Bay West
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Voluntary Investigation Cleanup
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Mr. Gerald Stahnke
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RE: RAP Addendum #1
Former Whiteway Cleaners/Despatch Industries Site
113 26th Street East, Minneapolis, Minnesota
MPCA Project Number VP2052
Site ID#: Leak00006806

Dear Ms. O'Dell and Mr. Stahnke:

On behalf of Hennepin County, Bay West, Inc. (Bay West) has prepared this Addendum to the Response Action Plan (RAP), dated March 2003, for the above-referenced site. The RAP proposed the installation of a soil vapor extraction (SVE) system to remediate tetrachloroethylene (PCE) and petroleum-related compounds identified in soil beneath the site. The RAP also discussed the redevelopment plan for the site, as approved by the Whittier Neighborhood Alliance, and engineering controls that are proposed to be implemented in conjunction with property redevelopment. Proposed engineering controls include the installation of a vapor barrier and an auxiliary SVE system beneath the concrete slab for the new development. These engineering controls are designed to provide added protection to future occupants from potential exposure to PCE as the result of unanticipated vapor migration.

PROJECT STATUS

On April 28, the Voluntary Investigation and Cleanup (VIC) section of the Minnesota Pollution Control Agency (MPCA) issued a conditional approval of the RAP. One of the conditions for approval was a requirement that the site also be enrolled in the MPCA's Voluntary Petroleum Investigation and Cleanup (VPIC) program to obtain review and approval of proposed activities with regard to soil contaminated with petroleum hydrocarbons. The site was subsequently enrolled in the VPIC program, and the RAP submitted to VPIC for review and approval. On May 8, 2003, VPIC program staff issued conditional approval of the RAP. In their respective conditional approval letters, both VIC and VPIC requested that additional informa-

tion be provided regarding proposed remediation activities, engineering controls for the new development and contaminated soil management/final disposition.

Since RAP submittal, the property developers working on the site (i.e., Bell and Chazin) have had numerous meetings with the City of Minneapolis Planning and Zoning Department and Hennepin County regarding the proposed redevelopment plan. As a result, slight modifications to the proposed redevelopment plan have been made. Additionally, the property developers also retained Braun Intertec Corporation (Braun) to perform a geotechnical evaluation of the site in order to provide the necessary information to allow structural engineering work associated with the new development to proceed. As a result of this work, a major change in the foundation design has been proposed by the property developers. Proposed modifications to the redevelopment plan and foundation design can be summarized as follows:

- → Development Modifications – The building setback from the street has increased slightly (i.e., less than 5 feet). At grade garages have replaced some surface parking spaces and a couple of the residential units. A site layout map with the most current redevelopment plan is provided as Figure 1.
- → Foundation Design Modifications – The site is underlain by up to 12 feet of un-engineered fill above the native soil. The original foundation design consisted of constructing frost footings for new structures. Prior to pouring the footings, screw anchors were to be advanced through the center of the footings in numerous locations (i.e., between 150 and 200) to anchor the new structure to the native soil.

  Based upon the geotechnical work performed by Braun, a new structural design approach has been developed that will be considerably less costly to construct. Braun has determined that the fill material underlying the site is suitable for the type of construction proposed. However, the fill material is not suitable in its present condition, as it contains small amounts of rubble/debris and is not sufficiently compacted. Additionally, the concrete floor from the former structure resides below the fill in some areas of the site. Braun has recommended the existing fill be excavated to the top of the native soil within the new building footprints and that the old concrete floor also be removed. Excavated fill will be screened to remove rubble/debris, placed back into the excavation in discrete lifts, and re-compacted as it is placed in the excavation.

  Once the fill has been reconditioned, conventional spread footings can then be used for foundation design. Based upon Braun's analysis, the cost of excavating, screening, reusing and recompacting fill material is considerably less expensive than installing screw anchors.

