

# Options for Disposal of Refinery Lagoon Sludge: A Comprehensive Laboratory Treatability Study

**Sophia Dore** (sophia.dore@ghd.com), Donald Pope, Ryan Thomas, and Alan Weston  
(GHD, Niagara Falls, NY, USA)  
Charles Munce (GHD, Baton Rouge, LA, USA)  
Joe Kraska (GHD, Lake Charles, LA, USA)

**Background/Objectives.** Sludge was present in a lagoon at a refinery site. The sludge contained petroleum hydrocarbons, polycyclic aromatic hydrocarbons (PAHs) and metals. The site owner plans to close the lagoon and consider the following options for management of the sludge:

1. In situ stabilization with solidification to be performed either with the lagoon water still present (in the wet) or with the lagoon water removed (in the dry)
2. Excavation and disposal (a) on Site or (b) off Site
3. Each option has its own set of criteria that has to be met with respect to the unconfined compressive strength of the sludge and leaching of petroleum hydrocarbons, PAH and metals from the sludge. A laboratory treatability study was performed to determine which treatments were available to meet the different criteria in order to allow an evaluation of the implementability and costs for each option.

**Approach/Activities.** The treatability study involved simulating the treatment process that would occur for each disposal option and then testing key disposal parameters on the treated sludge to determine whether the treatment would meet criteria. The following tests were performed for the evaluation of each disposal option:

1. In situ stabilization
  - a. Stabilization testing in the wet and in the dry
  - b. Evaluation of the unconfined compressive strength of stabilized material
  - c. Leach testing of stabilized soil via SPLP, LEAF and ANSI 16.1 to evaluate long term leaching potential
2. Excavation and disposal
  - a. Testing of dewatering via filterpress, centrifuge and settling
  - b. Testing of stabilization of dewatered material
  - c. Evaluation of the unconfined compressive strength of stabilized material
  - d. Leach testing via SPLP (on Site disposal) or TCLP (off Site disposal)

**Results/Lessons Learned.** The in situ stabilization option tests showed that the sludge could be stabilized both in the wet and in the dry, however larger doses of stabilization agents were required in the wet. The optimum stabilization agent was Portland cement, however the use of bulking materials present at the site with the Portland cement was successful in lowering the required dose of Portland cement. No leaching in excess of groundwater criteria was observed when stabilized sludge was tested by SPLP and flux based leach tests, LEAF1315 and ANSI 16.1 showed that the mass flux of contaminants from stabilized sludge did not exceed the calculated maximum mass flux. Testing of unconfined compressive strength showed that the sludge could be stabilized sufficiently for the capping options.

For excavation, on-site and off-site disposal, dewatering by filter press and by polymer enhanced settling were effective, however, dewatering by centrifuge was not. Stabilization of the dewatered soil using Portland cement with bulking agents was able to provide sufficient unconfined compressive strength for these disposal options. SPLP, TCLP, LEAF1315 and ANSI

16.1 testing showed that leaching would not occur above criteria. Detailed designs are now in progress for the disposal options that proved most cost effective.