



Trail Area Residential Soil Assessment and Remediation – 2019 Work Plan

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1 Introduction

SNC-Lavalin Inc. (SNC-Lavalin) has prepared the following work plan on behalf of Teck Metals Ltd. (Teck) in response to a request from the BC Ministry of Environment and Climate Change Strategy (ENV) dated December 7, 2018 (Appendix I). Teck has been working to develop and seek ENV approval for a Wide Area Remediation Plan (WARP) to address historical contamination across the area affected by aerial deposition from the Teck Trail Operations facility (i.e., the Environmental Management Area [EMA]). However, development of risk-based remediation concentrations that will satisfy all parties has not yet been determined and as such the completion of a WARP is awaiting the results of an independent health assessment being undertaken by the province. The ENV request sets out their expectations for the appropriate and timely identification and remediation of highest risk sites in Trail in the 2019 work season and until such time as a final WARP is approved.

In summary, ENV has requested the following:

- › A report signed by a contaminated sites Approved Professional (CSAP) documenting Trail area residential soil assessment and remediation work previously completed by Teck (i.e., to end of 2018);
- › A risk based remedial strategy including a risk ranking methodology supporting rationale for prioritization of assessment and remediation for the highest-risk sites within the Trail area;
- › A communication plan for informing and seeking approval of land owners for investigation and/or remediation of their properties including reporting results to property owners, and for informing the broader community of the risk based remedial strategy and the scope of work being carried out in 2019; and
- › A risk mitigation plan to mitigate the exposure of residents and community members to metal impacted soil during investigation and remediation activities and a contingency plan to address potential delays and/or issues that may arise.

1.1 Acknowledgements

This work plan has been developed collaboratively under the direction of Teck with contributions from several parties as follows:

- › Section 2: Background – SNC-Lavalin and Teck;
- › Section 3: Detailed Site Investigation of Trail Residential Properties Assessment and Remediation – SNC-Lavalin;
- › Section 4: Risk Based Remedial Strategy; SNC-Lavalin;
- › Section 5: 2019 Workplan – SNC-Lavalin and Teck;
- › Section 6: Communication Plan – Kirk & Co. Consulting Ltd.; and
- › Section 7: Risk Mitigation and Health and Safety – SNC-Lavalin.

2 Background

Metallurgical facilities have been operating in Trail since 1896. Operations have included smelting and refining of copper, lead and zinc as well as fertilizer and ammonia production, with operations evolving and expanding over more than a century. Historical deposition of aerial emissions from these facilities (collectively referred to as Teck Trail Operations) has resulted in the distribution of metals across the surrounding area. The primary metals of concern in soil distributed through emissions are arsenic, cadmium, lead and zinc.

In the 1980s, a number of researchers found associations between elevated children's lead levels and subtle health effects. This prompted a 1989 study in Trail, which found elevated blood lead levels in children, and recommended formation of a task force. The Trail Community Lead Task Force was formed in 1990 with the objective of developing a strategy to reduce children's lead exposures in Trail. The Lead Task Force was chaired by the Mayor of Trail and comprised representatives from the provincial government environment and health agencies, the smelter company (Cominco Ltd., at the time), and the community. The Lead Task Force conducted research to identify the most significant human exposure pathways and health risks in order to develop a remedial action plan (Hilts et al., 2001)¹. In 2001, the Lead Task Force made the following recommendations:

- › Provincial health agency (formerly Kootenay Boundary Community Health Services Society): Continue blood lead testing of children 6 to 36 months of age; continue counseling and services for families with children who have elevated, or risk of elevated blood lead levels; and, continue community and pre-school education programs about preventing and reducing exposure to lead;
- › Teck Trail Operations: Pursue further reductions in facility emissions with increased reporting to the public on plans and progress; continue greening around the smelter property and the community; continue environmental monitoring of air and street dust; continue addressing soil on a case-by-case basis; and, implement a new program to advise and assist people that are doing excavation, construction, demolition or renovation, to reduce potential exposure to lead;
- › City of Trail: Flush and sweep the streets; continue dust control on alleys and other unpaved areas; and, continue greening of bare public areas; and
- › Establishment of a Trail Area Health & Environment Committee (THEC) to monitor, coordinate, and advise on the implementation of the Lead Task Force's recommendations.

During the Lead Task Force years, Trail Operations began a series of modernization projects which resulted significant reductions in stack emissions from >100 tonnes/year prior to 1997 when the KIVCET smelter was commissioned to less than 0.5 tonnes/year since 2011. Teck meets permitted stack emission limits, as authorized by ENV.

As stack emissions were reduced significantly, the focus shifted to evaluating and managing fugitive emissions, defined as non-stack emissions (i.e., dust and fumes) that are released directly from processing equipment or buildings, or during transfer or mixing of materials at Teck Trail Operations. The Fugitive Dust Reduction Program began in 2012 to reduce or eliminate the most significant fugitive emissions through a combination of new enclosures, roadways management, and by reducing or eliminating emissions from existing buildings. Since 2012, annual ambient lead concentrations have been reduced from an average of 0.38 µg/m³ to 0.13 µg/m³.

¹ Hilts SR, White ER and CL Yates. 2001. Identification, Evaluation and Selection of Remedial Options. Trail Lead Program. January, 2001.

Through the work of the Trail Lead Task Force, historical reductions in stack emissions and ongoing reduction of fugitive emissions were recognized as the greatest opportunity to reduce health risks in the community (e.g., through reduction of exposure to lead in dust). However, as emissions sources are reduced, the relative importance of other pathways, such as exposure to metals in soil, increases.

To implement Lead Task Force recommendations related to addressing residential soil on a case-by-case basis and minimizing exposure to excavation, construction and renovation dust, the THEC developed the Home & Garden Program. The Home & Garden Program conducts soil sampling and remediation to mitigate potential impacts of elevated soil concentrations (THEC, 2014)². Available residential soil data collected from soil assessment and remediation from 2007 up to November 2, 2018 are provided as part of the detailed soil investigation in Section 3. Note that final soil assessment data from 2018 are still being determined and will be reported to ENV at the next agreed to data transfer or if preferred, to coincide with the Progress report that will be submitted on June 30, 2019.

2.1 Regulatory Context

The primary regulation that governs soil remediation at residential properties in Trail is the *Contaminated Sites Regulation*³ (CSR), which was brought into force under Environmental Management Act⁴ (EMA) in April 1, 1997 and has since been amended several times to account for updates to scientific and policy information.

The CSR lays out standards for site identification, assessment, and cleanup (“remediation”) under the administration of the ENV Land Remediation Section.

A site is contaminated if substances in the environment (soil, water, sediment, vapour) at the site exceed the numerical standards prescribed in the CSR. The CSR provides numerical and risk-based standards to determine when remediation is needed and satisfactorily completed. The legislation and regulation provide a framework for two general types of remediation. Contamination may be:

- › Removed so that it no longer remains at a site – where the numerical standards (or ENV approved background concentrations) apply; or
- › Contained and managed onsite – where risk-based standards apply.

The CSR was being developed over the early years of the Lead Task Force and once enacted the Lead Task Force expanded their study beyond lead to consider human health risks related to other smelter-related contaminants. This was evaluated by conducting a human health risk assessment (HHRA) that was completed in four phases between 1997 and 2008 (Exponent, 1997, 1998, 2000; Integral, 2008). In 2000, studies were begun to evaluate the effects of historical smelter emissions on the environments around Trail.

² THEC (Trail Health & Environment Committee). 2014. Trail Area Health & Environment Program. “It Starts with the Kids!” September 9, 2014. Available at: <http://www.thec.ca/pages/reports/>

³ *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 13/2019, January 24, 2019.

⁴ *Environmental Management Act* (EMA), B.C. Reg. 13/2019 / effective January 24, 2019.

Aquatic and terrestrial ecological risk assessments (ERAs) were completed, also using a phased approach, through 2011 (Cantox Environmental et al., 2001, 2003; Golder, 2003, 2010; Intrinsik, 2007; Intrinsik et al., 2011). Assessment of wetlands began in 2004, with follow-up studies in 2012 and 2014 (Golder and Intrinsik, 2007; Golder, 2013; Ecoscape, 2015; Machmer et al., 2017; Intrinsik, 2018).

Because of the large geographic area (as described in the following section), THEC, through the Trail Health and Environment Program (THEP), employs a risk-based approach for the purposes of identifying, prioritizing and remediating residential properties in the Trail area. However, as indicated previously, development of risk-based remediation target concentrations that will satisfy all parties has not yet been determined. Doing so is a complex science-based process and a study is currently being defined by the BC Ministries of Health and Environment that will be undertaken in parallel to this work plan. The outcome of this study is expected to have a significant role in setting action levels and/or risk based remediation target concentrations for the THEP.

2.2 Environmental Management Area Definition

An Environmental Management Area (EMA)⁵, is an extensive geographic area that comprises many individual sites or parcels contaminated by specific substances associated with a known source or sources and attributable to one or more responsible parties. The EMA associated with Teck Trail Operations was established based on concentration limits determined for arsenic, cadmium, lead and zinc in surficial soils attributable to historical Trail smelter emissions (SNC-Lavalin 2018)⁶. To achieve this, the following factors were considered for each substance:

- › background data from the ENV and other supplemental reference data as per Protocol 4⁷;
- › mandatory site-specific factors in CSR Schedule 3.1; and
- › CSR matrix standards based on a site wide median soil pH.

A summary of the concentration limits with rationale is provided in the table below.

Table 2-1: Concentration Limit for Each Specified Substance

Specified Substance	Most Stringent Standard (mg/kg)	Rationale
Arsenic (As)	19.7	Site-specific data from Goodarzi et al., 2002, using Protocol 4, Option 2a (establishing background based on supplemental reference data).
Cadmium (Cd)	3	Most stringent matrix standard based on a site-wide median soil pH of 7.0 - < 7.5 in the surrounding soils below 1.0 m depth. Standard is for the protection of groundwater flow to freshwater aquatic life.
Lead (Pb)	120	Most stringent and mandatory matrix standard and established regional background by ENV. Standard is for human health protection for intake of contaminated soil.

⁵ An EMA was previously referred to as wide area contamination as defined in ENV's Environmental Protection Division Procedure 8 – Definition of Acronyms for Contaminated Sites. November 1, 2017.

⁶ SNC-Lavalin, 2018. Determination of Concentration Limits for Teck Trail WARP Boundary. July 23, 2018.

