RANSOM Consulting, Inc.

Consulting Engineers and Scientists

May 28, 2015

Project 101.06074.012

Ms. Becky Blais
Maine Department of Environmental Protection
17 State House Station
Augusta, Maine 04333

RE: Conceptual Mitigation Alternatives Analysis
Former Beal's Linen
7 Chestnut Street
Auburn, ME
REM ID: 02284

Dear Ms. Blais:

On June 25, 2014, Ransom Consulting, Inc. (Ransom) met with Maine Department of Environmental Protection (MEDEP) personnel to discuss the status of on-going investigation and remediation activities at the former Beal's Linen property located at 7 Chestnut Street in Auburn, Maine (the "Site"). The purpose of the meeting was to identify mitigation measures that may be necessary to further protect public health in the area of the Site. Specifically, several potential mitigation options were identified and discussed during the meeting, as outlined below. On September 3, 2014 Ransom and the MEDEP met again to discuss additional mitigation alternatives. During the discussion key data gaps were identified that impacted the evaluation of mitigation measures. Additional data was collected in October 2014 based on the review of possible mitigation alternatives discussed with MEDEP. This document provides a summary of mitigation alternatives discussed with MEDEP over several months and incorporates all the data collected to date. This document will be used in the future as a basis for a feasibility study of alternatives and for making decisions regarding future data collection. The objective of this document is to evaluate the potential benefits and limitations of each of the proposed remedial options relative to mitigating previously identified contamination and source areas at the Site. The evaluation includes a discussion of the degree of effectiveness for mitigating short-term and long-term risks and a conceptual cost estimate for each option. At the request of the MEDEP, this document has been prepared by Ransom for the purpose of presenting a screening-level evaluation of potential mitigation and/or remediation alternatives. Following review of the conceptual alternatives outlined in this document, Ransom recommends that a full evaluation of alternatives and remedial approach be conducted as part of a future feasibility study.

BACKGROUND

The Site is being investigated as part of the MEDEP's Dry Cleaner Initiative, which was established to evaluate and mitigate potential human health risks at former dry cleaner sites. As part of the Dry Cleaner

Initiative, several investigations have been conducted at the Site and surrounding properties, as listed below:

1. On October 31, 2013, three soil vapor samples (SG-1 through SG-3) were collected by the MEDEP within the Chestnut Street right-of-way along utility trenches adjacent to the Site;

2. On March 3 and 4, 2014, a sub-slab vapor sample, a near-slab vapor sample, and two indoor air samples were collected by the MEDEP from the Site property;

3. On March 20 and 21, 2014, indoor air samples were collected by Ransom and the MEDEP from 13 of the apartment units within the Site building, and one indoor air sample was collected from the neighboring Webster School apartment building and child care center. The March 2014 sampling activities are documented in the "Results of Indoor Air Quality Assessment" letter report, dated April 18, 2014, prepared by Ransom;

4. From April 3 to April 8, 2014, indoor air samples, sub-slab vapor samples and/or near-slab vapor samples were collected from nearby off-site properties including 14 Chestnut Street, 16 Chestnut Street, 24 Chestnut Street, 37 Webster Street, 12 Bearce Street, and 18 Winter Street. Findings from the April 2014 sampling events are documented in the "Results of Area Receptor Assessment" letter report, dated April 29, 2014, prepared by Ransom;

5. On April 15, 2014, a Phase I Environmental Site Assessment (ESA) was completed for the Site property by Ransom. Findings from the Phase I ESA are documented in the "ASTM Phase I Environmental Site Assessment, 7 Chestnut Street, Auburn, Maine" report dated April 15, 2014, prepared by Ransom;

6. On April 17, 2014, a temporary sub-slab depressurization system ("Primary SSDS") was put into operation to mitigate contaminant vapors beneath the slab foundation of the Site building. Monthly operation and maintenance activities have been performed to ensure the proper operation of the Primary SSDS and monitor system parameters;

7. From May 19 to 29, 2014, a Remedial Investigation was completed by Ransom and the MEDEP, which included installation of a series of groundwater wells at the Site and surrounding properties, and collection of soil, groundwater, and soil vapor samples from locations representing on-site and off-site properties as well as underground utility corridors. In conjunction with the Remedial Investigation, an additional round of indoor air samples was collected from six of the apartment units within the Site building;

8. Between October 2014 and January 2015, Ransom completed additional Remedial Investigation and site monitoring activities to address data gaps and document current conditions at the Site and surrounding properties. The additional investigation activities included the exploration of subsurface features including: a trench drain and sump structure, installation of additional groundwater monitoring wells, video exploration of

the nearby sewer infrastructure, and collection of soil, groundwater, soil vapor, and indoor air samples from the Site and surrounding properties. A "Remedial Investigation and Data Gaps Assessment" report, dated March 10, 2015, has been prepared and submitted to the MEDEP; and

9. Based on the results of the October 2014 indoor air sampling event, an individual (stand-alone) sub-slab vapor mitigation system ("Auxiliary SSDS") was designed and installed to provide additional vacuum influence beneath Apartment Unit #1 (northeast portion) of the Site building. Results of the January 2015 sampling event indicate that the Auxiliary SSDS is successfully mitigating the effects of vapor intrusion for Apartment Unit #1.

CURRENT STATUS AND SITE CONDITIONS

Findings from the previous investigations confirmed the presence of contaminants of concern including tetrachloroethylene (PCE) and its breakdown products in soil vapor and groundwater at the Site and surrounding properties. Dissolved-phase contaminants appear to be migrating with the prevailing groundwater flow direction to the east of the site. Vapor-phase contaminants appear to be migrating independently of groundwater concentrations in utility corridors in Chestnut Street, Webster Street, Bearce Street, Walnut Street, and to a limited extent along Winter Street.