As will be discussed in this Addendum, the fill material contains relatively low concentrations of PCE and other volatile organic compounds (VOCs) of concern. In some portions of the site the native soil that underlies the fill material contains elevated concentrations of PCE and other VOCs. Subsurface vapormigration is occurring at the site. As such, there is the potential for elevated vapor concentrations to develop inside any excavation. If the rate of vapor accumulation is sufficient, there is also the potential for vapors to migrate out of the excavation and be dispersed in adjacent areas.

In order to allow the alternate foundation design approach recommended by Braun to be implemented, and be protective of human health, the installation of a temporary soil vapor extraction system (SVE) is proposed. The temporary SVE system will be designed to remove soil vapors from the areas where the greatest PCE and other VOC concentrations have been detected. Once soil vapor saturated with PCE and other VOCs has been removed, additional contaminant removal will be achieved through the volatilization and recovery of VOCs sorbed to native soil and, to a much lesser extent, the overlying fill. The temporary SVE system will be operated until a sufficient mass of PCE and other VOCs has been removed to minimize the

possibility that vapor migration during excavation work might lead to elevated PCE and VOC concentrations within the excavations or at the ground surface. Atmospheric monitoring will be conducted during fill reconditioning work to document environmental conditions and allow changes in how the work is performed, if warranted. Once the fill has been reconditioned and the site is ready for redevelopment, the installation of building foundations will proceed and the long-term SVE system described in the RAP will be installed.

The purposes of this RAP addendum are to:

- → Describe the scope of work associated with the proposed fill reconditioning plan.
- → Describe the PCE concentration distribution within the fill and underlying native soil.
- → Describe the temporary SVE system that will be installed and operated at the site prior to implementing the fill reconditioning plan.
- → Discuss parameters that will be monitored to determine when the temporary SVE system has removed a sufficient mass of PCE and other VOCs to allow the fill reconditioning plan to be implemented.

The issues raised by VIC and VPIC in their aforementioned conditional approval letters are not related to the temporary SVE system proposed in this RAP Addendum. As such, addressing these issues is beyond the scope of this RAP Addendum. All issues raised by VIC and VPIC in their conditional approval letters will be addressed in future RAP Addendums prior to the installation of the long-term SVE system and the initiation of property redevelopment work described in the original RAP.

FILL RECONDITIONING PLAN

As the result of both environmental investigation and geotechnical evaluation work completed at the site, numerous soil borings have been advanced at the property. Soil boring logs for the site have been reviewed and the depth of the fill has been estimated across the property. Based upon this review, a depth to fill contour map has been prepared and placed as an overlay on the site map with the new redevelopment plan (Figure 2). The fill reconditioning plan will consist of the following:

- → All fill material will be removed from ground surface to the top of native soil within the footprints where buildings will be constructed.
- → Beneath future paved and green space areas, fill reconditioning is not required. Other than the removal required to maintain proper sidewall slopes for the required building footprint excavations, no fill removal is planned beneath future paved and green space areas.
- → Excavated fill will be screened to remove rubble/debris/rocks that exceed a specified dimension. The developer's geotechnical/structural engineer will specify the screen size.
- → Fill that passes through the screening equipment will be reused as backfill. The fill will be placed back into the excavation in lifts and compacted. The developer's geotechnical/structural engineer will specify the maximum lift thickness, fill preparation requirements (e.g., moisture addition) and compaction requirements.
- → The excavated fill will be field screened with a PID after it has passed through the screen. In the unlikely event that elevated PID measurements remain in some of the fill, this material will be placed near the base of a deep (i.e., 12-foot) excavation, in a location proximal to where SVE points for the long-term system will be installed. This placement will allow the fill to be actively vented by the

long-term SVE system and will prevent the placement of more highly compacted fill near the surface of the site.