⁷ Protocol 4; Protocol for Contaminated Sites – *Establishing Background Concentrations in Soil*, BC Ministry of Environment & Climate Change Strategy, Version 9, November 1, 2017.

Table 2-1 (Cont'd): Concentration Limit for Each Specified Substance

Specified Substance	Most Stringent Standard (mg/kg)	Rationale
Zinc (Zn)	450	Most stringent matrix standard for the protection of soil invertebrates and plants toxicity. Median soil pH in the surrounding the area is 7.0 - < 7.5 below 1 m depth (i.e., the aquatic life pathway is no longer the most stringent).

Once the concentration limits were determined, the EMA was then established by amalgamating the outer limit of each specified substance as shown below in Figure 2-1. It is important to recognize that the EMA is an area where one or more of the specified substances from historical aerial emissions may be found; however, not all properties within the EMA are contaminated sites and/or require risk management actions.

Teck has completed soil investigation throughout the EMA; however, to date work on residential properties has focussed on the area within the THEP boundary (refer to Figure 2-1) since this is the area where impacts related to smelter emissions are greatest. Soil investigations conducted to date outside the THEP boundary have primarily targeted Teck owned or publicly owned land (i.e., not residential lands). Soil lead concentrations are generally lower on lands outside the THEP boundary and as such residential properties have not been prioritized for assessment. Residential properties outside the THEP boundary will still be eligible for assessment; however, will be a lower priority based on lower concentrations and lower likelihood of soil management requirements. In 2019, Teck will conduct a detailed evaluation of available data to determine if properties within the EMA but outside the THEP boundary should be prioritized for assessment in 2020.

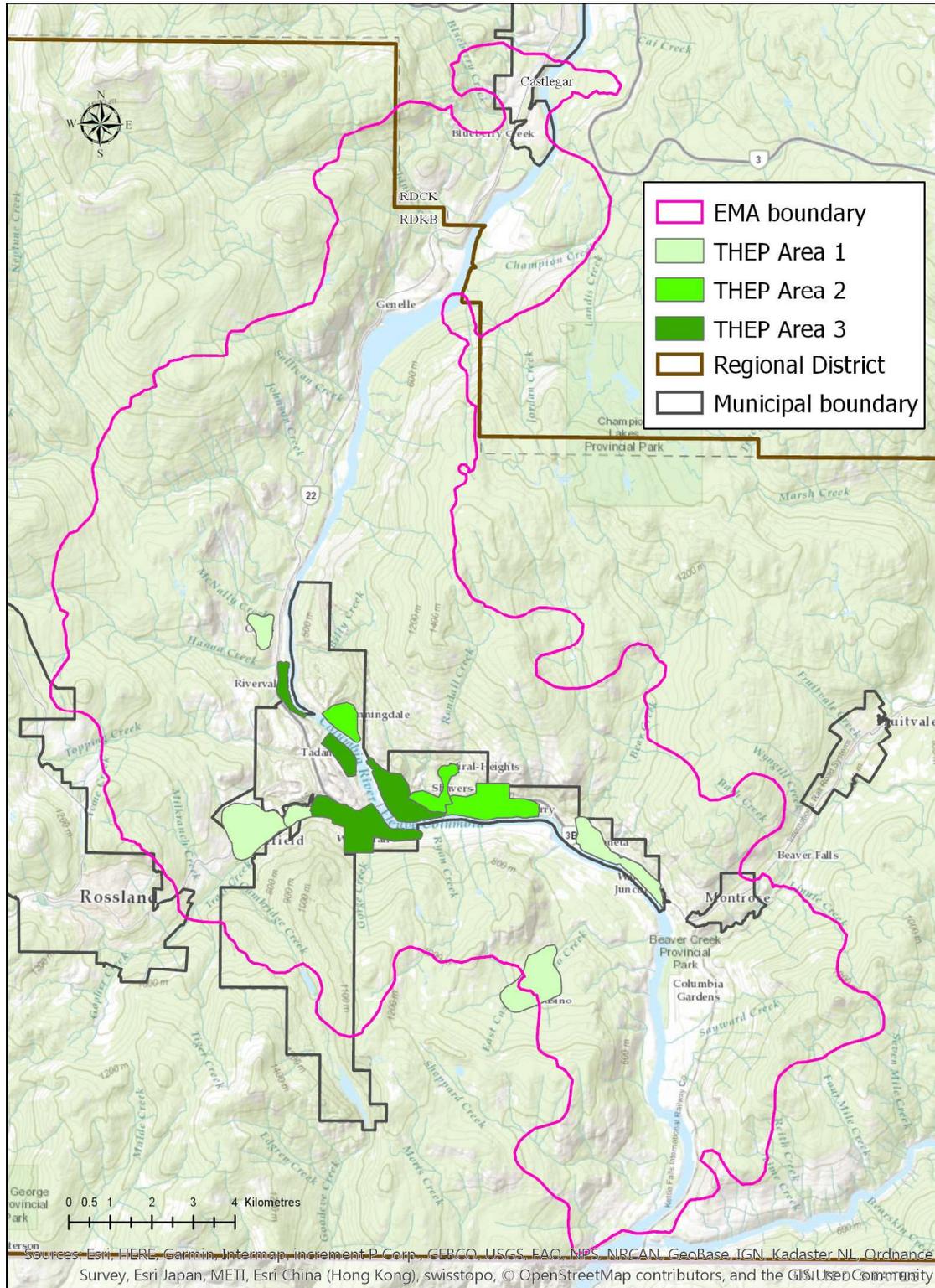


Figure 2-1: The Environmental Management Area Boundary

3 Trail Residential Programs: Pre-2019⁸ Detailed Soil Investigation

3.1 Background

Since 2007⁹ the THEP, through the work of the Home & Garden program, has carried out soil assessment and remediation at residential properties in Trail and Rivervale (THEC, 2014)¹⁰. The Home & Garden Program has the goal to identify and reduce potential impacts of elevated metals that residents may be exposed to in their home and yard environment. This goal is carried out through the following components:

- › Healthy Homes – in-home visits and outreach to provide information, education and support about lead in indoor dust for families that are expecting or have children less than 3 years of age;
- › Soil Assessment – soil testing to identify metal concentrations in yards and gardens;
- › Remediation and Yard Improvement – for qualifying yards, replacement of soil to reduce residents' potential exposure to metals in yard and garden soil;
- › Lead Safe Renovation; and
- › Community Program Office – a physical space where residents, property owners and others can get information about services, sign up for programs or pick up supports available to them.

Within the context of this report, we will address the soil assessment and remediation components of the Home & Garden program; however, other aspects such as Healthy Homes, may be providing the most essential services related to reducing exposure to lead in the most vulnerable population, children.

Over the last decade, soil assessment and remediation targets have changed but the priorities for both soil assessment and remediation have remained the same and address those most vulnerable to the effects of lead in priority order:

- › Properties with children less than 3 years of age;
- › Vegetable gardeners;
- › Properties in neighbourhoods close to the smelter where metals are typically higher; and
- › All other properties, typically where property owners are doing their own yard work/landscaping (i.e., yard renovation support).

In general, soil assessment has been an open offer to property owners; however, on occasion, soil assessment is offered directly to property owners of specific neighbourhoods and where children¹¹ are living. The approach for identification and prioritization of properties for assessment will be modified in 2019 resulting in expansion of the program and is discussed in section 5.

⁸ Note that due to the timing of this report, the entire dataset from 2018 soil assessment is not available. Results provided herein include soil collected up to November 2, 2018. Data after that will be included in future annual reports.

⁹ Prior to the THEP, soil testing in Trail was completed under the Trail Lead Task Force since 1990.

¹⁰ THEC (Trail Health & Environment Committee). 2014. Trail Area Health & Environment Program. "It Starts with the Kids!" September 9, 2014. Available at: <http://www.thep.ca/pages/reports/>

¹¹ Previously applied to properties with Children < 3 years old. In 2019, the program is being expanded to include properties with children < 12 years old.

Prior to 2019, residential properties were prioritized for remediation or risk management (e.g., ground cover improvement or part remediation) based on the presence of children less than 3 years old living at the property and/or soil lead UCLM (upper confidence limit of the mean) compared to the prioritization screening concentration (PSC) (generally referred to as Action Levels) agreed to by the THEC. The PSC has been revised (lowered) from time to time based on changes in science and policy. The program typically has been able to remediate the highest priority properties within one year of assessment.

3.2 Soil Assessment Methods

Soil Assessment methodology generally follows the technical guidance within the CSR. The general workflow for soil assessment is outlined as follows:

- › Signed access consent is obtained from the property owner. The signed document is scanned and linked to the appropriate unique THEP property identification number in the THEP program database (i.e., the “THEdb”) which is described further in Section 3. The consent and consent date are also recorded in the THEdb and the property is prioritized for soil assessment.
- › Soil samples are collected from the top 0.15 m of soil at the property. Lawn areas are sampled by collecting at least 10 discrete samples across the yard which include special areas of interest that may be present (e.g., children’s play areas). Ornamental and vegetable gardens are sampled separately from the yard and are collected as composite samples from each individual garden area. We note that in 2019 the approach prioritization of ornamental and vegetable gardens is being revised as outlined in Section 4.
- › Detailed sampling methods are provided in the attached Operating Procedures (Appendix II). A property condition checklist and photos of the property are stored in the THEdb as a record of site condition at the time of soil assessment. Following sample collection, soil samples are screened for metals using an X-Ray Fluorescence (XRF) device at the program office. A subset of samples from each property is submitted for laboratory analysis. A correlation between laboratory results and XRF readings is used to assign predicted ‘lab’ values to samples that were not lab analyzed. Using Pro-UCL, a 95% upper confidence limit of the mean (UCLM) concentration for lead is calculated using the discrete samples from the yard and is recorded in the THEdb. Where applicable, flower and/or vegetable garden composite samples are analyzed and results are recorded in the THEdb.
- › The lead concentrations from laboratory and XRF, along with information on the condition of the yard are then used to prioritize properties for remediation. A letter report is provided to the property owner with the soil results, and where appropriate, remediation is offered.

3.3 Soil Remediation Methods

The remediation of residential properties has been a risk based strategy. Over the years four main types of remediation and risk management of soils have been provided on residential properties:

- 1: Full yard remediation: excavation of the entire yard to a depth of 0.3 m below grade or deeper.
- 2: Partial remediation: replacement of soil in part of the yard due to either site access constraints or lower metals in parts of the yard.
- 3: Vegetable garden remediation: replacement of soil within vegetable gardens.
- 4: Yard Improvement: the risk management of soils on the yard through ground cover improvements such as lawn care or covering bare areas.