Indoor air conditions within the Site building were determined to be impacted as a result of vapor intrusion into the building. The contaminant concentrations initially detected in the Site building suggested the potential for human health risk, and occupants of the building were notified and relocated as necessary. The Primary SSDS system installed at the Site in April 2014 appears to be mitigating the potential for vapor intrusion to the majority of the building (all apartment units except Unit #1). As discussed above, an Auxiliary SSDS system was designed and constructed to mitigate vapor intrusion into Apartment Unit #1 of the Site building. Indoor air samples collected within the Site building following installation of the Primary SSDS and the Auxiliary SSDS systems indicate contaminant concentrations in the indoor air of the Site building have been reduced to concentrations which are not anticipated to represent a health risk as confirmed by the Maine Center of Disease Control (MECDC).

Indoor air concentrations of contaminants of concern detected in surrounding property buildings do not appear to represent a health risk at this time. However, continued off-site contaminant migration presents the potential for vapor intrusion and impacts to indoor air in the off-site properties in the future. The Primary SSDS and Auxiliary SSDS systems are expected to have little, if any, influence on off-site vapor-phase contaminant migration. Findings from the Remedial Investigation activities identified a potential source area on the eastern side of the Site, and suggest that contaminants were likely discharged to the sanitary sewer system. The contaminants are anticipated to have leaked from the sewer system and impacted soil, groundwater, and soil vapor conditions in the area of the sewer system. Unidentified source area(s) may also be located beneath the foundation of the existing Site building.

Prior to the completion of a full feasibility study, additional investigation may be necessary to confirm the current understanding of Site conditions, identify additional source areas of contamination, and provide details on contaminant distribution in the subsurface. Similarly, additional investigation may be necessary to fully evaluate the potential exposure risks to off-site receptors. The potential exposure risks may be influenced by fluctuations of contaminant concentrations at off-site receptors due to changes over time and pressure gradients within the off-site receptor buildings. In order to further evaluate the risk to off-site receptors, an indoor air sampling and building pressure manipulation event should be conducted at each off-site receptor location using methods that are capable of collecting real-time laboratory quality data, such as the HAPSITE field-portable gas chromatograph/mass spectrometer.

GENERAL APPROACH FOR EVALUATING ALTERNATIVES

In general, human health risks from vapor intrusion are produced from contaminated vapors in the subsurface when they enter an occupied space at concentrations exceeding risk criteria based on exposure duration. After the release of volatile contaminants that generated the vapors has ended, the presence of vapors in the subsurface can continue for many decades. The persistence of the vapors in the subsurface is a result of continued volatilization from non-aqueous phase liquid **(**NAPL**)** present in the subsurface, volatilization from contamination sorbed on subsurface soil/fill (including lint or other discarded materials), and volatilization from contaminated groundwater in the subsurface. All three conditions are considered sources of vapors in the subsurface. To date, investigations have identified areas of groundwater contamination capable of generating subsurface vapors (MW-102, MW-104, MW-105). Additionally, investigations have identified two areas of elevated subsurface vapors in the proximity of suspected subsurface vapor sources (PID102, 103, and B125). However, the source(s) of the elevated subsurface vapors has not been confirmed. The conceptual site model (CSM) indicates that both areas of elevated subsurface soil vapors are related to disposal of contamination into the sewer drains. It is not known if the releases to the sewer drains are directly related to dissolved phase contamination at MW-102, MW-104, and MW-105. The need to confirm the sources of soil vapors and dissolved phase contamination will depend on the selected remedy. Therefore, additional source area investigation is anticipated once the remedy is selected. Furthermore, it should be recognized that the overall effectiveness of any remedial remedy is reduced by the presence of the apartment building that covers the footprint of the former dry cleaner and associated contaminant source areas.

For the purpose of this document, the alternatives for addressing the residual Site contamination can be categorized as “Mitigation Alternatives” or “Remediation Alternatives”. The Mitigation alternatives evaluated below target subsurface vapor contamination directly in the vapor migration pathway closest to the human receptor(s), but do not target the sources generating the vapors. Therefore, projected project durations for the mitigation alternatives are considered to be greater than 20 years.

The Remediation alternatives evaluated below target both the vapor migration pathway closest to the receptor and the source(s) generating the vapors. Therefore, projected project durations for remediation alternatives are considered to be less than 20 years.

Remedial alternatives that address vapor phase contamination exclusively are limited by diffusion rates from the source(s) to the vapor phase. These alternatives are also limited by the areas being targeted by the remedy. Therefore, projected project durations are considered less than 20 years, but greater than 10 years.

Remedial alternatives that address vapor phase contamination in addition to dissolved phase, NAPL phase, and sorbed contamination have projected project durations of less than 10 years.

POTENTIAL MITIGATION & REMEDIATION ALTERNATIVES

Potential exposure mitigation alternatives are discussed below and summarized in the attached Table 1.

<u>Exposure Mitigation Alternatives</u>

Alternative A: Long-Term Monitoring and SSDS Operation

This alternative would involve the operation and maintenance of the Primary SSDS and the Auxiliary SSDS systems in their current configuration (i.e., without expanding the extraction area, radius of influence, or increasing the capacity of the systems), until such time as the contaminant vapors no longer pose a health risk to occupants of the Site building or surrounding properties.

