

MEMO

To:

Michael Warfel
Department of Ecology
3190 160th Ave SE
Bellevue, WA 98008

Arcadis U.S., Inc.
1100 Olive Way
Suite 800
Seattle
Washington 98101
Tel 206 325 5254
Fax 206 325 8218

From:

Ross LaGrandeur
Arcadis U.S., Inc.
1100 Olive Way, Suite 800
Seattle, WA 98101

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Subject:

CHI Franciscan Clinic Vapor Intrusion

Arcadis appreciates the opportunity to discuss the potential vapor intrusion issues reported at the CHI Franciscan Clinic located at 4550 Fauntleroy Way Southwest, Seattle, Washington (Clinic). We understand that employees working inside the Clinic had experienced odors in the basement and noted that the strongest odors were observed in the supply room, adjacent to the alley way separating the building and the fueling station, which is located at 4580 Fauntleroy Way Southwest, Seattle, Washington (Former BP Facility). We also understand that Associated Environmental Group, LLC (AEG) was retained by CHI Franciscan to investigate the source of the odor and perform mitigative actions. After reviewing the *Technical Memorandum - Vapor Assessment* and *Technical Memorandum – Vapor Mitigation System Installation* Arcadis has the following comments:

- A historical city directory search indicates that the Clinic property operated as a car lot/dealership between 1986 to 2010 which included automotive repair for a portion of that time.

- Past operations on the Clinic property should be investigated to determine if additional sources for vapor intrusion are present beneath the property.
- Detections of tetrachloroethylene (PCE), trichloroethylene (TCE) and vinyl chloride in soil gas samples collected beneath the Clinic property indicate that there is a potential source of chlorinated volatile organic compounds beneath the property.
 - Auto maintenance has not historically occurred on the Former BP Facility property.
 - No documentation indicates that a waste oil tank was ever present on the Former BP Facility property, nor currently exist.
- Recent research on the topic of petroleum vapor intrusion (PVI) indicates that biodegradation of petroleum hydrocarbon vapors occurs over relatively short vertical distances (1 to 5 feet) in well oxygenated soil and that most documented cases of PVI are in instances of direct contact between contamination and a building foundation. (*United States Environmental Protection Agency, Evaluation Of Empirical Data To Support Soil Vapor Intrusion Screening Criteria for Petroleum Hydrocarbons, 2013*)
 - AEG's soil gas points collected in the alley between the Former BP Facility and the Clinic building were advanced to 13 feet below ground surface, approximately the same elevation as basement's concrete slab.
 - Depths to water in the alley way wells (GMW-1, MW-11 and MW-12) have ranged from 22.08 feet to 27.39 feet below top of casing. These measurements suggest that there is approximately 9 feet of vertical separation distance from a potential dissolved phase or light non-aqueous phase liquid petroleum source.
 - Knowledge of oxygen, carbon dioxide and methane concentrations in soil gas between the Former BP Facility and the Clinic building would allow for an evaluation to determine if biodegradation of petroleum hydrocarbon vapors is occurring at the site.
- PVI chemical constituents are difficult to isolate from a sub-slab source as they are present in many household cleaners and building materials as discussed in section 4.3 of Washington State Department of Ecology's *Implementation Memorandum No 18*. No building survey or chemical inventory was included with AEG *Technical Memorandum – Vapor Assessment*.
 - Additionally, indoor air samples were collected for gasoline-range organics and cannot be directly compared to Method B indoor air Cleanup levels.
 - A site-specific cleanup level for air phase hydrocarbons (APH) cannot be calculated without fractionated APH ranges (EC5-8 aliphatics, EC 9-12 aliphatics, and EC 9-10 aromatics).
 - No outdoor background air samples were collected during the two indoor air sampling events by NOW Environmental Services (NOW).
 - Outdoor background concentration of PVI chemical constituents could be drawn into the building through the HVAC system or open doors.
- Arcadis has operated a soil vapor extraction system (SVE) on the Former BP Facility property since April 2016. The SVE system is intended to remove and remediate petroleum vapors beneath the fueling station property by applying a vacuum to the subsurface.

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- Arcadis measured vacuum in inches of water with a magnehelic pressure gauge in the three alley wells (GMW-1, MW-11 and MW-12) and found that wells GMW-1 and MW-12 exhibited a vacuum of 0.56 and 0.60 inch of water, respectively. MW-11 measured a vacuum of 0.18 inch of water.
- This measured vacuum in the ally wells indicates that vapors emanating from the Former BP Facility property would likely be captured or minimized by the SVE system to areas extending into the alley.

Questions:

- Have additional indoor air samples been collected inside the CHI Franciscan building to determine if the sub-slab depressurization system installed by AEG has reduced PVI chemical constituent concentrations within the basement?
- Have or will indoor air samples be collected with simultaneous outdoor air sample locations, both analyzing for fixed gases and the proper Aliphatic and Aromatic carbon ranges?
- Have petroleum odors been observed by CHI Franciscan building occupants after the installation of the sub-slab depressurization system?