The general workflow associated with soil remediation and risk management on a property is outlined as follows:

- › Signed consent is obtained from the property owner. A plan is developed and the property is put into a remediation sequence with other yards planned for the given year. The remediation work is generally carried out by removing soil on the property to a minimum depth of 0.30 m in yard (lawn and ornamental garden) areas. Remediation of produce gardens involves removal of a minimum of 0.6 m of soil. The depth of remediation is based on the minimum standards needed to establish an adequate barrier from contaminated soil for the protection of human health as outlined in the US EPA's Lead-Contaminated Residential Sites Handbook¹². The Handbook acknowledges that there may be long term advantages of deeper soil remediation to reduce the need for risk controls and these situations are evaluated in Trail on a case by case basis when deeper remediation is feasible. Soil generated from residential remediation is disposed of at the Teck Landfill or reprocessed at the Teck Metals Smelter. Within 3 days of starting remediation on a property, a Notification of Independent Remediation is provided to ENV.
- › During remediation, samples are collected from the base of the excavation and the remediation depth is recorded and documented on the Remediation Soil Log. Once the area and depth of remediation is sufficient, the contractor installs a demarcation fabric to identify the extent of the remediation work for future reference.
- › Previously sampled, clean and approved backfill is sourced locally, from the Castlegar and Nelson areas, approximately 30 to 70 km north of Trail. The backfill is placed on the property and the property is landscaped to pre-remediation conditions or as outlined in the remediation plan. Depending on the size and access to the property, remediation can range from one to two days to several weeks.
- › A summary report of the remediation activities and a drawing of the work completed is provided to property owners following the work. A Site Risk Classification Report and Notice of Completion of Remediation is provided to ENV. Detailed procedures for yard remediation are outlined in the Operating Procedures attached (Appendix II).

Due to a variety of reasons, in some circumstances, full or partial remediation of a prioritized property, may not be feasible. In such cases, risk management of yard areas may involve installing or improving ground cover instead of removing soil. Situations where this would occur include, for example:

- › difficult site access (i.e., terraced yards, retaining walls, etc.);
- › excavation is not possible (around large trees, over shallow utilities, etc.);
- › metals are below the relevant PSC¹³; and
- › landowner has not provided remediation consent.

The range of risk management services (called 'yard improvement' within the community) may include some or all of the following and is typically only available to properties that are part of Healthy Homes:

- › Lawn Care – aeration, fertilization, top dressing and overseeding of lawn areas;

¹² US Environmental Protection Agency (EPA), Superfund Lead-Contaminated Residential Sites Handbook. EPA Lead Sites Workgroup. August 2003.

¹³ The THEC previously set PSC values (also known as remediation action levels). These values have evolved over the life of the program in response to changes in science and policy. On properties with children less than 3 years of age, soil lead levels below the PSC, and poor ground cover, risk management would be offered to reduce the potential exposure to lead in soil in specific areas or across the entire yard if necessary.

- › Covering bare areas – installation of landscape fabric and landscape materials such as mulch or drain rock; and
- › Shallow excavation of soil and covering with clean backfill material and landscaping.

3.4 Data Management

3.4.1 THEP Information Management System

In coordination with Teck, SNC-Lavalin has developed the information management system for the Home & Garden Program within the THEP (i.e., the THEdb), as well as various ESRI GIS applications, including ArcGIS Desktop, ArcGIS Pro, Survey 123 and Collector.

THEdb is a purpose-built database management system designed to store and provide easy access to the information necessary to effectively and efficiently manage the Home & Garden Program component of the THEP. The THEdb stores the following information:

- › Assessments: dates and types of soil assessments, surface soil, excavation-base, post-remediation, including those for the Property Development Program of the THEP;
- › Analyses: for assessment soil samples with XRF and lab results, locations, dates, logs, depths, duplicates;
- › Properties: address, jurisdiction, folio number, unique provincial property identifier, age of home, GPS coordinates of centre of the property, neighbourhood, lead-based paint screening (limited);
- › Property owners: name, phone number, email address where available;
- › Families participating in the Healthy Families Healthy Homes program, associated properties (primary residence, secondary residence, daycare, past residences, etc.), material supports provided by THEP, dates of birth of children participating in Blood Lead Clinic, Case Management histories;
- › Information on how families entered to program, to evaluate relative success of recruitment events;
- › Remediation and yard improvement work: start and end dates, remediation contractor, remediation details including remediation extents, area and volume of soil remediated, type of cover material, cost of remediation, NIR/NCIR filing dates, whether the property was High Risk according to Site Risk Classification, and the post-remediation soil concentrations;
- › Documentation: electronic files consisting of consent forms (e.g., permission to sample soil, permission to remediate, remediation plans), property condition checklists, soil logs, photographs, pre-remediation videos, assessment and remediation report letters to property owners, lab chain of custody and certificates of analysis;
- › Comments: additional comments and notes recording current understanding or communications etc., on any/all of the above; and
- › Procedural requests (e.g., for soil assessment, XRF analysis, lab analysis, letter reports, etc.), with dates, and sign-offs.

The information within the THEdb regarding Requests includes, but goes well beyond the simple request for vegetable garden or yard soil assessment, to encompass the entire workflow that follows from them. For example, each yard soil assessment includes a detailed sequence of steps that includes obtaining consent for sampling, the actual soil sampling, recording the sample locations, filing documents

generated in the field, screening samples with XRF, preparing Chain-of-Custody forms and shipping selected samples to the lab, processing lab results, generating a 95% UCLM concentration¹⁴, filing lab analyses, recording results in the property record, and finally generating and mailing the assessment letter report to the owner.

These steps are all required to ensure that consistent quality data is being collected, that the various documents generated are filed and made easily available, that no steps are missed, and that requests are not missed. As each stage in the process is completed, it is signed off and dated, which automatically generates the next step in the process. Similar workflows are constructed for the various other parts of the Program, each with its own sequence of requests. The Requests Manager interface component in the THEdb presents all program Requests in one place to allow staff to facilitate communication and allow them to determine the status of any given Request. It also provides various filters that allow staff fulfilling different duties to determine Requests that require their attention, so that they can focus on their specific duties and help the entire staff work efficiently to fulfill all requests in a timely manner.

All electronic laboratory documents, report letters, photos, videos, chains of custody, certificates of analysis, and maps are stored on the SNC-Lavalin server computer in Trail, and are linked to the associated property in the THEdb for quick reference and availability. Paper field documents, such as the various Consent forms, property condition checklists, soil logs, Healthy Homes Checklists, remediation plans, etc. are scanned, filed on the server and linked to the appropriate property in the THEdb.

The THEdb is designed and built on an entity-relationship database model that eliminates or limits data duplication to the extent possible to avoid data consistency problems and to facilitate efficient and fast querying, reporting, and data entry. Forms are designed to view data in a structured way that ties related information together and allows for quick and intuitive access. Data displayed in the forms is protected from change except where data entry is required. Manual data entry by staff is always managed through these forms, and uses pick-lists and range checking wherever possible to ensure efficiency, consistency and accuracy. Lab analyses and other data received or produced electronically are bulk loaded by the database administrator to eliminate data entry errors and reduce the time which would otherwise be required to manually enter the information. The THEdb physically resides on a computer in the THEP Community Program Office to optimize speed and usability, and is backed-up to a server located in SNC-Lavalin's Burnaby office daily to ensure the safety of the data and the ability to recover it with minimal loss in the event of computer or storage device failure.

The THEdb and all information within it, is owned by Teck. Data are summarized and presented to the THEC, or to Teck upon request. The Program Office provides information and data to property owners about their specific property on request (e.g., in the case of a new property purchase, soil information can be provided to the new owner). Data is also shared with IH and ENV as needed or requested. We expect data sharing with ENV to be a main component of the program moving forward.

3.5 Assessment and Remediation Results

Since the program was developed in 2007, 1,324 properties have been tested as part of the yard soil assessment and another 733 vegetable gardens have been tested either independently or as part of a yard. Remediation has been completed on 133 properties and many more properties have received,

¹⁴ Refer to Appendix IV for a detailed procedure for calculation of 95% UCLM concentration.

garden remediation (140), or yard improvement (i.e., risk management) work (257). Analytical results for residential yard soil assessment and remediation work carried out under the program prior to November 2, 2018 are presented in Table 1. In late fall 2018, while the weather was still good, the focus was on collecting samples on as many properties as possible, with the intent to XRF and lab analyze them in December and January. As such, we are waiting for results from 60 properties. In 2018, 263 properties were sampled, our largest year to date and field samples were collected up to December 10, 2018. Tables and maps will be updated periodically, and the remaining 2018 data will be included in the next update.

The data tables present the XRF and laboratory analytical results for the specified substances (As, Cd, Pb and Zn) compared to relevant concentration limits established in SNC-Lavalin (2018) and presented in Section 2. All data collected to date is summarized in Table 1. Surface soil samples are also provided in Table 2 and surface soil samples from properties that have not been remediated in Table 3. The 95% UCLM for properties that have not been remediated are in Table 4 and excavation base and post remediation samples are in Tables 5 and 6 respectively. Other laboratory analyzed metals are provided for reference but are not compared to regulatory limits. As shown on the soil assessment tables, specified substances exceed the relevant concentration limits in many instances, consistent with the signature observed in soils impacted by historical emissions. Individual sample results are presented for properties that have not been remediated in Table 3¹⁵, and Table 4 shows the calculated 95% UCLM lead concentration for those properties.

A compilation of drawings is provided to visually present the distribution of lead concentrations across neighbourhoods in Trail. Map Book 1 presents information from Table 4; the most up to date yard 95% UCLM soil lead concentrations that was calculated from the 10 or more discrete surface soil samples following soil assessment. Hatched properties indicate a yard that has been remediated and in those cases, the soil sample of the backfill is shown on the drawings to show surface soil concentrations currently present on the property. Map Book 2 presents only the properties that have received remediation and the associated 95% UCLM soil lead from the excavation base (Table 5). This information presents the soil metal concentrations below the landscape materials, the 30 cm of clean cover and the geotextile demarcation fabric that is placed on the property following excavation of contaminated soil.

This data for individual yards is also available in re-classification reports previously submitted to ENV and in remediation summary reports that have been provided to property owners after remediation is carried out, which can be provided to ENV on request.