Initial sampling and monitoring activities are anticipated to include the following: field screening of sub-slab soil vapor conditions and vacuum influence beneath the slab foundation of the Site building; field screening of soil vapor conditions at four off-site locations (PID102, PID103, PID119, and PID121); and recording groundwater elevations in area monitoring wells. Monitoring would be performed on a monthly basis throughout 2015, a quarterly basis in 2016, and a bi-annual basis thereafter. The monitoring schedule assumes the current SSDS systems would be equipped with remote telemetry capability to reduce the amount of monitoring visits. Off-site monitoring would also include collection of indoor air samples and sub-slab soil vapor samples at 14 Chestnut St., 16 Chestnut St., 37 Webster St., 11 Bearce St., and 12 Bearce St. The off-site air sampling would be conducted bi-annually during 2015 and 2016. The indoor air samples and sub-slab vapor samples collected from off-site properties would be submitted for laboratory analysis of contaminants of concern. Anticipating satisfactory results, this alternative assumes the off-site air sampling activities could be discontinued after 2016.

Since the current vapor mitigation systems are not targeting the source area and due to the relatively small amount of contaminant mass anticipated to be removed by the current systems, this alternative is expected to remain operational into the future. If the results of the monitoring activities indicate a continued risk to off-site receptors, additional mitigation measures, such as those discussed below, may be necessary.

Anticipated costs associated with Alternative A are outlined in Table 2. For the purposes of this analysis, we have assumed a timeframe of 20 years for Alternative A.

Alternative B: SSDS System Modification and Operation

In addition to preventing vapor intrusion into the Site building, this alternative would involve the modification of the current SSDS systems to mitigate the off-site migration of vapor-phase contaminants.

The modifications to the current system would likely include the following:

1. A horizontal vapor extraction trench would be constructed along the northwestern property boundary, adjacent to Chestnut Street. The vapor extraction trench would be manifolded into the existing Primary SSDS;

2. Two vertical extraction points would be constructed on the eastern side of the building, in the vicinity of the trench drain and sump structure identified in this area. The vertical extraction points would also be manifolded into the existing Primary SSDS.

This alternative is anticipated to be more protective to human health by addressing potential off-Site receptors, as well as the on-Site receptors, and may reduce the short-term environmental risks in a shorter time period than Alternative A. However, this alternative assumes that the Primary SSDS system (in conjunction with the Auxiliary SSDS system) will be effective at maintaining vapor mitigation control beneath the slab foundation of the Site building, as well as mitigating the off-Site contaminant migration towards Chestnut Street and Bearce Street.

This alternative will require periodic monitoring of soil vapor conditions and indoor air conditions at the Site and off-Site properties to evaluate the effectiveness of the SSDS system modifications. Initial sampling and monitoring activities are anticipated to include the following: field screening of sub-slab soil vapor conditions and vacuum influence beneath the slab foundation of the Site building; field screening of soil vapor conditions at four off-site locations (PID102, PID103, PID119, and PID121); and recording groundwater elevations in area monitoring wells. Monitoring would be performed on a monthly basis throughout 2015, a quarterly basis in 2016, and a bi-annual basis thereafter. The monitoring schedule assumes the current SSDS systems would be equipped with remote telemetry capability to reduce the amount of monitoring visits. Off-site monitoring would also include collection of indoor air samples and sub-slab soil vapor samples at 14 Chestnut St., 16 Chestnut St., 37 Webster St., 11 Bearce St., and 12 Bearce St. The off-site air sampling would be conducted bi-annually during 2015 and 2016. The indoor air samples and sub-slab vapor samples collected from off-site properties would be submitted for laboratory analysis of contaminants of concern. Anticipating satisfactory results, this alternative assumes the off-site air sampling activities could be discontinued after 2016.

If the system demonstrates acceptable effectiveness, the periodic monitoring requirements may be reduced and/or the time of mitigation may be reduced in comparison to Alternative A. However, if the modifications to the SSDS disrupt the system's ability to mitigate exposure risks to the Site building, and/or prove to be ineffectual at preventing off-site migration of vapor-phase contaminants, then separate soil vapor extraction systems may need to be constructed at off-site properties as outlined in Alternative C.

Anticipated costs associated with Alternative B are outlined in Table 3. Because Alternative B does not address the contaminant source, we have assumed a timeframe of 20 years for Alternative B.

Alternative C: Off-Site SSDS Systems for Neighboring Properties

In addition to the on-Site vapor mitigation systems, this alternative would include potentially four additional SSDS systems located off-Site on neighboring properties most affected by the Site's contaminants. Similar to the on-site vapor mitigation systems, the off-site SSDS systems would vent soil vapor directly to the atmosphere without the need for treatment of the discharged vapor. The off-site SSDS systems would be in place until such time as the contaminant vapors no longer pose a health risk to occupants of the surrounding properties. This alternative is anticipated to be more protective to human health by addressing potential off-Site receptors and may reduce the short-term environmental risks in a shorter time period than Alternatives A or B.

This alternative will require periodic monitoring of soil vapor conditions and indoor air conditions at the Site and off-Site properties to evaluate the effectiveness of the additional SSDS systems. Initial sampling and monitoring activities are anticipated to include field screening of sub-slab soil vapor conditions and vacuum influence beneath the slab foundation of the chosen neighboring Site buildings in addition to the Site building itself. Monitoring would be performed on a monthly basis throughout 2015, a quarterly basis in 2016, and a bi-annual basis thereafter. The monitoring schedule assumes the on-site and off-site SSDS systems would be equipped with remote telemetry capability to reduce the amount of monitoring visits. Assuming the off-site SSDS systems are effective at preventing vapor intrusion, this alternative would eliminate the need for continued indoor air sampling at the off-site properties.

Due to the foundation construction variability's in the off-site structures, foundation sealing will likely be required in the off-site structures to enable successful SSDS treatment.

If the systems demonstrate acceptable effectiveness, the periodic monitoring requirements may be reduced and/or the time of mitigation may be reduced in comparison to Alternative A.

Anticipated costs associated with Alternative C are outlined in Table 4. Because Alternative C does not address the contaminant source, we have assumed a timeframe of 20 years for Alternative C.