- → Rubble/debris/rocks/boulders that do not pass through the screen will be stockpiled on site.
- → If walls and/or floors of former below ground structures are encountered during excavation work, they will be removed and placed in the rubble pile.
- → Toxicity Characteristic Leachate Procedure (TCLP) tests will be performed on stockpiled materials to determine their final disposition. Based upon the large mass to surface area ratio anticipated for material that fails to pass through the screen, and the relatively low VOC concentrations present within the fill, it is considered likely that the materials will be non-hazardous. The materials will be recycled and/or disposed, in a manner appropriate for the TCLP test results obtained. If required for recycling or disposal, additional analytical testing will also be performed (e.g., VOCs, GRO, DRO).
- → Atmospheric monitoring will take place during the completion of fill reconditioning work, in accordance with a site-specific health and safety plan (HASP) that will be prepared prior to the initiation of work on-site. Public notification and access restrictions to the sidewalks on 26th Street and Stevens Avenue are issues that may need to be addressed in advance of the work. The purpose of the temporary SVE system is to alleviate many of the known health and safety concerns prior to initiating fill reconditioning work. Many of the details associated with the HASP (e.g., initial worker PPE requirements), potential public notification needs and potential access restrictions can best be determined based upon site conditions at the time the work is performed (i.e., after the temporary SVE system has been operational for several months and additional data is available). Data collected during operation of the temporary SVE system will be submitted to the MPCA and the Minnesota Department of Health (MDH). Based upon this future data, plans regarding potential public notification and potential access restrictions will be prepared and submitted for MPCA and MDH review and approval prior to initiating field work associated with the soil reconditioning plan, if appropriate.

Once the fill reconditioning work has been completed, near ground surface samples (i.e., 0 to 4 feet below ground surface) will be collected within the future building footprint and green-space areas. The purpose of this sampling will be to document the concentrations of PCE, other VOCs, gasoline range organics (GRO) and diesel range organics (DRO) that remain in the fill material after several months of soil vapor extraction system operation and the completion of fill reconditioning work. Generally speaking, the sampling plan will likely consist of collecting one sample from beneath each new residential unit and the green-space area in front of each unit. Additional samples will be collected from beneath commercial units and garages. A detailed sampling plan will be submitted to the MPCA and MDH for review and approval prior to initiating work associated with property redevelopment.

Results from the sampling event will be used to determine final disposition of surface soil during property redevelopment. The final design of the synthetic vapor barrier and auxiliary vapor recovery system that will be installed beneath new structures may impact the recommendations made for final disposition. As such, the final design for these supplemental protective devices will be submitted to the MPCA and MDH prior to, or in conjunction with, the proposed final disposition of surface soil. During the completion of site redevelopment work, surface soil will be handled in the manner approved by the MPCA and MDH.

PCE CONCENTRATION DISTRIBUTION IN FILL AND UNDERLYING SOIL

As the result of environmental investigation work completed at the site, organic vapor and laboratory analytical results are available from numerous boring locations and soil samples, including samples collected from within the fill material. Figure 3 depicts laboratory analytical results (PCE) for samples collected within the fill material overlaid on the depth of fill contour map and the proposed redevelopment map. The highest PCE concentrations detected within the fill were 49 mg/kg at boring location GS-9 and 52 mg/kg at boring location D-5.5b. As such, the highest PCE concentrations within the fill are less than the PCE residential soil reference value (72 mg/kg). Laboratory analytical results for numerous samples are less than 1 mg/kg. This data suggests the PCE present within the fill material poses little risk to completing thefill reconditioning plan as previously described.

As reported in the *Summary Report for the 2003 Geoprobe Investigation* (Bay West, July 21, 2003), elevated DRO concentrations have been detected within the fill at some locations on-site. Examples include 870 mg/kg at 4 to 6 feet below grade in soil boring SD-4, 390 mg/kg at 2 to 4 feet below grade insoil boring GS-2, 230 mg/kg at 0 to 2 feet below grade in soil boring SD-2, 190 mg/kg at 2 to 4 feet below grade in soil boring GS-5, etc. While operation of the temporary SVE system will remove some DRO, it is not the intent of the temporary SVE system to achieve substantial reductions in DRO concentrations within the fill. As the parameters included in a DRO analysis have low volatility, the fill reconditioning plan can be completed in a safe manner, even with the DRO concentrations at their present values.

