Maryland Department of the Environment

The Remediation and Subsequent Redevelopment of a Chromium Processing Site With Extensive Chromium Contamination of Groundwater and Soil.

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Aerial Photograph (early 1970s):

Inner Harbor, Baltimore

- Allied/ Harbor Point site
- Living Classrooms pier
- Site of current Morgan Stanley and Living Classrooms buildings
Summary of the Projects:

- The Exelon project involved the review and implementation of plans to put an office and condo complex on top of a major hazardous waste site. Building would require 1,095 piles.

- Site geology: shallow interlayered sand and silt aquifer over a very dense Cretaceous clay over more sand, and a saprolitic soil over bedrock sloping to the south. Depth to refusal is about 50 feet on the north side, 70 feet on the south.

- Wills Wharf – being built now – is smaller office building but partly on the cap.

- The site was closed in the 1990s with a RCRA C hazardous waste cap, slurry wall down to bedrock, and a pump-and treat system, to contain high levels of hexavalent chromium (Cr+6).

- The Challenge: How can they build these without damaging the closure, or exposing the residents of Fells Point??
Here’s a view of the peninsula looking northeast, giving an approximate view of what they have planned. The Exelon building is the silver one, occupied in 2016; Point Street is topped out and nearing occupancy; Wills Wharf is just starting; and the others still to go. Pic borrowed from the Baltimore City Mayor’s website dated 6/3/2013, accessed 9-8-2015.
Historical facts

- Chromium manufacturing began *circa* 1840s through mid 1980s
- Initially chromium was mined in Baltimore County – Soldiers’s Delight etc.
- Chromium ore was brought by vessels to the Chrome Works plant in Fells Point.
Chromium Leachate
Construction of groundwater barrier and controls

- Embankment Construction
- Slurry wall construction down to bucket refusal – up to 70 feet on distal side
- Head Maintenance System vault
Cap Installation

- Cap includes both a plastic layer (60 mil LLDPE) over a geosynthetic clay liner (GCL) and an underlying granular capillary break to prevent upward migration of chromium.

- A high-density polyethylene (HDPE) drainage net was incorporated above the geomembrane liner. The drainage net and membranes are protected by a thick non-woven geotextile cushion above and below.

- Synthetic layers are covered with 24 inches or more of soil cover and six inches of stone (minimum 30 inches total cover) to protect against mechanical damage.
Protective Gravel Layer

The Cap was covered with gravel working surface, ready for planned redevelopment.
Piercing the cap – what’s involved?

- Carefully dig down to the original plastic, and weld side panels to minimize water drainage into the hole.
The geosynthetic contractor places temporary poly sheet as a work surface, then removes the LLDPE geomembrane and the underlying clay geotextile layer (GCL).
Piercing the cap – what’s involved #3

- They probed the excavation for obstacles such as footers left under the cap that could interfere with piledriving, and dug it up when needed (OFTEN).
• Materials from under the cap were placed in the bucket of a loader, and then directly into a roll-off container, not stockpiled on the ground.
Re-sealing the cap at the pilings.

- Demonstration of how the cap was sealed to the pilings. Piles were filled with concrete, and capped with epoxy to prevent wicking of chromium salts.
Some shots of the construction 1:

- Probing the excavations to remove footers etc. that would block piledriving. Mist to left is from a spray wand to knock down any dust. Note cap, geotextiles and gravel to right.

IMG_20140630_100949_153.jpg – from 6/30/2014 by E. Dexter
Some shots of the construction 2:

- Pile driven through a temporary layer of poly overlying a layer of clean soil. Note depth markings on piles; and the absence of any space for dust to escape the hole while driving.
Some shots of the construction 3:

- General view of site activities on 7/2/2014, from deck of Honeywell building. Note hazardous waste hauler truck being loaded in middle ground (and the Legg Mason Bldg).

Pic 1 from inspection report of 7/2/2014 by E. Dexter
Some shots of the construction 4:

- Liner repair along Wills Street. Note stainless clamps around nearest piles, and the plastic cylinder in the center – device used to leak-test the seals

Pic from inspection report of 11/24/2014 by E. Dexter
Some shots of the construction 5:

- Pic 3, 0915 am - Freshly open hole, looking north. Some visibly Cr-contaminated soil observed to right near bucket. Note how fresh soil is somewhat moist – not much dust from digging.