3.6 Discussion

The assessment and remediation of residential yards in Trail has evolved over time through pilot projects, new programs and studies. The focus of remediation and risk management work has always been to reduce potential health risks for residents from lead contamination in their yard soil. Soil assessment work used to guide remedial activities has been carried out in general accordance with ENV guidance and best practices, but has not typically met the requirements of Detailed Site Investigation as outline in the CSR. Although some data gaps remain, as outlined in Section 5 below, the level of investigation is inferred to be sufficient to facilitate prioritization of properties for remediation or risk management.

¹⁵ The corrected XRF lead for individual samples that is used for the 95% UCLM calculation will be provided in subsequent updates to ENV. Values provided in Table 3 are calculated based on the current correlation between XRF and laboratory results which does not perfectly replicate the correlation applicable to each sample set.

4 Risk Based Remedial Strategy

4.1 Prioritization of Residential Properties for Remediation

On behalf of Teck, SNC-Lavalin has developed an approach to identify highest risk residential properties for remediation prioritization in 2019. The objective of the prioritization strategy is to provide a scientifically-defensible approach that will identify and prioritize those properties for which remediation is most important, and therefore should occur soonest. To meet this objective, the United States Department of Housing and Urban Development (US HUD) was identified as an agency to have a recent approach for identifying lead in soil that may pose greatest risk to children. Nevertheless, certain aspects of the US HUD (2012) approach were considered to require modification due to certain site-specific aspects of Trail, BC and more recent scientific positions on risk assessment. Consequently, an enhanced version of the US HUD (2012) approach was identified as the most appropriate basis for the prioritization of lead in residential soils at Trail, BC. Refer to Appendix V for details.

The proposed modified-US HUD approach focuses on three key attributes of a given property:

- › Presence of children in the target age groups: <6 years old (i.e., “young children”) and 6 to <12 years old (“older children”);
- › Presence of good ground cover (primarily grass but also gravel or mulch cover); and
- › Soil Lead concentration based on:
 - for yards with good ground cover, the 95% UCLM of concentrations measured in yard; or
 - for yards with areas of poor ground cover (at play areas), the higher of the 95% UCLM Lead concentrations at areas with good ground cover, or the highest soil Lead concentration measured at any play area with poor ground cover.

Overall, we view the modified-US HUD approach as a reasonable and appropriately conservative approach that offers more protection than directly adopting the US HUD (2012) approach. Consistent with US HUD (2012), properties without children are considered to pose much lower risks and were not considered as part of the overall prioritization. Using the modified-US HUD approach, the prioritization of the sites for remediation can be completed in a scientifically defensible manner according to the following rationale:

- › Priority 1 Properties: A property is a Priority 1 if it:
 - A. does not have good ground cover (i.e., soils are bare and not covered with grass or other materials); and
 - B. the soil Lead concentration exceeds 400 ppm where children <6 years of age are present or 2,800 ppm where children 6 to <12 years of age are present. In addition to these, it is possible that certain ornamental gardens may be included in this category when soil Pb concentrations exceed 1,200 ppm if young child-occupied or 8,400 ppm if older child occupied (refer to SNC-Lavalin, 2019).

These sites represent the highest risk and, thus, should receive the most immediate attention for risk-management activities.

- › Priority 2 Properties: A property is a Priority 2 if it:
 - A. has good ground cover (i.e., soils are covered with grass or other materials); and
 - B. the soil Lead concentration exceeds 1,200 ppm if younger child-occupied or 8,400 ppm if older child-occupied.

Although the soil at these properties may present potential concerns, the presence of ground cover creates a situation where the risk is not considered to be as the highest priority (indeed, under the US HUD [2012] approach, these sites would be ranked as not posing risk provided the ground cover exists).

- › Priority 3 Properties: A property is a Priority 3 if it:
 - A. has good ground cover or is an ornamental garden and soil lead concentration is less than 1,200 ppm if younger child-occupied; OR
 - B. has good ground cover or is an ornamental garden and soil lead concentration is less than 2,800 ppm if older child-occupied; OR
 - C. has soil lead concentration <400 ppm if younger child-occupied; OR
 - D. has soil lead concentration < 2800 ppm if older child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover or the magnitude of the lead concentration creates a situation where the risk is not considered to be a high priority (indeed, under the US HUD [2012] approach, these sites would be ranked as not posing risk).

The garden produce pathway is not addressed in this prioritization strategy and requires further consideration. There is the potential for the garden produce pathway to represent significant exposure; however, there is currently insufficient data available to address this pathway. It is recommended that an appropriate methodology for assessing garden produce be developed in the near future. Evaluation of this pathway may form part of a study being developed by provincial agencies; however, as this is not currently defined. On an interim basis, Teck will coordinate with THEP in 2019 to undertake assessment/remediation of vegetable gardens and testing of garden produce obtained voluntarily from property owners as described in detail in Appendix V and summarized in Section 5, below.

It is recommended that occupancy (i.e., age groups) should be tracked for all properties where a Priority Screening Concentration for older children was selected. Where grass or ground cover is a key determinant in the ranking results (i.e., Priority 2, 3A and 3B properties), it is recommended that such cover should also be monitored.

It is important to stress that the above Prioritization Screening Concentrations are not considered to represent risk-based cleanup concentrations and instead are only presented and used as part of the prioritization approach (see Appendix V for details).

4.2 Prioritization of Sites for Assessment

Prioritization of properties for assessment is also necessary and must align with the prioritization approach for remediation as outlined above. In particular, the proposed approach focuses on the three attributes outlined above, as follows:

- › Step 1: Fulfill a critical data gap as discussed below by identifying all unassessed residential properties occupied by children in the target age groups (0 to <6 and 6 to <12 years old);

- › Step 2: For child-occupied properties, determine if the property is situated in a neighbourhood where the average of the 95% UCLM Lead concentration for properties in that neighbourhood exceeds the most stringent PSC applicable to the age group of the children at the property (i.e., 400 pm for young-child occupied properties and 2,800 ppm for older-child occupied properties); and
- › Step 3: For properties screened through Steps 1 and 2 (i.e., child occupied and neighbourhood lead concentration exceeds relevant PSC) complete a ground cover quality assessment.

The existing data available through soil assessment activities up to the end of 2018 can be used to identify some Priority 1 sites i.e., those with children < 3 years of age, as these properties already have sufficient soil assessment and ground cover information (as required by the approach outlined above and in Appendix V). Once additional yards with children aged 4 to <12 years are identified, soil assessment activities in 2019 will be focussed on those properties that, through the above screening process, have potential to be Priority 1 sites (i.e., child occupied, neighbourhood 95% UCLM Lead concentration exceeds the highest applicable PSC and poor ground cover). The methodology for assessment will be generally consistent with the pre-2019 investigation approach with additional focus on bare areas and primary play areas as discussed in the section below (2019 Strategy).

5 2019 Assessment and Remediation Strategy

Teck's objective for 2019 is to identify and assess all residential properties in the EMA which have the potential to be classified as Priority 1 properties to ensure that these properties are properly prioritized for remediation. Assessment of potentially lower priority sites will be completed in 2019 if possible, or in subsequent years. It is expected that approximately 300 properties will be assessed in 2019. Based on a percentage of child occupied homes from recent census data, most of these properties will be targeted assessment of properties where children under the age of 12 are living. Certainly a limitation in this will be obtaining consent for properties, particularly in tenancy situations. Based on previous experience approximately 1/3 of offers for soil assessment are accepted. We expect slightly higher interest in this target group due to the presence of children and their relatively higher risk related to lead exposure. As noted below, it will be necessary to address some data gaps in order to facilitate this, and it is Teck's intent to establish approaches to address these data gaps in Q1 2019.

Based on the site assessment data, each assessed property will be evaluated in accordance with the proposed prioritization plan (Appendix V) to confirm the classification of each site, and in particular to identify the highest risk sites (Priority 1).

Overall, the methodology for site assessment and remediation in 2019 will be the same as that used in previous years as described in Section 3.1 with the following refinements:

- › Primary play areas (as defined in Appendix V) will be specifically identified at each yard during the assessment work and the quality of ground cover for these areas will be documented;
- › Discrete soil samples will be collected from each such area in addition to the minimum ten discrete samples that are collected from the remainder of the yard; and
- › Calculation of the 95% UCLM Lead concentration for the yard will include data from primary play areas with poor ground cover; however, both the 95% UCLM concentration and the individual concentrations for each primary play area with poor ground cover will be compared to the relevant PSC values.

Prioritization of a given property will be driven by the highest concentration measured at a primary play area with poor ground cover or the 95% UCLM concentration for the yard, whichever is highest.

For the vegetable gardens, in 2019 Teck will undertake the following:

- › Test garden produce obtained from the community on a voluntary basis to compare to previous data obtained prior to implementation of fugitive dust emissions improvements;
- › Inform residents that an approach is being developed to assess the potential for exposure via the garden produce ingestion pathway and that, in the meantime, there are certain produce gardening and preparation techniques that may reduce Pb exposure;
- › Vegetable gardens will be assessed/remediated in conjunction with yard soil assessment/remediation according to the prioritization approach presented herein with the refinement that vegetable gardens will be considered Priority 1 when soil Pb concentration exceeds 400 ppm for properties occupied by younger or older children (i.e., <12 years old); and

- › When requested by a property owner, continue to offer to assess and remediate (if necessary) vegetable gardens at properties that do not fit the Priority 1 classification, provided that doing so will not delay assessment/remediation of Priority 1 properties (yards or gardens).

For 2019, as in previous years, remediation may include full yard remediation as described in Section 3.2, or it may include risk management actions aimed at addressing the highest risk conditions thereby reducing the priority ranking of the property. This may include actions such as targeted removal of soil from areas where concentrations exceed the relevant PSC or improvements to ground cover to reduce exposure potential, again reducing the priority ranking of the property.

To the extent feasible within the limitations of the Program, all properties that are identified as Priority 1 by the end of June 2019, will be remediated or risk managed within the 2019 field season. Any remaining or newly identified Priority 1 sites will be prioritized for remediation or risk management in the 2020 field season. As outlined in Appendix V the prioritization strategy allows for further ranking of sites so that properties are managed in appropriate order.

Teck is targeting to provide full yard remediation at 75 properties in the 2019 work season (compared to 24 full yard remediations conducted in 2018). This will be a significant increase in work for the contractors, will test the limits of the local soil suppliers and will result in increased activity in residential neighbourhoods. This will be an important step in establishing capacity as we work towards expansion of the program. In addition to increasing the number of full yard remediations, risk management activities including yard improvement will be increased to accommodate Priority 1 properties that are not remediated.