<u>Source Area Remediation Alternatives</u>

Potential source area remediation alternatives are discussed below and summarized in the attached Table 1.

Alternative D: Sub-slab Depressurization System and Soil Vapor Extraction System

This alternative would involve the construction of a separate Soil Vapor Extraction (SVE) system to control vapor-phase contaminant migration from the Site property to neighboring properties. The SVE system would be operated in conjunction with, but separate from, the Primary SSDS and the Auxiliary SSDS systems currently operating at the Site. The SVE system would initially be constructed to target contaminant migration to the east and northwest of the Site, as described in Alternative B, but could potentially be modified in the future to accommodate multiple extraction points, as dictated by the overall effectiveness and subsurface influence of the system to prevent and/or capture off-Site migration.

This alternative would also require long-term monitoring of potential receptors and SSDS/SVE system operation and maintenance. Initial sampling and monitoring requirements are anticipated to be similar to those outlined in Alternative B. If the mitigation systems prove to be effective at eliminating exposure risks and reducing off-Site contaminant migration, the long-term monitoring requirements may be reduced in comparison to Alternatives A, B and C.

Anticipated costs associated with Alternative D are outlined in Table 5. Alternative D does not specifically address the source area of contamination. However, based on the potential for a separate, more robust mitigation system to remove a larger volume of contaminants, we have assumed a timeframe of 15 years for Alternative D.

Alternative E: Air Sparging and Soil Vapor Extraction (SVE) System

Based on the information available to date, a dual-phase remediation system would likely be required, which would involve sparging of contaminated groundwater ("air sparging"), in conjunction with the soil vapor extraction (SVE) system addressed in Alternative D. These systems would be operated independently from the existing SSDS systems at the Site, which would also continue operation until the contaminant source has been removed.

In addition to monitoring the current SSDS systems, this alternative would require frequent monitoring of soil vapor and groundwater conditions at the time of system startup to ensure that contaminants are not mobilized toward a potential receptor. Monitoring may be necessary every other day for several weeks, then weekly for several months, and then monthly thereafter. Off-site monitoring would also include collection of indoor air samples and sub-slab soil vapor samples at 14 Chestnut St., 16 Chestnut St., 37 Webster St., 11 Bearce St., and 12 Bearce St. The off-site air sampling would be conducted bi-annually during 2015 and 2016. The indoor air samples and sub-slab vapor samples collected from off-site properties would be submitted for laboratory analysis of contaminants of concern. Anticipating satisfactory results, this alternative assumes the off-site air sampling activities could be discontinued after 2016. Additional monitoring may be necessary to calculate contaminant mass removal rates and determine the effectiveness of the remediation system(s).

Assuming a specific source area can be identified and delineated, full remediation of the contaminant source would eliminate the risk of exposure to Site occupants and surrounding property occupants in a much shorter time-frame than the four previous Alternatives discussed above. This alternative may also result in reduced costs associated with long-term monitoring of Site and surrounding property conditions. However, access to the contaminant source area may be limited by the location of the current Site building, underground utilities, and/or other physical features in the area of the Site. Substantial expenses may be incurred in order to gain access to, and fully remediate, the source area. Furthermore, the air sparging activities may cause increased mobilization of contaminants resulting in additional impacts to indoor air conditions at the Site or surrounding properties.

Anticipated costs associated with Alternative E are outlined in Table 6. Assuming that Alternative E would be successful at remediating the source of the contamination, we have assumed a timeframe of 5 years for Alternative E.

Alternative F: Multi Phase Extraction and Treatment System

This alternative would introduce a high-vacuum multi-phase extraction and treatment (MPET) system for in-situ removal and treatment of combined groundwater, soil vapor, and free-phase contaminants (i.e. LNAPLS, DNAPLS). These systems would be operated independently from the existing SSDS systems at the Site, which would also continue operation until the contaminant source has been removed.

Extraction wells would be installed to best target the source area(s). The extraction wells would be connected to a packaged treatment trailer that houses the high-vacuum extraction pump and treatment equipment. The high-vacuum technology of the MPET system enhances the recovery of soil vapors by lowering the water table (dewatering) and increasing the volume of unsaturated soil available for soil vapor extraction (SVE). Since mass transfer rates are usually greater in SVE applications (vapor-phase transport) than groundwater extraction techniques (liquid-phase transport) greater contaminant mass recovery rates can be achieved using high vacuum-enhanced SVE techniques.

The MPET system would be powered by a remote high-vacuum, liquid-ring-type, extraction pump housed within the treatment trailer. The treatment system would likely consist of the following major components:

1. Air/liquid separator;
2. Potential DNAPL/LNAPL/water separator for separating chlorinated compounds, petroleum product and water this is discharged from the air/liquid separator;
3. Product recovery/collection tank connected to the liquid separator;
4. Bag filters for filtering sediment, precipitated iron, and other larger grain sized particulate matter;
5. Two transfer pumps for processing liquids through the treatment system

6. Liquid-phase granular activated carbon (LGAC) units for treatment of the groundwater that is discharged from the oil/water separator; and

7. Vapor-phase granular activated carbon (VGAC) units for treatment of contaminated soil vapor and contaminated air volatilized from contaminated groundwater and/or free-phase product.

