working to control the releases until oily sheens and globules of coal tar were once again observed floating on the surface water at the southern end of the canal in the spring of 2005.

In 2006, a five-year review of the protectiveness of the remedy was conducted, as required by the ROD. EPA determined that, except for the poor performance of the subaqueous cap in the southern portion of the Site, the remedial actions were functioning as intended by the ROD. There, the cap did not meet the performance standard for the isolation of contaminants.

Subsequent studies indicated that the primary mechanism for the release of coal tar and oil into the canal was gas ebullition, a process by which contamination is transported by gas bubbles that form in organic-rich sediment and become coated as they encounter NAPL (*Final NAPL Investigation Report,* ARCADIS, February 2008). At the Pine Street Site, bubbles coated with NAPL passed through the sand cap, leaving behind an oily sheen on the surface of the water in the canal as they burst. In addition, the gas moving through the sand cap created a pathway for droplets of coal tar to migrate. Depending on the density of the coal tar, it either floated on the water surface or sank and accumulated on the surface of the cap.

To address this concern, EPA issued an ESD in 2009 that called for replacement and/or augmentation of the existing cap in a 350-foot stretch at the southern end of the canal. Over the fall and winter of 2010, the Performing Defendants removed 800 cubic yards of sand and replaced it with an engineered cap containing organoclay in its core. The organoclay material binds with coal tar and oil, preventing their release into the canal. In time, the reactive core mat will fill up with coal tar and oil and will need to be replaced. To lengthen the time between change-outs, several NAPL recovery wells were also installed along the east and west banks as part of this action, to further prevent the lateral migration of NAPL into the canal.

Neither coal tar nor oily sheens have been observed in the water or on the underwater cap at the northern end of the canal. However, starting in 2008, the results of bi-annual groundwater monitoring began to reflect an increasing trend in benzene concentrations at several locations between the canal and Lake Champlain (D. Maynard to T. Helgason, memorandum, July 1, 2010, *Pine Street Canal Superfund Site, Shallow Overburden Groundwater Quality Data*). Accumulations of NAPL were also intermittently measured, and NAPL removed, from monitoring wells on the lake side of the canal. Unlike at the southern end of the Site where coal tar and oil moved upwards aided by gas pressure, the horizontal transport of NAPL and its associated groundwater plume at the northern end is facilitated by stratigraphy (soil conditions) and groundwater flow gradients. When there is a gradient towards Lake Champlain, contaminated groundwater moves westward along interbedded layers of coarse sand and gravel that are sandwiched between a peat layer and an underlying clay/silt unit. EPA has concluded that additional containment in this area of the Site is needed to prevent off-site migration of contaminated groundwater and NAPL.

III. BASIS FOR THIS ESD

Performance standards for groundwater are not being met in the northern portion of the canal. Specifically, groundwater samples collected outside the Class IV boundary are exceeding the

EXPLANATION OF SIGNIFICANT DIFFERENCES
PINE STREET CANAL SUPERFUND SITE
BURLINGTON, VERMONT
September 2011

Site Name: Pine Street Canal Superfund Site

Site Location: Burlington, Vermont

Lead Agency: United States Environmental Protection Agency (EPA)

Support Agency: Vermont Department of Environmental Conservation (VT DEC)

I. INTRODUCTION

This Explanation of Significant Differences (ESD) is being issued for the Pine Street Canal Superfund Site (the "Site") to address differences between the actions being considered and the remedy that was set forth in the Record of Decision (ROD) for the Site on September 29, 1998. EPA is required to publish an ESD by Section 117(c) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. § 9617(c), and the rule at 40 C.F.R. § 300.435(c)(2)(i).

EPA's 1998 ROD called for a containment remedy, including placing a sand cap over contaminated sediments in the canal that posed an unacceptable ecological risk. Construction of this cap was completed in March 2003. A year later, the cap was extended over a portion of the western bank of the canal, after coal tar and oil (collectively referred to as "non-aqueous phase liquid" or NAPL) was discovered migrating along historic cribbing and the root systems of dead trees, and accumulating in pools on the ground and the surface of the underwater cap. In the spring of 2005, oily sheens and globules of coal tar were observed floating on the surface water at the southern end of the canal. It was determined that this outbreak was the result of NAPL migrating upwards through the cap into the water in the canal, and in 2009, EPA issued an ESD that called for amending a portion of the cap to better contain the hazardous materials left in place. Over the fall and winter of 2010, a section of the sand cap was removed and replaced with an engineered cap containing organoclay in its core. The organoclay binds with coal tar and oil, preventing their release into the canal. In time, the reactive core mat will fill up with coal tar and oil and will need to be replaced. To lengthen the time between change-outs, several NAPL recovery wells were also installed along the east and west banks as part of this action, to further prevent the lateral migration of NAPL from the upland source into the canal.

Another component of the containment remedy selected in 1998 was a groundwater monitoring program, the purpose of which was to ensure that dissolved contaminants in groundwater do not migrate beyond the site boundary into nearby Lake Champlain. For nearly ten years, the plume of contaminated groundwater beneath the Site was stable. However, since 2008, increases in benzene concentrations in groundwater samples along with the intermittent presence of