

TRENDS

TRICKS OF THE TRADE ■ EDITED BY ERIN SPINKA



Sturdy Foundations

With sound engineering, closed landfills can be commercial sites.

CLOSED LANDFILL SITES present new building opportunities. But knowing that foundation support, landfill gas (LFG) control and liner maintenance will be required often can cause developers to shy away. However, the Juniper Serra (Colma) landfill in San Mateo County, Calif., is proving that landfill development, maintenance and monitoring challenges are not insurmountable. The site now is home to a successful commercial business.

Ten years after closing in 1983, the Colma landfill site was selected by Bocci-Schneider Interests, Colma, Calif., to be developed as a Home Depot. Due to changes in California landfill regulations that made it more difficult to install deep foundations through closed landfill sites, the Brian Kangas Faulk civil engineering firm (now BKF Engineers), Redwood City, Calif., had to prepare an innovative foundation design for the redevelopment.

The age of the landfill had to be considered. Settlement takes many years, depending on the depth of the fill, the types of waste present and the placement method. Before buildings or other improvements could be constructed on the closed landfill, estimates of expected settlement needed to be made based on experience, empirical observations and numerical models. For the Colma site, the designers used empirical settlement

monitoring data and a 20-year, straight-line projection, which yielded a conservative settlement estimate.

Designers called for a deep-pile foundation to support the building. Engineers installed 150-foot-long steel "H" piles that extend through the buried trash and 20 feet into the Colma formation below the landfill. A cathodic system protects the steel piles from the landfill's corrosive environment.

To connect the building to the parking areas, both supported by waste and subject to settlement, the designers created a hinged slab to "float" with the settlement of the landfill. The slab doubles as a store entrance and provides a controlled transition between the parking lot and building.

To protect structures from LFG, engineers also had to determine whether to use active control technologies, which remove gases before they reach structures; air injection or air curtain systems, which use pressure to drive gases away from structures; or passive control technologies, which use membrane barriers and vents to prevent gases from entering structures.

SCS Field Services, Long Beach, Calif., provided the operation, monitoring and maintenance services for the LFG extraction, treatment and sensor systems. LFG generation rates decreased over time, so SCS designed, permitted and installed a replacement gas flare that had a higher turn-down ratio for lower flows and operated intermittently.

The company also provided health and safety support and construction oversight for below-grade repairs to site utilities and the hinged slab. The first repair was made in 1997.

Scores of closed landfills in the United States have been successfully developed into productive land uses. Experience has shown that significant technical challenges such as settlement, deep foundations and gas protection can be overcome. In 2002, the Colma project received the Solid Waste Association of North America's Silver Award for LFG control.

—Mike McLaughlin and Joe Miller
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Reston, Va. and Pleasanton, Calif.

SOME COMPONENTS OF THE COLMA LANDFILL REDEVELOPMENT:

- a network of nine vertical gas extraction wells;
- eight parallel extraction trenches;
- 1,850 lineal feet of gas collection header piping;
- one pneumatically operated sump;
- one knock-out vessel for condensate and two extraction blowers;
- a fully enclosed ground flare;
- a dual membrane liner system installed below the building structural slab, underlying the building footprint except at foundation pile caps or grade beams; and
- a hinged slab to "float" with the settlement of the landfill.