At the start of the 2019 field season (typically April), remediation will commence at pre-existing Healthy Homes properties with family information, soil lead concentration greater than 400 ppm and a ground cover evaluation indicating bare soil on the property (i.e., a subset of Priority 1 properties that can be identified using existing data). There are currently 22 properties in the database that meet these criteria and the Home & Garden team will be working with these homeowners to obtain consent and develop a remediation plan. These properties fit into the previous remediation priorities and also the prioritization strategy outlined herein and will allow the remediation work to start concurrent with filling occupancy and ground cover data gaps as outlined below.

With regard to public parks (e.g., play grounds, sports fields, walking trails, etc.), we recognize that these areas may be frequented by children of all ages, primarily from late spring to early fall when weather is favourable. Public parks include large areas where ground cover is good or that would not be considered primary play areas (e.g., sports field and walking trails) as well as areas where bare ground is present that would be considered primary play areas (e.g., play structures). Teck has previously collected limited data from public areas (included in the data set presented in Section 3) which has indicated that elevated soil lead concentrations are present, consistent with data collected at residential properties in the same neighbourhoods. However, additional soil assessment data is necessary to adequately characterize all relevant areas of public parks in order to facilitate prioritization and remediation.

Additionally, public parks are a well-used resource in the Trail area, hosting numerous community activities (e.g., picnics, sporting events) in addition to ad hoc use by neighbourhood children and adults. Conducting, assessment and (if needed) risk management work will require coordination with local officials to minimize impacts to park users.

Teck's objective for 2019 is to review existing data for public parks to identify data gaps. Teck will engage with local officials in 2019 to coordinate access to public parks for additional assessment as needed to

support application of the proposed prioritization approach. Completion of risk management activities at public parks is expected to be carried out in 2020 to the extent practical given access considerations.

5.1 Contingency Plan

Properties classified as Priority 1 that cannot be remediated or risk managed in 2019 will be provided guidance to minimize potential exposure to metals in the yard. This communication will include, but is not limited to:

- › An in-person discussion about the yard and areas that may be of concern;
- › Tips and supports for improving ground cover (i.e., grass seed, sprinklers and hose); and
- › Tips and supports for keeping dust and dirt out of the home (i.e., door mats).

As well, homeowners are often doing work in their yards and it is prudent that the Home & Garden program work with owners to remediate soil alongside their own work as part of Yard Renovation support for excavation projects. In 2018, consent or plans were made with 14 homeowners with soil above previous PSC that will be remediated in 2019. These are not necessarily the highest risk properties, but due to the increased risk of exposure to soil for residents and the potential to generate dust during landscaping and excavation projects, it is important that Teck participate in these projects as they arise.

Teck's participation in these types of homeowner driven projects generally includes; removal and disposal of soil to ensure the proper control and management of contaminated soils. Typically at the extent of the excavation, demarcation fabric is placed and clean backfill may be provided in some cases. Landscape materials are typically not provided since often the homeowner is initiating the project for their own landscaping purposes (e.g., building a driveway, installing a swimming pool, etc.). Remediation monitoring will be completed and recorded consistent with the process used for property remediation in Trail and outlined in Appendix II.

5.2 Data Gaps

Additional information is necessary in order to facilitate prioritization of highest risk properties as outlined above and in Appendix V. As well, previous investigation carried out at residential properties and parks in Trail have focussed on collecting data to guide and confirm priorities for remediation. Data collection has not satisfied the technical requirements of a detailed site investigation as described in the CSR; however, data are considered sufficient to determine appropriate actions and relative priority for reducing lead exposure from soil on residential properties. Data gaps have been categorized according to their criticality to meet aims of the program and prioritize risk management activities consistent with this work plan.

5.2.1 Critical Data Gaps

The following data gaps will need to be addressed to facilitate planning and execution of the 2019 Workplan.

Identification of child-occupied properties: Through THEP, Teck has established a reliable approach for identifying properties where children 0 to 3 years of age reside. In order to expand the program to include properties with children aged 3 to <6 years and 6 to <12 years (resident or frequently visiting), Teck will need to develop additional avenues for identifying these properties. This will likely include engagement with Interior Health or others to facilitate outreach to families with children. As well, further public outreach to the community will be provided to identify these properties with older children. Teck will develop mechanisms to address this during Q1 2019 so that these additional properties are identified for the 2019 field season, to the extent practicable. It must be understood that new properties identified in 2019 that also require soil assessment and are identified as Priority 1 may not be remediated in 2019. This is due to timelines for assessment and remediation planning which can take several months, as well as other remediation planning constraints such as obtaining signed consent forms, the accessibility of the property and the materials available to complete the remediation.

Evaluation of Ground Cover Quality: the modified US HUD approach outlined in Section 4.1 and in Appendix V considers the quality of ground cover (including hard surface, grass, mulch, gravel, etc.) as an important basis for prioritization of the highest risk properties. Current information regarding ground cover is limited to a subset of properties where assessment/remediation were completed and where the THEP has offered risk management or ground cover improvement. In Q1 2019, Teck will determine an appropriate methodology for assessing ground cover quality at each yard that is considered to have potential to be classified as highest risk so that these properties can be appropriately prioritized for the 2019 field season. A detailed ground cover characterization approach will be submitted to ENV for review prior to implementation.

Garden Produce: The approach outlined in Section 4.1 and in SNC-Lavalin (2019) to prioritize properties for remediation does not address risks from garden produce consumption. While this data gap does not affect planning and execution of the 2019 Workplan, this exposure pathway has the potential to pose a greater risk to Trail area residents who have gardens than direct exposure to soil. The soil to garden produce pathway requires further evaluation (i.e., it would seem possible that smelter air emissions depositing on garden produce could also have been an important source of lead in garden produce). It is recommended that an appropriate methodology for assessing garden produce be developed in the near future. Evaluation of this pathway may form part of a study being developed by provincial agencies; however, as this is not currently defined, in the interim Teck will coordinate with THEP in 2019 to undertake assessment/remediation of vegetable gardens and testing of garden produce obtained voluntarily from property owners as described in detail in Appendix V.

5.2.2 Non-critical Data Gaps

The following data gaps are not considered critical for the purposes of planning and execution of work in 2019, but may need to be addressed prior to obtaining approval of a WARP for the EMA at some future date.

Limited vertical delineation: Because remediation plans typically dictate the depth of remediation as 0.3 m in yards, 0.6 m in vegetable gardens or the practical depth of excavation if less than these depths

(e.g., due to obstructions such as tree roots, utilities, etc.), there is limited sample data regarding the vertical extent of contamination. Although not critical for planning and execution of the 2019 Workplan, further investigation would be necessary to vertically delineate the contamination in each area (e.g., a neighbourhood or portion of a neighbourhood) to support DSI level assessment, if warranted.

Limited dataset for some neighbourhoods: Assessment and remediation has been carried out at yards in the Trail area with particular focus on neighbourhoods considered most likely to have elevated soil lead concentrations which would therefore present highest risk to children if present (e.g., Tadanac, East Trail, Shaver's Bench). Fewer yards in other Trail area neighbourhoods, and none north of Rivervale/Oasis, have been assessed or remediated given the relatively lower soil concentrations anticipated to be present. While further investigation in these other areas will be required in future, this data gap is not considered to be critical for planning and execution of the 2019 Workplan.

Limited groundwater assessment: This data gap is considered non-critical with respect to the 2019 Workplan. While groundwater monitoring wells have not been completed in all neighbourhoods, boreholes advanced in Trail associated with other site assessment work indicate that surface soil contamination associated with historical aerial emissions did not extend to the water table. Furthermore, monitoring wells located in East Trail, a neighbourhood with the highest surficial metals concentrations, report concentrations of the specified metals (As, Cd, Pb, Zn) at or close to detection limits, and in all cases below CSR standards. Additionally, groundwater chemistry from sampling conducted as part of a water well survey for the ERA indicated that a spatial pattern of exceedances of CSR standards in groundwater was not present (Golder, 2007), suggesting that historical aerial deposition has not affected groundwater in the area

5.3 2019 Data Reporting

A progress report will be issued by June 30, 2019 which will include:

- › A list, ranking and schedule for the assessment of all sites in priority neighbourhoods; and
- › A list, ranking and schedule for remediation of Priority 1 properties in 2019 including the proposed remediation strategy for each property, whether by remedial excavation or implementation of other risk management strategies as outlined in Section 3.3.

In 2019, the approach for reporting of assessment and remediation data to property owners will be the same as in previous years, as described in Sections 3.1 and 3.2 above.

An annual report shall be submitted to the director no later than March 31, 2020 (and following years) and shall include, but not necessarily be limited to:

- › A summary of investigation and remediation work completed to date and in the previous year and an assessment of overall progress towards the remediation of highest risk sites and in comparison to the proposed remediation schedule. Where contingency actions have been implemented to address delays &/or issues that may have arisen during the work season, the delays/issues and actions taken should be indicated;
- › Updated soil data in a format acceptable to the director;
- › A summary of inspections and monitoring of risk controls implemented to date and in the past year and an evaluation of the overall performance of the controls;
- › A summary of communication records with landowners or other community members/groups related to investigation or remediation work completed in 2019 or planned for later years;

- › A summary of risk mitigation measures implemented during the work season and results of performance monitoring;
- › A list, ranking and schedule for remediation of Priority 1 properties (if any remain or if any new Priority 1 properties are identified) and Priority 2 properties in 2020 including the proposed remediation strategy for each property, whether by remedial excavation or implementation of other risk management strategies as outlined in Section 3.3, and
- › Supporting documentation.

6 Communication Plan

Teck, with support and input from the Trail Area Health and Environment Program team and Kirk & Co. Consulting Ltd., developed an outline communications plan (refer to Appendix VI) for review by ENV. This is being developed in to a communications and engagement plan which was submitted under separate cover. The objectives of this plan are to:

- › Support the identification of all residential properties that have children under 12 years old present that have the potential to be classified as Priority 1, and provide information about the 2019 Soil Management Plan to them.
- › Provide information to residents, the broader community, and THEP/Teck employees/ contractors explaining the 2019 Soil Management Plan as the next step in a continual process of improvement for Teck and meeting the requirements of the Contaminated Sites Regulation (CSR).
- › Introducing residents and the broader community to the CSR and how it applies to Trail, including Teck's obligation as the responsible party.
- › Effectively communicate and anticipate issues related to the 'new' aspects of the program, i.e.:
 - The priority-based approach (based on age, ground cover, and soil lead concentrations);
 - The wider area of focus (the issue of lead in soil will be new to some communities);
 - The increased program activity (more work will be taking place than in previous years); and
 - Where residents can learn more information regarding the CSR, the history of the THEP to date, and planned next steps.