This alternative would require continued monitoring of soil vapor and indoor air conditions to confirm the effectiveness of the current SSDS system and monitor off-site contaminant migration. At this time, the proposed monitoring is expected to include the following: field screening of sub-slab soil vapor conditions and vacuum influence beneath the slab foundation of the Site building; field screening of soil vapor conditions at four off-site locations (PID102, PID103, PID119, and PID121); and recording groundwater elevations in area monitoring wells. Monitoring would be performed on a monthly basis throughout 2015, a quarterly basis in 2016, and a bi-annual basis thereafter. The monitoring schedule assumes the current SSDS systems would be equipped with remote telemetry capability to reduce the amount of monitoring visits. Off-site monitoring would also include collection of indoor air samples and sub-slab soil vapor samples at 14 Chestnut St., 16 Chestnut St., 37 Webster St., 11 Bearce St., and 12 Bearce St. The off-site air sampling would be conducted bi-annually during 2015 and 2016. The indoor air samples and sub-slab vapor samples collected from off-site properties would be submitted for laboratory analysis of contaminants of concern. Anticipating satisfactory results, this alternative assumes the off-site air sampling activities could be discontinued after 2016. Additional monitoring may be necessary to calculate contaminant mass removal rates and determine the effectiveness of the remediation system(s).

Anticipated costs associated with Alternative F are outlined in Table 7. Assuming that Alternative F would be successful at remediating the source of the contamination, we have assumed a timeframe of 10 years for Alternative F.

Alternative G: In-situ Chemical Oxidation

Chemical oxidation is a process that involves the injection of reactive chemical oxidants into groundwater and/or soil for the primary purpose of rapid contaminant breakdown and/or destruction. Based on Site characteristics and discussions with product vendors, Ransom recommends the application of a sodium persulfate-based chemical oxidizer, such as PersulfOx® developed by Regenesis Inc. PersulfOx® contains a built-in catalyst which activates the persulfate component and generates contaminant-destroying free radicals without the need for the addition of a separate activator.

For this alternative, the sodium persulfate product would be mixed in solution and injected by a direct-push drill rig across the treatment area. Based on the data currently available, Ransom anticipates a treatment area extending from Webster Street adjacent to the southwestern property boundary to the northeastern property boundary, and from Chestnut Street adjacent to the northwestern property boundary to the southeastern property boundary of the Site. Injection points would be located on an approximately 15-foot grid throughout the treatment area. The vertical treatment interval for groundwater and vadose-zone soils would vary from approximately 12 feet on the southwestern portion of the Site to approximately 25 feet on the northeastern portion of the Site, with an average depth of approximately 20 feet below grade. The chemical oxidation alternative would require two applications of product, with approximately 10 to 12 weeks between applications.

Similar to the previous alternatives, this alternative would require continued monitoring of soil vapor and indoor air conditions to confirm the effectiveness of the current SSDS systems and monitoring of off-site contaminant migration. However, assuming this treatment alternative is highly effective, the time required for monitoring and operation of the on-site SSDS systems may be greatly reduced to potentially two to 3 years.

Ransom is available to further discuss the potential benefits and limitations of the alternatives presented above. We appreciate the opportunity and look forward to working with you on this project.

Sincerely,

RANSOM CONSULTING, INC.

Eriksen Phenix, C.G.
Project Geologist

Peter J. Sherr, P.E.
Senior Project Manager

EPP/JLM/PJS:lrk

Attachments:
Table 1: Conceptual Mitigation Alternatives
Table 2: Summary of Estimated Remediation Costs for Alternative A
Table 3: Summary of Estimated Remediation Costs for Alternative B
Table 4: Summary of Estimated Remediation Costs for Alternative C
Table 5: Summary of Estimated Remediation Costs for Alternative D
Table 6: Summary of Estimated Remediation Costs for Alternative E
Table 7: Summary of Estimated Remediation Costs for Alternative F
Table 8: Summary of Estimated Remediation Costs for Alternative G
Table 9: Comparison of Mitigation Monitoring Costs, Remedial System Capitol Costs, and Remedial System Annual Operation Costs

Table 1: Conceptual Mitigation Alternatives
Former Beal's Linen
7 Chestnut Street, Auburn, Maine

	Mitigation Alternatives			Remediation Alternatives			
	Alternative A	**Alternative B**	**Alternative C**	**Alternative D**	**Alternative E**	**Alternative F**	**Alternative G**
	Monitoring & Mitigate 7 Chestnut	**Monitoring with Experimental Extraction**	**Off-Site SSDS**	**Soil Vapor Extraction (SVE) System**	**Air Sparging & SVE System**	**Multi Phase Extraction and Treatment (MPET) System**	**In-situ Chemical Oxidation**
Task 1	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.	Operate and monitor current vapor mitigation systems for 7 Chestnut (Monitoring 2015 monthly, 2016 quarterly, 2017 forward bi-annually). Install remote telemetry to reduce site visits.
Task 2	Monitor PID102, PID103, PID119, PID 121 with ppbRAE (2015 May to December, 2016 April & November only, none thereafter)	Monitor PID102, PID103, PID119, PID 121 with ppbRAE (2015 May to December, 2016 April & November only, none thereafter)	Install potentially four (4) additional SSDS systems at neighboring properties	Monitor PID102, PID103, PID119, PID 121 with ppbRAE (2015 May to December, 2016 April & November only, none thereafter)	Indoor and Subslab sampling bi-annually at 14 Chestnut, 16 Chestnut, 37 Webster, 12 Bearce, and 11 Bearce	Monitor PID102, PID103, PID119, PID 121 with ppbRAE (2015 May to December, 2016 April & November only, none thereafter)	Monitor PID102, PID103, PID119, PID 121 with ppbRAE (2015 May to December, 2016 April & November only, none thereafter)
Task 3	Indoor and Subslab sampling bi-annually in 2015 and 2016 at 14 Chestnut, 16 Chestnut, 37 Webster, 12 Bearce, and 11 Bearce	Indoor and Subslab sampling bi-annually in 2015 and 2016 at 14 Chestnut, 16 Chestnut, 37 Webster, 12 Bearce, and 11 Bearce		Indoor and Subslab sampling bi-annually in 2015 and 2016 at 14 Chestnut, 16 Chestnut, 37 Webster, 12 Bearce, and 11 Bearce	Complete a Source Area investigation for full characterization of source both vertical and lateral extent in groundwater, soil, and air	Indoor and Subslab sampling bi-annually in 2015 and 2016 at 14 Chestnut, 16 Chestnut, 37 Webster, 12 Bearce, and 11 Bearce	Indoor and Subslab sampling bi-annually in 2015 and 2016 at 14 Chestnut, 16 Chestnut, 37 Webster, 12 Bearce, and 11 Bearce
Task 4		Install air extraction points with liner in area of trench drain and sump structure, and tie into current system		Install air extraction points with liner in area of trench drain and sump structure, behind 7 Chestnut St.	Install remedial system(s) to remediate source(s)	Complete a Source Area investigation for full characterization of source both vertical and lateral extent in groundwater, soil, and air	Advance temporary injection points for 2 applications of chemical oxidation product
Task 5		Install air extraction trench parallel to Chestnut Street at 7 Chestnut and tie into current system		Install air extraction trench parallel to Chestnut Street at 7 Chestnut	Conduct additional monitoring as necessary to document soil vapor and groundwater conditions and ensure that contaminants are not mobilized towards receptors	Install remedial system(s) to remediate source(s)	
Task 6				Add separate extraction system in the trailer to handle additional extraction of vapors			
Task 7				Add air treatment for vapors extracted prior to discharge			

