Remediation of Lead- and Petroleum- Contaminated Soils at a Boston Brownfield Site using Cement-based Solidification/Stabilization

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Abstract: The "Big Dig" in Boston will redirect traffic back through previously neglected areas of the city. Properties that had little value now are worth redevelopment. An office, residential and retail campus is planned for the site of the oldest electric generating plant in the city. Cement-based solidification/stabilization (S/S) treatment was used to address lead- and petroleum-contaminated soils at the site. Excavations at the site found petroleum-based free product apparently released from underground storage tanks (USTs), as well as and soils contaminated with heavy metals, apparently from ash fill. Remediation of the contaminated soils involved recovery of free product through tank structure removal and pumping, along with cement-based S/S of contaminated soils and fill. A portable S/S treatment plant was mobilized to the site. Approximately 2,800 cubic yards of material was excavated at the site. Rather than disposing of the contaminated material off-site, the material was treated and reused at the site. Off-site transportation and disposal would have cost the property owner an additional $600,000 over the treatment costs. Additional savings of $30,000 were recognized through the reuse of the material as pavement base for a planned parking lot on the property. As a result of the treatment, petroleum and lead in the soil were successfully treated and contained at the site.

The "Big Dig" project in Boston includes redirection of expressway traffic in Boston below grade. New entrance and exit ramps for the expressway will open up urban areas that had fallen out of favor. Suddenly these neglected areas have greater potential for use as shopping and residential properties. An example of these properties is the "campus" of buildings located between 440 and 580 Harrison Avenue in Boston. The site was once composed of vacant, dilapidated warehouse-type buildings The buildings are being renovated with modern interiors while retaining their historical facades and interesting architectural elements inside and out. The building at 550 Harrison Avenue is being redeveloped into office, theater and retail space. This historic building is at the site of the first electric power station for Boston's subway system. At the time it was built in 1890, the power station was the largest power station in the world.

Over a century of various uses, the power station location and surrounding properties had become contaminated with lead and petroleum products. Sources of these contaminants included the common practice of using fly ash as

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fill, and the installation of underground petroleum storage tanks and oil/water separators.

During design of the renovation of the property, different options were investigated to address the contaminated soils. One option was to excavate the 2,800 cubic yards of lead- and petroleum contaminated soils with costly transport and off-site disposal. The selected option consisted of:
(1) excavation of the contaminated soil, (2) on-site treatment with cement-based solidification/stabilization (S/S) and (3) on-site re-use. The selected option saved the owners of the property $600,000 in off-site transportation and disposal costs. Additional savings of $30,000 were recognized through the reuse of the material as pavement sub-base for a planned parking lot on the property.

Portland cement-based S/S treatment was selected to treat the contaminated soils, on the basis of its history of successful treatment of a wide range of inorganic and organic contaminants. The U.S. Environmental Protection Agency considers S/S to be an established treatment technology. S/S technology has been selected for use at 25% of the nation's Superfund sites where the sources of contamination have been addressed. S/S is designated as Best Demonstrated Available Technology (BDAT) for over 50 RCRA-listed hazardous wastes. The technology has found increasing use at Brownfield remediation projects due to the opportunity to reuse S/S-treated soil as an engineered fill or pavement base.

The picture on the left shows the excavations where underground structures and contaminated soils were removed.

Excavated soils were staged in front of the historic buildings. An excavator can be seen standing on the pile of excavated soils in the photograph on the next page.

The lead- and petroleum-contaminated soils were processed through a mobile treatment system transported onto the property. Processing through this treatment train began with screening of the material trough a vibrating "grizzly" (photograph below, in orange). Oversized material, including valuable cobbles, was separated out for cleaning and reuse, debris was disposed of off-site.

Screened material was conveyed on a belt to a pugmill (yellow). Computer controls on the pugmill ensured the proper amount of cement is added and mixed into the contaminated soils. The mix design for this site required a 6% addition of cement. Treated material exits the pugmill on another belt conveyer. The treated material was staged on plastic sheeting for curing and treatment performance verification.

Treated material was then used as pavement base for a parking lot on-site.

Cement-based solidification/stabilization was used at this Brownfield project to safely treat lead- and petroleum-contaminated soils, transforming an environmental liability into an economic asset.