7 Risk Mitigation and Health and Safety

Protection of workers, residents and the public from hazards associated with soil assessment and remediation work is a critical objective of the program. To this end, all parties involved in assessment and remediation programs are called upon to contribute to the management of risks associated with the work.

- › During the planning stages for remediation of a given property, the owner (and tenant if applicable) is provided with a copy of the Resident Health and Safety Plan (Appendix III) developed for the program and SNC-Lavalin provides instruction to familiarize residents/tenants with the hazards and mitigations associated with the remediation work.
- › SNC-Lavalin conducts all soil assessment and remediation monitoring work in accordance with health and safety procedures that comply with SNC-Lavalin and Teck health and safety policies and Worksafe BC requirements. SNC-Lavalin's Health and Safety Plan (HASP) template for the program is included in Appendix III.

The contractors completing yard remediation work are experienced and knowledgeable regarding the program. The remediation contractors are responsible for health and safety at each work site. Each contractor has developed comprehensive procedures to identify hazards associated with the work and to protect workers, residents and the public during completion of the work. A summary of the remediation contractors health and safety procedures and a copy of their Job Safety Analysis, are included in Appendix III.

As well, as discussed in the contingency plan above, there is uncertainty regarding the total number of properties that will be determined to represent highest-risk and classified as Priority 1 for remediation. As such, it is not known at this time if all such properties can be addressed within one year of being assessed. Properties classified as Priority 1 that cannot be remediated or risk managed in 2019 will be provided guidance to minimize potential exposure to metals in the yard. This communication will include, but is not limited to:

- › An in-person discussion about the yard and areas that may be of concern;
- › Tips and supports for improving ground cover (i.e., grass seed, sprinklers and hose); and
- › Tips and supports for keeping dust and dirt out of the home (i.e., door mats).

The intent of the comprehensive Health and Safety Plan as well as the communication plan for properties, particularly where there are anticipated delays in remediation is so that children, workers, residents and neighbours are all aware and protected from potential exposure to metals prior to and during remediation.

8 Professional Statement

As required under Part 16, Section 63 of the *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 13/2019, January 24, 2019. SNC-Lavalin Inc. (SNC-Lavalin) acknowledges that the person(s) signing this report has (have) demonstrable experience and is (are) familiar in completing the work, as described, for the type of contamination at this property. The documentation provided has been prepared in accordance with the applicable regulations in the *Environmental Management Act* (EMA), B.C. Reg. 13/2019 / effective January 24, 2019.

9 Notice to Reader

This report has been prepared and the work referred to in this report have been undertaken by SNC-Lavalin Inc. (SNC-Lavalin) for the exclusive use of Teck Metals Ltd. (Teck), who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report. Should this report be submitted to the BC Ministry of Environment & Climate Change Strategy (ENV) by Teck, ENV is authorized to rely on the results in the report, subject to the limitations set out herein, for the sole purpose of determining whether Teck has fulfilled its obligations with respect to meeting the regulatory requirements of ENV.

The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, site conditions change or standards are amended, modifications to this report may be necessary. The results of this assessment should in no way be construed as a warranty that the subject site is free from any and all environmental impact.

Any soil and rock descriptions in this report and associated logs have been made with the intent of providing general information on the subsurface conditions of the site. This information should not be used as geotechnical data for any purpose unless specifically addressed in the text of this report. Groundwater conditions described in this report refer only to those observed at the location and time of observation noted in the report.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

The contents of this report are confidential and proprietary. Other than by Teck, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Teck and SNC-Lavalin.



Tables

Provided in Separate Excel File

- 1: THEP All Soil Analysis Results – 2007 to 2018
- 2: THEP Initial Surface Soil Analysis Results – 2007 to 2018
- 3: THEP Surface Soil Analysis Results for Properties with No Previous Remediation – 2007 to 2018
- 4: THEP 95% UCLM for Properties with No Previous Remediation
- 5: THEP Excavation Base Soil Analysis Results – 2008 to 2018
- 6: THEP Post Remediation Soil Analysis Results – 2008 to 2018



Drawings

Also Provided in Separate File

- › Map Book 1 – Trail Area Health & Environment Program Surface Soil Status for Lead
- › Map Book 2 – Trail Area Health & Environment Program Excavation Base Soil Lead (cont'd below)



Appendix I

ENV Correspondence, December 7, 2018



VIA EMAIL: Clare.North@teck.com

December 7, 2018

File: 26250-20/3250
Site ID: 3250

Ms. Clare North, M.Sc., P.Geo.
Superintendent, Environmental Remediation
Teck Metals Ltd.
Trail Operations
PO Box 1000
Trail BC V1R 4L8

Dear Ms. North,

Re: Remediation of Teck Metals Ltd. Trail Operations Facility Environmental Management Area in Trail BC

Information provided by Teck Metals Ltd. (Teck) to the Ministry of Environment and Climate Change Strategy (ministry) indicates that there may be as many as 1,200 properties (sites) in Trail, BC that would be classified as high risk in accordance with ministry protocol due to the presence of lead concentrations in surface soil exceeding the ministry's upper cap concentrations (1,200 ug/g). The ministry is aware of and supports Teck's work over the past several years to develop and seek ministry approval of a Wide Area Remediation Plan (WARP) that addresses historical contamination across the entire area affected by the Teck smelter in Trail (the "Environmental Management Area"). However, completion of the final WARP is currently awaiting the results of an independent health assessment being undertaken by the province that may not be available until late 2019. This letter sets out ministry expectations for the appropriate and timely remediation of highest risk sites in Trail in the 2019 work season and until such time as a final WARP is approved.

1. A report signed by a contaminated sites Approved Professional shall be submitted to the director for review by January 31, 2019 that shall include, but not necessarily be limited to:
 - a) A detailed soil investigation sufficient to support the risk-based remedial strategy required under item b) below prepared in accordance with the Contaminated Sites Regulation (CSR) and applicable protocols and guidance documents. Soil data should be at a level of detail and in a format acceptable to the director (see April 30, 2015 response from the ministry on the 2014 draft Wide Area Remediation Plan and November 16, 2017 email on the presentation of soil data). An evaluation of information gaps critical to the development of the risk-based remedial strategy and a plan to address the gaps should be included;

- b) A risk-based remedial strategy including a risk-ranking methodology and supporting rationale for selecting priority sites for investigation and remediation (including interim risk controls) and a 2019 workplan outlining the number and type of sites to be investigated and remediated;
 - c) A communication plan for informing and seeking the approval of land owners for investigating &/or remediating their sites and for providing investigation or confirmation of remediation reports at the completion of work. The communication plan must also include a strategy for informing the broader community of the work being carried out under the 2019 workplan and more generally to address highest risk sites in the Environmental Management Area;
 - d) A risk mitigation plan to mitigate the exposure of residents and community members to metal impacted soil during investigation and remediation activities and a contingency plan to address potential delays &/or issues that may arise during the work period;
 - e) Supporting documentation.
2. A progress report shall be submitted to the director no later than June 30, 2019 (and in following years) that shall include but not necessarily be limited to:
- a) List of sites selected for investigation and remediation;
 - b) The results of communication completed with owners of selected sites and other members or groups in the community;
 - c) Any proposed changes to the 2019 workplan as a result of completed communication efforts and the potential implications of changes on the remediation of highest risk sites;
 - d) Description of any delays &/or issues that have been identified that may impact remediation progress and proposed contingency actions to mitigate impacts on the 2019 workplan.
3. An annual report shall be submitted to the director no later than March 31, 2020 (and following years) and shall include, but not necessarily be limited to:
- a) A summary of investigation and remediation work completed to date and in the previous year and an assessment of overall progress towards the remediation of highest risk sites and in comparison to the proposed remediation schedule. Where contingency actions have been implemented to address delays &/or issues that may have arisen during the work season, the delays/issues and actions taken should be indicated;
 - b) Updated soil data in a format acceptable to the director;
 - c) A summary of inspections and monitoring of risk controls implemented to date and in the past year and an evaluation of the overall performance of the controls;
 - d) A summary of communication records with land owners or other community members/groups related to investigation or remediation work completed in 2019 or planned for later years;

- e) A summary of risk mitigation measures implemented during the work season and results of performance monitoring.
- f) Supporting documentation.

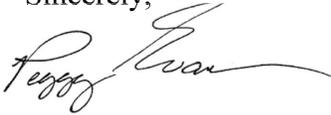
Due to the presence of high risk conditions and potentially unacceptable risks to human health from elevated lead concentrations in soil in the Teck, Trail Environmental Management Area, the above expectations are imposed as director's requirements for independent remediation pursuant to section 54(3)(d) of the *Environmental Management Act* and the reporting requirements of Protocol 12, "Site Risk Classification, Reclassification and Reporting" .

Persons undertaking investigations and remediation at contaminated sites in British Columbia are required to do so in accordance with the *Environmental Management Act*, Contaminated Sites Regulation and ministry protocols. Information on the contaminated sites regulatory regime can be found at the ministry's [site-remediation](#) page.

Please be advised that should investigations or remediation not proceed in a manner or schedule satisfactory to the director, additional requirements may be imposed under other authorities of the *Environmental Management Act*.

If you have any questions regarding this letter please contact me at 778-698-4855 or Lavinia Zanini at 604-582-5348.

Sincerely,



Peggy Evans,
for Director, *Environmental Management Act*

cc: Dan Bouillon, Manager, Environment, Teck Metals Ltd.
Steve Hilts, Director, Environmental Legacies, Teck Resources Ltd.
Lisa Pasin, Mayor, City of Trail
Dr Kamran Golmohammadi, Medical Health Officer, Interior Health
Dr. Trevor Corneil, VP Population Health & Chief Medical Health Officer, Interior Health
Dr. Bonnie Henry, Provincial Health Officer
Matt Herman, Executive Lead, Population and Public Health, Ministry of Health
David Morel, Assistant Deputy Minister, Ministry of Environment and Climate Change Strategy
Kevin Butterworth, Executive Director, Environmental Emergencies and Land Remediation, Ministry of Environment and Climate Change Strategy
Tessa Graham, Executive Director, Regional Operations, Ministry of Environment and Climate Change Strategy
Peter Kickham, A/Director, Land Remediation, Ministry of Environment and Climate Change Strategy



Appendix II

Field Methodology

Field Methodology

Operating Procedure – Composite Soil Assessment

Composite soil assessment sample collection and handling procedures for heavy metals in residential gardens.