Table 2: Summary of Estimated Remediation Costs for Alternative A
Continued Monitoring and Mitigation of 7 Chestnut Street

Operate/Monitor VMS (Assume 20 year Operating Life)	**Estimated Costs**
Ransom Labor and Expenses	
Vapor Mitigation System Inspection ($580/event; monthly in 2015, quarterly in 2016, bi-annually thereafter)	$ 30,150.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$ 1,650.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 ($720/event; 8 events in 2015, 2 events in 2016, none thereafter)	$ 7,200.00
Indoor Air and Sub-Slab Soil Vapor Sampling ($1,463/event; 2 events in 2015, 2 events in 2016, none thereafter)	$ 5,850.00
Monitoring and O&M Reporting (Air Sampling Reports, 2 in 2015, 2 in 2016; O&M reports quarterly in 2015, bi-annuall thereafter).	$ 23,050.00
Laboratory Fees: Indoor Air/Sub-slab Sampling ($360/sample, 14 samples per event; 2 events in 2015, 2 events in 2016, none thereafter)	$ 20,150.00
Abandonment of Off-site Monitoring Wells	$ 4,500.00
Remote Telemetry System Installation & Monthly Fees	$ 14,400.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$ 5,000.00
Electricity Expenses ($1,340/year)	$ 26,800.00
Condensate Sampling and Disposal ($360/year)	$ 7,200.00
Contingency (Additional Samples, Upkeep, Monitoring)	$ 10,000.00
TOTAL:	**$ 155,950.00**

Table 3: Summary of Estimated Remediation Costs for Alternative B
Additional Piping Utilizing Existing Equipment

Operate/Monitor VMS (Assume 20 year Operating Life)	**Estimated Costs**
Ransom Labor and Expenses	
Vapor Mitigation System Inspection ($580/event; monthly in 2015, quarterly in 2016, bi-annually thereafter)	$ 30,150.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$ 1,650.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 ($720/event; 8 events in 2015, 2 events in 2016, none thereafter)	$ 7,200.00
Indoor Air and Sub-Slab Soil Vapor Sampling ($1,463/event; 2 events in 2015, 2 events in 2016, none thereafter)	$ 5,850.00
Monitoring and O&M Reporting (Air Sampling Reports, 2 in 2015, 2 in 2016; O&M reports quarterly in 2015, bi-annuall thereafter).	$ 23,050.00
Laboratory Fees: Indoor Air/Sub-slab Sampling ($360/sample, 14 samples per event; 2 events in 2015, 2 events in 2016, none thereafter)	$ 20,150.00
Abandonment of Off-site Monitoring Wells	$ 4,500.00
Remote Telemetry System Installation & Monthly Fees	$ 14,400.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$ 5,000.00
Electricity Expenses ($1,340/year)	$ 26,800.00
Condensate Sampling and Disposal ($360/year)	$ 7,200.00
Contingency (Additional Samples, Upkeep, Monitoring)	$ 10,000.00
Subtotal:	**$ 155,950.00**
Additional Piping Utilizing Existing Equipment	
Anticipated Contractor Costs	$ 22,600.00
Engineering Design and Construction Oversight (25% of Contractor Costs)	$ 5,700.00
Startup and Testing	$ 2,500.00
Subtotal:	**$ 30,800.00**
TOTAL:	**$ 186,750.00**

Table 4: Summary of Estimated Remediation Costs for Alternative C
Design and Construction of Off-site SSDS Systems