Figure 4 illustrates PCE iso-concentrations overlaid on the depth of fill contour and building redevelopment map. The iso-concentration contours are based upon the highest PCE concentration detected at each soil boring location, regardless of depth. As Figure 4 illustrates, several areas of the site contain elevated PCE concentrations. Based upon the data illustrated in Figures 3 and 4, soil containing the greatest PCE concentrations is located in the native soil beneath the fill material. As described in the RAP, PCE concentrations greater than 1,000 mg/kg are relatively common in native soil beneath the fill, with concentrations as high as 12,000 mg/kg (soil boring D-6, 18 to 20 feet below grade) and 17,000 mg/kg (soil boring E-6, 30 to 32 feet below grade) having been detected in some locations. Consistent with this data, the highest PCE concentrations at most soil boring locations was beneath the fill-native soil interface.

The more heavily impacted soil that underlies the non-native fill is considered the source of PCE vapors that have been documented as having migrated into adjacent structures. It is the proximity of this more heavily impacted soil to the fill that will be removed as part of the fill reconditioning plan that raises concerns regarding the potential for PCE vapors to accumulate within excavated areas and to potentially migrate along ground surface outside the excavation.

TEMPORARY SVE SYSTEM

Prior to initiating field work associated with the fill reconditioning plan, a temporary SVE system will be installed at the site and operated for several months. The temporary SVE system will be operated to achieve the following:

- → Remove existing soil vapor that is either saturated or nearly saturated with PCE and/or other VOCs from the subsurface in the area where fill reconditioning work will take place.
- → Begin the process of recovering vapors that have migrated off-site by maintaining a negative pressure in the subsurface.
- → Begin source mitigation by maintaining a negative pressure in the subsurface and pulling soil vapor across native soil that contains elevated PCE and/or VOC concentrations.

Whereas the long-term SVE system will have vapor recovery points installed above and below the sandy clay layer that has been identified at depths ranging from 14 to 25 feet below grade, vapor recovery points for the temporary SVE system will only be installed above the sandy clay. Screens for the temporary points will extend into the non-native fill to promote vapor recovery from this zone along with additional reductions in VOC constituent concentrations.

A total of four SVE points will be used for the temporary SVE system, with one point installed in each of the four highest PCE concentration zones (i.e., > 131 mg/kg). The location of the four proposed temporary SVE points are illustrated in Figure 5. The temporary SVE points will be constructed in the same manner as the long-term SVE points described in the RAP (Figure 6).

One sand extraction point (SEP) was installed below the sandy clay layer to conduct the soil vapor extraction pilot study (Figures 5 and 7). The SEP will also be connected to the temporary SVE system to allow the removal of soil vapor saturated with PCE and other VOCs from beneath the sandy clay. Vapor recovery from below the sandy clay layer will minimize vapor migration from beneath the sandy clay layer to the overlying sand where the temporary SVE points will be installed.

In the *Soil Vapor Extraction Pilot Study Report* (SVE Pilot Study Report, Bay West, June 2003), an Engineer Manual (i.e., EM 110-1-4001, *Engineering and Design – Soil Vapor Extraction and Bioventing* (EDSVEB), June 2002) published by the US Army Corps of Engineer (USACE) was used to calculate the treatment zone radius, based upon several known or estimated parameters (i.e., volumetric flow rate achievable, vadose zone thickness, air-filled porosity of soil, number of pore volume exchanges required to remediate the site, and the time required for one pore volume exchange). In the SVE Pilot Study Report, it was estimated that 5,000 pore volume exchanges over a two-year time period would be required to remediate the site. Based upon these design criteria, a treatment zone radius of 40 feet was calculated.

As discussed in the SVE Pilot Study Report, there is a general lack of agreement regarding the number of pore volume exchanges required for a successful clean-up. Some experts recommend as few as 200 to 400, while others recommend between 2,000 and 5,000. USACE suggests a range between 1,000 and 1,500, unless initial concentrations are high or target clean-up goals are low.