SCOPE

This procedure describes the collection and handling of composite soil samples in residential flower and vegetable gardens. For the purposes of this procedure, general inorganic compounds, heavy metals in particular, are screened using an x-ray fluorescence analyzer (XRF) and submitted for laboratory analysis. For collection and handling of samples for other parameters, refer to the appropriate Preferred Operating Procedures.

SAFETY PRECAUTIONS

Potential contaminants of concern in residential soils include lead and other heavy metals, which can be harmful if ingested or inhaled. Physical contact with potential contaminants of concern should be avoided by wearing appropriate gloves while collecting and handling soil. Good hygiene and cleanliness should also be practiced to minimize exposure to heavy metals and transfer of contaminants to other sites.

Additional precautions must be followed to minimize radiation exposure while operating an XRF. Training and certification may be required for the specific XRF unit being used and are outlined in the OP: Shielded XRF operation and handling procedures.

Safety precautions associated with other onsite activities (i.e., remediation) may also apply. Refer to SNC-Lavalin Corporate Environmental Health & Safety Program for further information.

QUALITY CONTROL

Quality control is provided by careful documentation of field information, decontamination of sampling equipment between samples, homogenization of soil samples and documenting sample locations. Quality assurance is provided by submitting an appropriate number of blind field duplicate samples for laboratory analysis, generally one blind field duplicate for every ten samples submitted. Field duplicates and field samples are collected using exactly the same sample procedure, as described below. Sample naming is done such that the laboratory is unaware of which samples are duplicates. Refer to POP 4202 for QA procedures.

MATERIALS, EQUIPMENT REQUIRED:

1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):

- high visibility safety vest;
- Nitrile gloves (or appropriate to potential contaminants of concern);
- designated footwear;
- appropriate eyewear;
- First Aid Kit (OFA Level 1);
- Eye wash station; and
- Fire Extinguisher.

2) Field Equipment:

- pen and/or pencil;
- Indelible felt marker;
- field forms and/or field book (garden soil log);
- site map, property information;
- soil auger;
- hand trowel;
- sealable sample bags;
- DI Water and spray bottle;
- replacement soil and grass seed, as needed; and
- camera.

PROCEDURE

- 1: Confirm property ID (PID) and information in database prior to completing field sampling. Ensure property and contact information is current and complete and appropriate access consent has been obtained.
- 2: Inform property residents of sampling activities prior to commencing.
- 3: Prepare sample bags with appropriate sample nomenclature for sampling objectives: 1 composite surface soil (SS) sample per discrete vegetable garden (VG) or flower garden (FG) area:
 - Sample ID: SSyy-0PID-VG#-yyymmdd or SSyy-0PID-FG#-yyymmdd

Note: Blind duplicates follow the same nomenclature as the sample being duplicated; however, garden sample duplicates are given a number; VG1, VG2 and a PID of 0001, 0002, respectively. Ensure that 2 duplicate samples of any variety, which are collected on the same date, do not have the same number or letter.

- 1: Using a soil auger and/or hand trowel collect soil from 10 discrete locations to form the aliquot within each of the discrete garden area. Collect samples to a depth of 15 cm. Exclude vegetation (i.e., grass and rootlets) and place soil from all 10 locations directly into the single labeled sample bag. Approximately 50 g of soil is needed for each sample including an additional 50 g for duplicates. Carefully homogenize soil and remove air space before sealing bag. (Direct bag away from you to avoid inhaling fine dust particles).
- 2: Complete the garden sampling soil log, or where yard soil assessment has also been completed, include garden sampling details on the property condition checklist (including the garden location on the property sketch) and property soil log. Refer to OP: Discrete soil assessment sampling procedures.
- 3: Enter sample locations into the survey 123 app on your smartphone and ensure accuracy is sufficient.
- 4: Photograph the garden, and any interesting points in the yard including access constraints.
- 5: Collect sample bags and dispose of all waste materials. Leave the property in a tidy condition, as found. Fill sample locations with clean bagged replacement soil as needed and top with grass seed as needed (generally not applicable for garden sampling).
- 6: All samples are screened using an XRF. XRF screening on soil assessment samples should take place in the Trail office XRF lab, utilizing the protective shield and therefore minimizing radiation exposure risks as much as possible. Refer to OP: Shielded XRF operation and handling procedures.

- 7: All vegetable garden samples are submitted for laboratory analysis. Flower garden samples are submitted for analysis on a case by case basis (i.e., is a maximum XRF screening result for the property) generally; XRF screening results for flower gardens are sufficient.

Special considerations:

- › VG samples exceeding 1000 ppm for lead and/or 30 ppm for cadmium (or any other applicable UCC) will be offered remediation and thus, should be analyzed for Toxicity Characteristic Leaching Procedure (TCLP) for soil disposal purposes, requiring an additional 100 g of sample. Refer to OP: Preparation for Remediation and Yard Improvement Projects for additional information on soil disposal requirements.
- 8: Soil samples selected for analysis are submitted to the laboratory in the sealable plastic bag and labeled appropriately. Where, duplicate samples are analyzed, care should be taken that the soil is homogeneous between the two sample bags.
- 9: Prepare individual COCs for each property and assign a COC number (0PID-yymmdd) using the sample date. Vegetable garden composite samples are submitted with yard assessment samples from the same property, on the same COC. (Note: the COC number for remediation samples at the same property will differ by the sample date, as is the case for annual LTS sampling events). Ensure that the appropriate project number and Trail Health and Environment Program Pricing is indicated on the COC. DO NOT select any applicable regulatory limits. Digital copies of COCs are stored under a file name using the COC number followed by the date relinquished (e.g., 0PID-130509_130602). Once analytical results have been received and reviewed, remaining soil samples can be placed in long-term soil storage.
- 10: Provide an accurate completion date in the database for each task as it has been completed. Ensure all field documents, photographs and location data points have been electronically filed appropriately and all hard copies are filed by PID. Refer to OP: Data Management Procedures.

TECHNICAL NOTES

Studies completed on sample preparation show that for the purposes of this program it is not necessary to dry and sieve the soil prior to XRF soil screening and it may be screened directly through the soil bag.

XRF results can be skewed if the soil is excessively moist or wet. Sample collection during heavy rain events should be avoided where possible.

A trial of composite procedures was completed in 2009. The trial indicated that composite sampling methods provided a good understanding of garden soil, where soil is often mixed and turned over at least annually. Statistical analysis of the composite indicated a co-efficient of variation within acceptable range for the gardens tested.

Operating Procedure – Discrete Soil Assessment for Residential Yards

Discrete soil sample collection and handling procedures for the assessment of heavy metals in residential yards.

SCOPE

This procedure describes the collection and handling of discrete soil samples at residential properties. For the purposes of this procedure, general inorganic compounds, heavy metals in particular, are screened using an x-ray fluorescence analyzer (XRF) and submitted for laboratory analysis. For collection and handling of samples for other parameters, refer to the appropriate preferred operating procedures.

SAFETY PRECAUTIONS

Potential contaminants of concern in residential soils include lead and other heavy metals, which can be harmful if ingested or inhaled. Physical contact with potential contaminants of concern should be avoided by wearing appropriate gloves while collecting and handling soil. Good hygiene and cleanliness should also be practiced to minimize exposure to heavy metals and transfer of contaminants to other sites.

Additional precautions must be followed to minimize radiation exposure while operating an XRF. Training and certification may be required for the specific XRF unit being used. Refer to the XRF Operating Procedure: Shielded XRF operation and handling procedures.

Safety precautions associated with other onsite activities (i.e., remediation) may also apply. Refer to SNC-Lavalin Corporate Environmental Health & Safety Program for further information.

QUALITY CONTROL

Quality control is provided by careful documentation of field information, decontamination of sampling equipment between samples, homogenization of soil samples and documenting sample locations. Quality assurance is provided by submitting an appropriate number of blind field duplicate samples for laboratory analysis, generally one blind field duplicate for every ten samples submitted. Field duplicates and field samples are collected using exactly the same sample procedure, as described below. Sample naming is done such that the laboratory is unaware of which samples are duplicates. Refer to POP 4202 for QA procedures.

MATERIALS, EQUIPMENT REQUIRED:

1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):

- High visibility safety vest;
- Nitrile gloves (appropriate to potential contaminants of concern);
- Designated footwear;
- Appropriate eyewear;
- First Aid Kit (OFA Level 1);
- Eye wash station; and
- Fire Extinguisher.

2) Field Equipment:

- pen and/or pencil;

- Indelible felt marker;
- field forms and/or field book (property condition checklists and soil logs);
- site map, property information;
- soil auger;
- hand trowel;
- sealable sample bags;
- DI Water and spray bottle;
- replacement soil and grass seed; and
- camera.

PROCEDURE

- 1) Confirm property ID (PID) and information in database prior to completing field sampling. Ensure property and contact information is current and complete and appropriate access consent has been obtained.
- 2) Inform property residents of sampling activities prior to commencing.
- 3) Prepare sample bags with appropriate sample nomenclature for sampling objectives. A minimum of 10 random and discrete yard surface soil (SS) samples 0-15cm depth. Sample ID: SSyy-0PID-##-yymdd Note: Blind duplicates follow the same nomenclature as the sample being duplicated; however, the sample number for yard samples will follow an A, B, C scheme with a PID of 000A, 000B, and 000C, respectively. Ensure that 2 duplicate samples of any variety, which are collected on the same date, do not have the same number or letter.
- 4) Select sample locations per sampling objectives. Samples 1 through 10, should be spaced evenly across the yard to represent the overall yard condition and soil quality. Additional samples, numbered 11 and higher, may be collected to highlight areas of interest. Such areas to consider include drip lines, areas of poor ground cover, play areas and high traffic areas. Special areas of interest may be remediated independently, if warranted.
- 5) Using a soil auger and/or hand trowel collect a column of soil to the indicated depth for the sampling objective. Excluding minimal surface vegetation (i.e., grass and rootlets), empty the auger or trowel directly into the labeled sample bag. Sufficient quantity should be collected to fill approximately two 4oz soil jars (100 g – 150 g). Carefully homogenize soil and remove air space before sealing bag. (Direct bag away from you to avoid inhaling fine dust particles). Place sample bag next to sample location.
- 6) Complete the property condition checklist (including property sketch), indicating sample locations and recording surface conditions on the soil log.
- 7) Enter sample locations into survey 123 app on your smartphone and photograph property from different aspects, capturing the house number, vegetable gardens, access constraints and other areas of potential concern.
- 8) Backfill sample holes with clean topsoil and grass seed (where applicable). Collect sample bags and dispose of all waste materials.
- 9) Where applicable, collect composite sample of vegetable and flower gardens as per Residential Composite Soil Assessment sampling procedures.
- 10) Leave site in a tidy condition.
- 11) Screen samples using an XRF before selecting a subset of samples for laboratory analysis. XRF screening on soil assessment samples should take place in the Trail office XRF lab, utilizing the protective shield and therefore minimizing radiation exposure risks as much as possible. Refer to Shielded XRF operation and handling procedures. From the recorded screening concentrations (typically lead), a subset of samples are selected for laboratory analysis. Although special

considerations may occur, samples selected for analysis include the maximum and median lead concentration samples. (Note: All vegetable garden samples are submitted for analysis.)