Pic 3 from inspection report of 9/5/2014 by E. Dexter
Some shots of the construction 6:

- Pic from the construction cam on top of the Legg Mason Bldg., on September 4, 2014. Looking down and ESE.
Aerial shots of the construction 1:

- Pic from the construction cam on top of the Legg Mason Bldg., on November 6, 2014 – a rainy day.
Aerial shots of the construction 2:

- Pic from the construction cam on top of the Legg Mason Bldg., on December 11, 2014. Note concrete in west tower.
Aerial shots of the construction 3:

- Pic from the construction cam on top of the Legg Mason Bldg., on February 24, 2015 – a cold, snowy day. Note the harbor ice, and the second tower crane to the east.
Aerial shots of the construction 4:

- Pic from the construction cam on top of the Legg Mason Bldg., on March 27, 2015. West tower is going up!
Aerial shots of the construction 5:

Pic from the construction cam on top of the Legg Mason Bldg., on April 23, 2015. Note prep for new clean soil pile.
Aerial shots of the construction 6:

- Pic from the construction cam on top of the Legg Mason Bldg., on May 19, 2015 – a rainy day. Note the west non-contact water modutank is gone, and concrete floor of the plaza garage is half down.
Aerial shots of the construction 7:

- Pic from the construction cam on top of the Legg Mason Bldg., on June 24, 2015. Note the new clean soil pile to extreme right; glass going on the tower; the concrete floor of the plaza is all in; and the green rebar for the plaza floor.
Aerial shots of the construction 8:

- Pic from the construction cam on top of the Legg Mason Bldg., on July 14, 2015. Note the work starting on the parking ramp at the foot of the nearer tower crane – and all the puddles! Lots of rain this year.
Aerial shots of the construction 9:

- Pic from the construction cam on top of the Legg Mason Bldg., on Friday, September 4, 2015. The west tower has topped out, the western crane extended higher, and the east tower is topped out except for a utility floor.
Summary of the Environmental Conditions:

- Air monitoring revealed no significant releases of Cr-containing dust to the air during the project. As a side note, the huge number of highly sensitive tests on and offsite indicated that the City has a low background for chromium, in line with lesser data from other cities. Yay!

- Thus far there has been no indication of any damage to the groundwater protections – the Head Maintenance System was operated hard-wired, with WIFI backup when needed, throughout the whole project. (But we’ll keep watch).

- Groundwater elevations within the project were locally elevated due to the large volume of water displaced by the 1095 16” - 18” pipe piles; but the amounts were as projected, and extra pumping managed the increases.

- The existing plastic LLDPE cap that was observed during the process of opening holes for pile installation looked to be in “like new” condition – no flaws, holes or even dents were seen.
The site in 2017:

- Exelon Building
- Point Street Apartments (Off cap)
- Morgan Stanley Building
- Wills Wharf Bldg. (Being Constructed Now)

Looking north from south shoreline.
Wills Wharf construction 7-16-2018

Point St. Apartments Morgan Stanley Building

Pipe Pile Installation Sheet Pile Reinforcement of Slurry Wall
Frac Tanks for contact water and noncontact surface water.

View from the top of the Exelon Bldg. looking ESE (and down).
(Courtesy of Multivista, Armada Hoffler, and Harbor Point).
Ground-level view on 7/12/2018

Looking south along the Slurry Wall Excavation.

Picture from inspection by E. Dexter on 7/12/2018.
Geomembrane restoration 7/12/18

Crew is using an extrusion welder to fix some small dings in the LLDPE.

Repairs are tested with vaccuum box after (note suds).

Pictures from inspection by E. Dexter on 7/12/2018.
Restoring the Slurry Wall

• Bentonite is brought down by loader bucket, then mixed with clean soil in the trench by repeated turning with the small articulated arm loader.

• In this shot the blue arrow indicates old bentonite brought up as part of the mixing process.

• When up to grade and K-tests passed, the geomembrane is restored, and a concrete bridge slab poured over it to protect it.

Picture from inspection by E. Dexter on 7/12/2018.
Preparation for On-cap Pile Caps

Very careful machine operators and hand-digging clean off the geomembrane prior to removal and pipe pile installation.

Picture from inspection by E. Dexter on 7/12/2018.
Questions?

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http://www.mde.state.md.us/programs/Land/HazardousWaste/
HazardousWasteHome/Pages/AlliedChemical.aspx