup>2</sup> staff also provided quality assurance inspection/certification of synthetic liner systems placement and geotechnical testing for soil liner systems placement.

**Chemical Waste Management Inc. Hazardous Waste Landfills** – EMC<sup>2</sup> staff developed the design for secure landfill cells at a proposed hazardous waste facility in Alabama and developed and implemented the design for a groundwater monitoring system at an operating hazardous waste landfill in New York. The design for the landfill cells in the Alabama facility included a RCRA Subtitle C dual containment bottom liner and leachate collection system.

**Flue Dust Operable Unit, Montana** – EMC<sup>2</sup> staff developed the design and provided construction quality assurance oversight for treatment and impoundment of 500,000 cubic yards of hazardous copper smelting waste at this site. The waste was treated using cement/lime stabilization prior to placement in a modified RCRA Subtitle D repository. Design work included but was not limited to repository location investigations, repository slope stability, settlement and infiltration evaluations, surface water drainage and erosion control, groundwater monitoring, and material suitability/quantity determinations. EMC<sup>2</sup> staff subsequently provided construction quality assurance oversight during construction of the waste repository including liner inspection and testing, field geotechnical testing and construction documentation.

**Arbiter/Beryllium Expedited Response Action, Montana** – EMC<sup>2</sup> staff was responsible for construction management assistance and quality assurance for the construction of a RCRA Subtitle C repository and the excavation, transportation and disposal of 280,000 cubic yards of copper processing wastes at this site. EMC<sup>2</sup> staff also assisted the design engineers in making repository design modifications which included substitution of a geosynthetic clay liner for a three-foot-thick compacted clay bottom liner and a two-foot-thick cap liner. Due to the presence of trace amounts of highly toxic beryllium waste was packed in secure boxes and entombed in a cement grout matrix.

**Uranium Tailings Site Reclamation Design** - EMC<sup>2</sup> staff developed the reclamation designs for the following uranium mine tailings sites:

- Atlas Minerals Site near Moab, Utah
- Western Nuclear Site near Jeffrey City, Wyoming
- United Nuclear Site near Gallup, New Mexico

These sites have been or are planned for closure and involve isolating the tailings from precipitation/infiltration and reducing radon emissions from the piles by using cap systems. Design components/calculations included radon barrier evaluations, grading plans, surface water hydrology evaluations, surface water management/diversion and channel erosion protection designs.

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