The objective of the temporary SVE system is to remove a sufficient mass of PCE to allow the fill reconditioning plan to be implemented in a manner that allows work to be completed with a lower level of personnel protective equipment (PPE) and that will not require special public notice, safety precautions, or access restrictions on sidewalks and roadways adjacent the site. It is estimated that the temporary SVE system will operate approximately three to six months before the soil reconditioning plan is implemented. Using the maximum value of what the USACE believes is necessary to complete site remediation (i.e., 1,500 soil pore volume exchanges) as the design criteria required to achieve the desired work environment leads to the following calculations:

Time required for one pore volume exchange:

(1,500 exchanges)/(0.5 years)/(365 days/year) = 8.22 exchanges per day
Or (1,440 minutes/day)/(8.22 exchanges/day) = 175 minutes per exchange.

The required flow rate was calculated using the equation:

$$Q = pi*(r^2)*b*n_a/t_{ex}$$

Where Q = volumetric flow rate at atmospheric pressure
r = radius of treatment zone = 40 feet (as calculated in the RAP)
b = vadose zone thickness = 15 feet (fill and native sand thickness above sandy clay unit)

n_a = air-filled porosity of the soil = 0.35 (as presented in the RAP)
t_{ex} = time required for one pore volume exchange = 175 minutes (as previously calculated).

Using the values described above, the required volumetric flow rate is 150 cubic feet per minute (cfm) per temporary SVE point. With four SVE points proposed for the temporary system, the total flow rate required is 600 cfm.

Equipment for Temporary SVE System

The equipment required to operate the long-term SVE system will be purchased and used for the temporary SVE system. A regenerative blower with a capacity of 600 cfm at a vacuum of 15 inches of water column will be used for the temporary system. A second, identical blower will be purchased and incorporated into the long-term SVE system. In the RAP, a regenerative blower with a minimum capacity of 800 cfm at a vacuum of 12 inches of water column was proposed. As such, the long-term system will now have a capacity 50% (400 cfm) greater than what was originally proposed. The recommendation to install two blowers, at a capacity greater than what was originally proposed, is based upon the following:

- → The RAP proposed installing SVE points in locations on-site where the PCE concentration exceeded 1 mg/kg in the fill/sand that overlies the sandy clay unit that begins at approximately 15 feet below ground surface. Based upon additional investigation work completed in June 2003 and reported in the *Summary Report for the 2003 Geoprobe Investigation* (Bay West, July 2003), three additional SVE points will be required for the long-term SVE system to meet this design criterion. The proposed locations for the three additional SVE points will be submitted to the MPCA in a future RAP Addendum. With the overall increase in number of SVE points, an increase in blower capacity is necessary to maintain the desired flow at each point.
- → Installing two blowers as part of the long-term SVE system will provide an additional safety measure, in the event of equipment breakdown. If one of the blowers requires repair or replacement, soil vapor recovery operations will continue in the upper sand unit with the second blower. As such, soil vapor will continue to be removed from soil/fill that immediately underlies the new buildings that will be constructed on-site while the other unit is being repaired.

A two-stage vapor phase carbon adsorption system, sized for 1,200 cfm, will be purchased for the temporary SVE system. Blower exhaust will be processed through the carbon adsorption system and discharged to atmosphere.

The recovery and treatment of perched ground water residing on top of the sandy clay layer is included as part of the long-term SVE system. Ground water recovery and treatment, however, will not be included in the temporary SVE system. At the low vacuums that will be applied during operation of the temporary SVE system (i.e. less than 24 inches of water column), the collection of appreciable volumes of soil vapor condensate is not anticipated. If soil vapor condensate does accumulate in the blower knock out tank, it will be periodically transported and disposed off site in accordance with pertinent regulations. If appreciable volumes of condensate do accumulate, a temporary two-stage granular activated carbon adsorption system will be constructed on-site for treatment. A National Pollutant Discharge Elimination System (NPDES) and State Disposal System (SDS) Permit Application will be submitted to the MPCA to allow the discharge of treated condensate to an infiltration gallery onsite.

A 6-foot-high, chain-linked security fence will be constructed around the SVE blower, control panel, carbon adsorption system, and electrical service. Piping from the temporary SVE points to the blower will either be installed slightly below ground surface (i.e., 1 to 2 feet) or placed at ground surface. If piping is placed at ground surface, the security fence footprint will be expanded to include at-grade piping.

