Team 6: Remediation of an expired chromic acid storage sump

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The 0.75-acre site manufactured rotogravure printing rollers for thirty years in a 1,500 square foot building beginning in 1980. Manufacturing continued until digital printing technologies made rotogravure printing obsolete. Some of the manufacturing processes included plating with copper and hexavalent chromium. These chemicals have been released into the surrounding groundwater and soil. The release of these metals is regulated by the United States Environmental Protection Agency (USEPA) and the Connecticut Department of Energy and Environmental Protection (CTDEEP). Hexavalent chromium is more toxic than the naturally occurring trivalent chromium. Trivalent chromium is an essential nutrient for humans while hexavalent chromium is a known carcinogen. Hexavalent chromium has been linked to respiratory and gastrointestinal damage. Also, hexavalent chromium can accumulate on fish gills increasing mortality rates. High copper concentrations are mostly dangerous for aquatic biota in free surface waters, so the copper release could affect a wetland located 1,200 feet west of the site. Due to wording of the lease agreement with the landlord, the client removed a 4 by 4 by 6 foot deep in-ground concrete sump with a polyethylene liner, used for storing chromic acid. The sump was unlined from 1980 to 2000, and continued to store chromic acid during that time. When the liner was removed, there was yellow coloration of the concrete, concrete degradation, and a black liquid in the bottom of the sump. A sample was taken of the black liquid, which was suspected to be groundwater, and was determined to have a total chromium concentration of 800 mg/L. State and federal regulations and the lease language indicate a need for remedial action to return the site to pre-lease conditions and ensure regulatory compliance (0.05 mg/L).

A few remediation techniques were explored. The first is a permeable reactive barrier containing zero-valent iron. The effluent after the barrier should have reduced levels of chromium and copper. Another possible technique is well injections using iron and calcium polysulfide or sodium meta-bisulfite. These chemicals would be injected into the groundwater to precipitate chromium and affix it to the aquifer media where the regulations on chromium in soil are less stringent. To reach compliance of chromium and copper concentrations in the vadose zone, excavation is the main method for remediation. A detailed sampling plan must be completed to ensure the extents of the soil contaminations have been thoroughly addressed through remediation.