Operate/Monitor VMS (Assume 20 year Operating Life)	**Estimated Costs**
Ransom Labor and Expenses	
Vapor Mitigation System Inspection ($770/event; monthly in 2015, quarterly in 2016, bi-annually thereafter)	$ 40,050.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$ 1,650.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 (not necessary if off-site SSDS systems are effective)	(none)
Indoor Air and Sub-Slab Soil Vapor Sampling (not necessary if off-site SSDS systems are effective)	(none)
Monitoring and O&M Reporting	$ 18,750.00
Laboratory Fees: Indoor Air Sampling (not necessary if off-site SSDS systems are efffective)	(none)
Abandonment of Off-site Monitoring Wells	$ 4,500.00
Remote Telemetry System Installation & Monthly Fees	$ 14,400.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$ 5,000.00
Electricity Expenses ($1,340/year)	$ 26,800.00
Condensate Sampling and Disposal ($360/year)	$ 7,200.00
Contingency (Additional Samples, Upkeep, Monitoring)	$ 15,000.00
Subtotal:	**$ 133,350.00**
Additional SSDS Design and Construction	
Anticipated Capital Costs For Additional SSDS Systems	
Equipment and Materials	$ 30,000.00
Electrical Subcontractor	$ 5,000.00
Structural Subcontractors (Shed/Trailer)	$ 10,000.00
Additional Costs for Piping (As Described in Alt. B)	$ 22,600.00
Anticipated Annual Costs for Additional SSDS Systems	
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$ 3,800.00
Electricity Expenses ($1,340/year)	$ 20,100.00
Condensate Sampling and Disposal ($360/year)	$ 5,400.00
Carbon Disposal Costs	$ -
Contingency (Additional Samples, Upkeep, Monitoring)	$ 7,500.00
Engineering Design and Construction Oversight (25% of Contractor Costs)	$ 16,900.00
Startup and Testing	$ 3,500.00
Subtotal:	**$ 124,800.00**
TOTAL:	**$ 258,150.00**

Table 5: Summary of Estimated Remediation Costs for Alternative D
Design and Construction of Additional SVE System

Operate/Monitor VMS (Assume 15 year Operating Life)	**Estimated Costs**	
Ransom Labor and Expenses		
Vapor Mitigation System Inspection ($770/event; monthly in 2015, quarterly in 2016, bi-annually thereafter)	$	32,350.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$	1,650.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 ($720/event; 8 events in 2015, 2 events in 2016, none thereafter)	$	7,200.00
Indoor Air and Sub-Slab Soil Vapor Sampling ($1,463/event; 2 events in 2015, 2 events in 2016, none thereafter)	$	5,850.00
System Construction, Monitoring, and O&M Reporting (System Construction Report, 1 in 2015; Air Sampling Reports, 2 in 2015, 2 in 2016; O&M reports quarterly in 2015, bi-annuall thereafter).	$	23,750.00
Laboratory Fees: Indoor Air/Sub-slab Sampling ($360/sample, 14 samples per event; 2 events in 2015, 2 events in 2016, none thereafter)	$	20,150.00
Remote Telemetry System Installation & Monthly Fees	$	11,400.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$	3,800.00
Electricity Expenses ($1,340/year)	$	20,100.00
Condensate Sampling and Disposal ($360/year)	$	5,400.00
Contingency (Additional Samples, Upkeep, Monitoring)	$	15,000.00
Subtotal:	**$**	**146,650.00**
Additional SVE System Design and Construction		
Source Area Investigation	$	25,000.00
Anticipated Capital Costs For Additional Vapor Mitigation System		
Equipment and Materials	$	30,000.00
Electrical Subcontractor	$	5,000.00
Structural Subcontractors (Shed/Trailer)	$	10,000.00
Additional Costs for Piping (As Described in Alt. B)	$	22,600.00
Anticipated Annual Costs for Additional Vapor Mitigation System		
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$	3,800.00
Electricity Expenses ($1,340/year)	$	20,100.00
Condensate Sampling and Disposal ($360/year)	$	5,400.00
Carbon Disposal Costs	$	185,000.00
Contingency (Additional Samples, Upkeep, Monitoring)	$	7,500.00
Engineering Design and Construction Oversight (25% of Contractor Costs)	$	16,900.00
Startup and Testing	$	3,500.00
Subtotal:	**$**	**334,800.00**
TOTAL:	**$**	**481,450.00**

Table 6: Summary of Estimated Remediation Costs for Alternative E Air Sparging and Soil Vapor Extraction (AS/SVE System)	
Operate/Monitor VMS (Assume 5 year Operating Life)	**Estimated Costs**
Ransom Labor and Expenses	
Vapor Mitigation System Inspection ($770/event; monthly for the life of the system)	$ 46,200.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$ 1,630.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 ($720/event; 8 events in 2015, 2 events per year thereafter)	(none)
Indoor Air and Sub-Slab Soil Vapor Sampling ($1,463/event; 2 events per year)	$ 14,650.00
System Construction, Monitoring, and O&M Reporting (System Construction Report, 1 in 2015; Air Sampling Reports, 2 in 2015, 2 in 2016; O&M reports quarterly in 2015, bi-annuall thereafter).	$ 15,850.00
Laboratory Fees: Indoor Air/Sub-slab Sampling ($360/sample, 14 samples per event; 2 events per year)	$ 50,400.00
Remote Telemetry System Installation & Monthly Fees	$ 5,400.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$ 1,250.00
Electricity Expenses ($1,340/year)	$ 6,700.00
Condensate Sampling and Disposal ($360/year)	$ 1,800.00
Contingency (Additional Samples, Upkeep, Monitoring)	$ 2,500.00
Subtotal:	**$ 146,380.00**
Additional AS/SVE System Design and Construction	
Source Area Investigation	$ 25,000.00
Anticipated Capital Costs For Full Mitigation System	
Equipment and Materials, Including Piping	$ 125,000.00
Electrical Subcontractor	$ 10,000.00
Structural Subcontractors (Shed)	$ 7,500.00
Anticipated Annual Costs for Full Mitigation System	
Vapor Mitigation System Equipment Repair and Upkeep ($500/year)	$ 2,500.00
Electricity Expenses ($2,500/year)	$ 12,500.00
Condensate Sampling and Disposal ($720/year)	$ 3,600.00
Carbon Disposal Costs	$ 125,000.00
Contingency (Additional Samples, Upkeep, Monitoring)	$ 10,000.00
Engineering Design and Construction Oversight (25% of Contractor Costs)	$ 35,600.00
Startup and Testing	$ 5,000.00
Subtotal:	**$ 361,700.00**
TOTAL:	**$ 508,080.00**