TEMPORARY SVE SYSTEM PERFORMANCE MONITORING

Remediation Equipment Performance Monitoring

The primary means for monitoring SVE system performance monitoring will be field screening individual SVE points, SVE blower exhaust and the effluent from each carbon adsorption vessel with a photoionization detector (PID), along with collecting samples of blower exhaust for VOC analyses. Field screening with a PID will take place during routine equipment operation and maintenance inspections. Blower exhaust samples will be collected weekly for the first month of temporary system operation and monthly thereafter. Effluent from the second carbon adsorption vessel will be monitored at the same frequency to document emission rates to atmosphere.

The flow rate from the SVE blower will be determined during each routine equipment operation and maintenance inspection. Mass removal rates will be calculated by averaging analytical results and flow rates between consecutive sampling events. Field PID measurements of blower exhaust will be compared to laboratory analytical results to determine whether a correlation exists between the two methodologies.

The air line between the first and second carbon adsorption vessels will be field screened with a PID to determine when breakthrough has occurred. Screening frequency will be determined based upon the mass of carbon in each vessel and the estimated volume of soil vapor before breakthrough. The initial volume estimate will be based on model results provided by the carbon adsorption system manufacturer. Model input parameters will include the pilot study exhaust concentration of 11,000 $ppm_{(v)}$ and the temporary SVE system design flow rate of 600 cfm. Once breakthrough has occurred, the spent carbon will be replaced and flow through the two carbon vessels reversed. As a result, the vessel with the new carbon will become the second vessel in the two-vessel train. As additional analytical data becomes available for SVE exhaust, the model will be run again to provide new estimates of breakthrough times.

Site Performance Monitoring

It is anticipated that field work associated with the fill reconditioning plan will be implemented in second half of 2004. It is also anticipated that the majority of PCE and other VOCs in the sand layer beneath the fill will be removed by that time. However, a considerable mass of PCE and other VOCs will likely remain in the sandy clay layer and the underlying sand. During the SVE pilot study, it was demonstrated that the application of a vacuum in one soil type resulted in soil vapor transport through the adjacent soil types. As such, while the upper sand layer may contain relatively little PCE or other VOCs, VOC concentrations in SVE system exhaust may remain relatively high as contaminants migrate from the sandy clay layer and underlying sand to the temporary SVE points. Consequently, VOC concentrations in SVE system exhaust may not be a reliable predictor of the VOC concentrations that remain in the sand layer beneath the fill.

Prior to beginning excavation work associated with the fill reconditioning plan, a minimum of two soil borings will be advanced. The borings will be advanced in the general vicinity of the two temporary SVE points that yield the highest PID readings during routine system inspections. A soil gas sample will be collected at the fill/sand interface. A soil sample will also be collected from the sand layer immediately beneath the fill. Both soil gas and soil samples will be submitted to an analytical laboratory for VOC analyses. Analytical results will be submitted to the MPCA and MDH along with appropriate recommendations. These recommendations may include:

- → Additional operation of the temporary SVE system prior to initiating excavation work.
- → Preparation and implementation of a public notice plan and access restriction plan in conjunction with excavation work.

→ Proceeding with excavation work and the fill reconditioning plan without public notice or an access restriction plan.

Future work will proceed in accordance with MPCA and MDH approved recommendations.

Regardless of whether the VOC concentrations remaining at the time excavation work commences warrant public notification of the work and an access restriction plan for adjacent sidewalks, a site specific health and safety plan will be prepared by the Contractor retained to complete field work associated with the fill reconditioning plan. A copy of this plan will be forwarded to the MPCA and MDH upon request.

Hennepin County, Bay West, and the property redevelopers appreciate VIC's and VPIC's timely review of this RAP Addendum. If you have any questions or concerns regarding the information included in this document or the project in general, please contact John Evans at 612.348.4046 or me at 651.291.3491.

Respectfully,

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cc: John Evans, Hennepin County
Jim Kelly, Minnesota Department of Health

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