CONSTRUCTION OF A SOIL-BENTONITE CUTOFF WALL FOR CONTAINMENT OF WOOD TREATMENT PRODUCTS

By Louay M. Owaidat, Regional Manager - Geo-Con, Inc.
Scott G. Sumner, P.E., Senior Project Manager, TRC
Tarmo P. Pajutee, Senior Project Manager, URS

Abstract

A superfund site (site) required a leachate control system to isolate contaminated groundwater within the contamination area from migrating to adjacent properties. The site has been historically and currently used for wood treatment operations and lumber product manufacturing. The primary operation conducted on the site is the treatment of wood products such as railroad ties, telephone poles, guard rail posts, and manufacturing of plywood veneer.

The site was placed on the National Priority List (NPL) in 1984 as a result of an investigation by the North Coast Regional Water Quality Control Board (NCRWQCB). A Remedial Investigation (RI) for the site was completed by the Untied States Environmental Protection Agency (EPA). The selected remedy included construction of a soil-bentonite cutoff wall.

This paper describes the design, construction and performance of the soil-bentonite cutoff wall, which was used to isolate contaminated ground water and soil. The cutoff wall was constructed during the period May 1999 to August 1999. Challenges to the cutoff wall construction included underground and overhead utilities, and interference with the operation of active plants. A large excavator capable of excavating to a maximum depth of 62 ft. was used to construct the cutoff wall that met a maximum permeability of $5x10^{-7}$ cm/sec.

1.0 INTRODUCTION

The site is located in the City of Weed, Siskiyou County, California, approximately 60 miles north of Redding. A leachate control system was required to isolate subsurface soils containing DNAPLs and to remove and/or monitor groundwater. This system included a slurry wall, extraction wells located within and downgradient of the slurry wall area, and a groundwater extraction system located within the slurry wall.

The objectives of the slurry wall are as follows:

- Provide for source control by preventing groundwater flow through or away from the DNAPL impacted subsurface soils located under the site.
- Reduce the amount of groundwater that will require collection and treatment.
- Reduce the area of disturbance of the existing aquifer.

The objectives of the groundwater extraction system located within the slurry wall is to lower the water table within the slurry wall in order to maintain a zero or inward hydraulic gradient across the slurry wall.

This technical paper describes the design, construction methods and performance of the slurry wall portion of the leachate control system.

2.0 BACKGROUND AND EXISTING CONDITIONS

There are two aquifer units and one aquitard in the upper seventy (70) feet of the site soils. The first aquifer which is the upper aquifer consists of fill, alluvium, Shastina Pyroclastic Flow (SPF) and Pre-shastina Alluvial Assemblage (PSA).The fill consists of gravely sand, wood debris, construction debris, relocated site soils and clinker and slag. The alluvium consists of dark gray to tan, fine-silty sand, with organic-rich soil horizons and occasional peat layers. The SPF is a poorly-sorted, unstratified-pyroclastic debris flow deposit, which consists of silty gravely sand to sandy gravel. The base of this material is occasionally delineated by a sandy-silt or silty-sand layer. This material has a distinctive pinkish-gray color, and ranges to thirty-five (35) feet thick. The PSA is generally well sorted and of fluvial origin. It consists of a fine to medium to silty sand and gravely medium to coarse sand. This material is brown to gray, and can have a reddish or greenish hue. The PSA is generally 5 to 15 feet thick, and ranges up to twenty three (23) feet thick. The groundwater depth in this aquifer varies from a few feet to more than twenty (20) feet below ground surface.

The second aquifer which is the lower aquifer consists of Older Pyroclastic Flow Deposits which is located typically 5 to 12 feet below the water level in the upper aquifer. The Older Pyroclastic Flow Deposits are grouped into Cinder Deposits, Andesite, Fluvial Deposits/Debris Flows and Pyroclastic Flows. These individual groups range in thickness from a few feet to more than 80 feet. The aquitard which separates the upper and the lower aquifers consists of Older Clastic Assemblage (OCA). The OCA is present across the site, and consists of four dense material types; silty sand (SM), clayey sand (SC), silts (ML) and clays (CL). The thickness of these individual layers range from approximately 2 to 10 feet. As the OCA aquitard is an important part of the containment slurry wall, the following data is provided:

- The OCA appears to be dense to very dense, based on both dry density measurements and in-situ blow counts.
- Moisture content varies from 16 to 54 percent and does not appear to correlate with material type. There does, however, appear to be a correlation between moisture content and dry density, i.e., higher moisture contents are associated with lower densities. This observation is probably a result of sample disturbance, as loss of sample volume through the sample ring likely increases the residual moisture content that is measured.
- Dry density varies from 67 to 111.5 pounds per cubic foot (pcf). Several samples had measured densities between 67 and 83 pcf.

- Grain size analyses indicated that the fines fraction of the samples (i.e., that fraction passing a No. 200 sieve) for each of the four material types range as follows:

    - Silty Sand (SM) – 14 to 28 percent based on sieve test.
    - Clayey Sand (SC) – 24 to 45 percent based on sieve test.
    - Silts (ML) – less than 70 percent based on boring log descriptions.
    - Clay (CL) – less than 70 percent based on boring log descriptions.

- Plasticity indices for the OCA samples ranged from nonplastic to 22. The majority of the samples could be characterized as low to moderate plasticity.

The site is relatively flat, and is approximately 1 to 0.5% sloping towards the north-northwest. Surface conditions consist of the site production facilities including buildings, log decks, utilities (subsurface and overhead), railroad tracks and conveyance loading and transport systems.