Table 7: Summary of Estimated Remediation Costs for Alternative F Multi Phase Extraction and Treatment (MPET) System		
Operate/Monitor VMS (Assume 10 year Operating Life)	**Estimated Costs**	
Ransom Labor and Expenses		
Vapor Mitigation System Inspection ($770/event; monthly in 2015, quarterly in 2016, bi-annually thereafter)	$	24,650.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$	1,650.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 ($720/event; 8 events in 2015, 2 events in 2016, none thereafter)	$	7,200.00
Indoor Air and Sub-Slab Soil Vapor Sampling ($1,463/event; 2 events in 2015, 2 events in 2016, none thereafter)	$	5,850.00
System Construction, Monitoring, and O&M Reporting (System Construction Report, 1 in 2015; Air Sampling Reports, 2 in 2015, 2 in 2016; O&M reports quarterly in 2015, bi-annuall thereafter).	$	20,150.00
Laboratory Fees: Indoor Air/Sub-slab Sampling ($360/sample, 14 samples per event; 2 events in 2015, 2 events in 2016, none thereafter)	$	20,150.00
Remote Telemetry System Installation & Monthly Fees	$	8,400.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$	2,500.00
Electricity Expenses ($1,340/year)	$	13,400.00
Condensate Sampling and Disposal ($360/year)	$	3,600.00
Contingency (Additional Samples, Upkeep, Monitoring)	$	5,000.00
Subtotal:	**$**	**112,550.00**
Additional MPET System Design and Construction		
Source Area Investigation	$	25,000.00
Anticipated Capital Costs For MPET System		
Equipment and Materials, Including Piping	$	75,000.00
Electrical Subcontractor	$	7,500.00
Structural Subcontractors (Shed)	$	7,500.00
Anticipated Annual Costs for MPET System		
MPET System Equipment Repair and Upkeep ($375/year)	$	3,800.00
Electricity Expenses ($1,875/year)	$	18,800.00
Condensate Sampling and Disposal ($720/year)	$	7,200.00
Carbon Disposal Costs	$	175,000.00
Contingency (Additional Samples, Upkeep, Monitoring)	$	7,500.00
Engineering Design and Construction Oversight (25% of Contractor Costs)	$	22,500.00
Startup and Testing	$	5,000.00
Subtotal:	**$**	**354,800.00**
TOTAL:	**$**	**467,350.00**

Table 8: Summary of Estimated Remediation Costs for Alternative G In-situ Chemical Oxidation	
Operate/Monitor VMS (Assume 3 year Operating Life)	**Estimated Costs**
Ransom Labor and Expenses	
Vapor Mitigation System Inspection ($580/event; monthly in 2015, quarterly in 2016, bi-annually thereafter)	$ 10,450.00
Collect Water Level Readings ($408/event; quarterly for 2015, none thereafter)	$ 1,650.00
Collect Soil Vapor Reading from PID-102, -103, -119 and -121 ($720/event; 8 events in 2015, 2 events in 2016, none thereafter)	$ 7,200.00
Indoor Air and Sub-Slab Soil Vapor Sampling ($1,463/event; 2 events in 2015, 2 events in 2016, none thereafter)	$ 5,850.00
Monitoring, and O&M Reporting (Air Sampling Reports, 2 in 2015, 2 in 2016; O&M reports including groundwater/ soil vapor monitoring quarterly in 2015, bi-annuall thereafter).	$ 23,050.00
Laboratory Fees: Indoor Air/Sub-slab Sampling ($360/sample, 14 samples per event; 2 events in 2015, 2 events in 2016, none thereafter)	$ 20,150.00
Remote Telemetry System Installation & Monthly Fees	$ 4,200.00
Vapor Mitigation System Equipment Repair and Upkeep ($250/year)	$ 750.00
Electricity Expenses ($1,340/year)	$ 4,000.00
Condensate Sampling and Disposal ($360/year)	$ 1,100.00
Contingency (Additional Samples, Upkeep, Monitoring)	$ 1,500.00
Subtotal:	**$ 79,900.00**
In-situ Chemical Oxidation Treatment and Monitoring	
Supplemental Source Area Investigation and/or Pilot Study	$ 25,000.00
Anticipated Capital Costs Chemical Oxidation Treatment (includes 2 applications)	
Regenesis PersulfOx Product, 136,000 pounds (includes taxes and shipping)	$ 325,000.00
Drilling Contractor, mixing and injection equipment	$ 180,000.00
Anticipated Groundwater and Soil Vapor Monitoring (quarterly first year, semi-annual after)	
Consultant Labor & Expenses	$ 16,600.00
Analytical Costs	$ 30,800.00
Engineering Design and Construction Oversight (25% of Contractor Costs)	$ 45,000.00
Subtotal:	**$ 622,400.00**
TOTAL:	**$ 702,300.00**

Table 9: Comparison of Mitigation Monitoring Costs, Remedial System Capital Costs, and Remedial System Annual Operation Costs				
Alternative	**Total**	**Operate Current Mitigation System**	**Remedial System Capital Costs**	**Remedial System Annual Costs**
A	$ 155,950.00	$ 155,950.00	NA	NA
B	$ 186,750.00	$ 155,950.00	$ 30,800.00	NA
C	$ 258,150.00	$ 133,350.00	$ 88,000.00	$ 36,800.00
D	$ 481,450.00	$ 146,650.00	$ 113,000.00	$ 221,800.00
E	$ 508,080.00	$ 146,380.00	$ 208,100.00	$ 153,600.00
F	$ 467,350.00	$ 112,550.00	$ 474,800.00	$ 212,300.00
G	$ 702,300.00	$ 79,900.00	$ 575,000.00	$ 47,400.00