Special considerations:

- › Samples exceeding 4000 ppm for lead and/or 60 ppm for cadmium should be considered for Toxicity Characteristic Leaching Procedure and/or Synthetic Precipitation Leaching Procedure (TCLP/SPLP) submission, requiring an additional 4oz jar of sample. Refer to Remediation Procedures.
- 12) Samples are submitted to the laboratory in their re-sealable bags. Laboratories require approximately 50 g of soil as a minimum quantity of SLAM metals analysis. And another 100 g for TCLP and SPLP, if required. Where duplicate samples are analyzed, care should be taken that the soil is homogeneous between the two sample bags.
- 13) Prepare individual COCs for each property and assign a COC number (0PID-yymmdd) using the sample date. All samples from a property are submitted on the same COC (i.e., include vegetable garden composite samples). (Note: the COC number for remediation samples at the same property will differ by the sample date, as is the case for annual LTS sampling events). Ensure to indicate the appropriate project number and Trail Health and Environment Program Pricing is indicated on the COC. DO NOT select any applicable regulatory limits. Digital copies of COCs are stored under a file name using the COC number followed by the date relinquished (e.g., 0PID-130509_130602). Once analytical results have been received and reviewed, remaining soil samples can be placed in long-term soil storage.
- 14) Provide an accurate completion date in the database for each task as it has been completed. Ensure all field documents, photographs and location data points have been electronically filed appropriately and all hard copies are filed by PID. Refer to Data management procedures.

TECHNICAL NOTES

Studies completed on sample preparation show that for the purposes of this program it is not necessary to dry and sieve the soil prior to XRF soil screening and it may be screened directly through the soil bag.

XRF results can be skewed if the soil is excessively moist or wet. Sample collection during heavy rain events should be avoided where possible.

Operating Procedures – Preparation for Remediation and Yard Improvement

SCOPE

This procedure outlines the preparation work needed for soil remediation and yard improvement projects. It is essential to be properly prepared to provide efficient and accurate documentation of the work completed on residential properties. This procedure describes the steps to initiate remediation or yard improvement projects and the steps to develop the scope of the work. Monitoring of ongoing remediation and improvement work is detailed in subsequent operation procedures.

SAFETY PRECAUTIONS

THEP Home and Garden Team has a Health and Safety Plan in place to address all potential risk during work on residential properties. The main hazards with are:

- › Working alone or in isolation;
- › Traffic (driving to and from families place of residence); and
- › Aggressive, unmanaged pets (i.e., dogs).

Fill out and sign off on appropriate Health and Safety Plan (HASP) prior to completing field work.

QUALITY CONTROL: Quality control is provided by careful documentation and filing of the remediation plan, “as built” drawing and property information such as photos and videos.

MATERIALS, EQUIPMENT, FORMS, REQUIRED

- 1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):
 - High visibility safety vest;
 - Non-slip footwear;
 - First Aid Kit (OFA Level 1);
 - Eye wash station; and
 - Fire Extinguisher.
- 2) Field Equipment:
 - pen and/or pencil;
 - field forms;
 - site map, property information;
 - soft and hard measuring tapes (80 m length recommended for soft tape); and
 - video and digital camera.
- 3) Forms:
 - Consent to Access Property for Remediation;
 - Remediation/Yard Improvement Plan; and
 - Remediation/Yard Improvement “as-built” Drawing.

PROCEDURE

- 1: **Obtain signed access consent** for remediation or yard improvement from the homeowner to gain access to the property (as per A02: *Consent Forms*).

- 2: **Initiate the type of remediation and/or improvement work** in the database (Improvement, Yard, Garden, Partial, Full) by reviewing the condition of the yard and the soil assessment results. Also record the type of work on the Remediation/Yard Improvement Plan.
- 3: **Review available leachable metals analysis** for soil disposal purposes. If additional samples are required for leachable analysis, collect and submit samples according to *SA02: Discrete Soil Sample Collection*. Compare leachable metals analysis to the Hazardous Waste Regulation Schedule 4 – Table 1. Soil above these criteria requires specific disposal procedures at Teck Metals Trail Operations. The steps include:
 - Notify the Superintendent of Environmental Remediation at Teck and the Remediation Contractor of the results.
 - Provide the designate within Teck’s Materials Handling Department the volume of soil that will be excavated and the date it will be hauled.
 - Confirm the drop-off location at Teck Metals with Teck’s Materials Handling Department and communicate the location with the Remediation Contractor.
 - Record the total volume of soil excavated and disposed of at Teck.
 - It is important to notify Teck of soil planned for special handling early in the planning process.
- 4: **Develop the Remediation/Yard improvement Plan (the Plan)** to define the scope of work for the property. It must be developed and approved by the Property Owner(s), the Home and Garden Representative and the Remediation Contractor. The Plan must ensure the work is risk protective, technically feasible, safe and generally agreeable to all parties. The remediation and yard improvement priorities can vary between properties and also within the yard (i.e., yard areas vs. gardens). When developing a remediation plan use the following guidelines to develop the scope of work and an “as built” drawing to visually document the remediation plan.
 - For yard improvement work on properties that are part of the Healthy Homes Program; provide better ground cover as necessary to prevent children’s exposure to bare soil in the yard and to help keep dust and dirt from being tracked into the home. Key areas of interest are parking areas, pathways/walkways to the home, patio areas and areas of the yard where children play. The work typically involves replacing a shallow layer (~10-15 cm) of soil with clean soil backfill (as tested under *R02: Backfill Soil Testing*) to provide a base for new ground cover such as; sod. Areas planned for cover with gravel or patio stones may be prepared and covered without removing a designated depth of soil. Monitor the yard improvement work using *R04: Yard Improvement Monitoring*.
 - In Vegetable Gardens; plan to remove soil to a depth of 60 cm where soil is found to be greater than the Action Level. Replace vegetable gardens with suitable backfill and amend with organics, as indicated by nutrient analysis under *R02: Backfill Soil Testing*. Monitor the garden remediation using *R03: Garden Remediation Monitoring*.
 - For yard remediation properties; remove soil to a depth of 30 cm in yard areas where soil metals are greater than the Action Level for yards. Replace yard with approved backfill soil (see *R02: Backfill Soil Testing*) and landscape features. Follow remediation procedures outlined in *R05: Yard Remediation Monitoring*.
- 5: **Submit the Remediation plan to the Superintendent of Environmental Remediation at Teck for Approval** prior to the start of work. Provide via email, a copy of the remediation plan to Teck for approval. Include the Remediation Contractor and appropriate staff of the Home and Garden team for reference.

- 6: **Video and Photograph the Property:** As a record of initial property condition, a video of the property is recorded prior to the start of the work. It is best to take this as close to the remediation or improvement start date as possible as to document the property immediately before the work begins.
- 7: **Discuss Homeowner Safety:** Ensure the property owner understands risks of the ongoing remediation work on their yard. Provide the owner with the Residents H&S document and discuss ways they can minimize their risks of exposure or injury during the work.
- 8: **Prepare the remediation “as-built” drawing** for the property to provide a visual documentation of the Remediation Plan. The drawing will be used to monitor the ongoing remediation and improvement work and will be finalized in the reporting stage for the yard remediation and improvement work.
- 9: **File all documents, forms, photos/videos and consent records** in the Property Folder (P:\Current Projects\Teck Metals Ltd\TRAIL RESIDENTIAL PROGRAM\Properties) and link records to the appropriate PID in the Database. Sign off the appropriate work flow in the Database

Operating Procedure – Backfill Soil SAMPLING

Backfill soil quality assessment for replacement soil used on remediation projects

SCOPE

This procedure describes the collection and handling of soil samples for determining backfill soil quality for soil nutrients and soil metal concentrations. For the purposes of this procedure, general inorganic compounds, heavy metals in particular, are screened using an x-ray fluorescence analyzer (XRF). Soil nutrient quality and metals are submitted for laboratory analysis.

SAFETY PRECAUTIONS

Backfill soil quality is expected to be free of potential contaminants; however to ensure sample quality, contact with the soil should be avoided by wearing appropriate gloves while collecting and handling soil and by cleaning sampling equipment between each use. Good hygiene and cleanliness should also be practiced to minimize exposure and/or cross contamination with other sites.

Precautions must be followed to minimize radiation exposure while operating an XRF. Training and certification may be required for the specific XRF unit being used.

Safety precautions associated with other onsite activities (i.e., remediation) may also apply. Refer to SNC-Lavalin Corporate Environmental Health & Safety Program for further information.

QUALITY CONTROL

Quality control is provided by careful documentation of field information, decontamination of sampling equipment between samples, homogenization of soil samples and documenting sample locations. Quality assurance is provided by submitting an appropriate number of blind field duplicate samples for laboratory analysis, generally one blind field duplicate for every ten samples submitted. Field duplicates and field samples are collected using exactly the same sample procedure, as described below. Sample naming is done such that the laboratory is unaware of which samples are duplicates. Refer to POP 4202 for QA procedures.

MATERIALS, EQUIPMENT REQUIRED

1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):

- high visibility safety vest;
- gloves (appropriate to potential contaminants of concern; typically nitrile);
- designated footwear;
- appropriate eyewear;
- First Aid Kit (OFA Level 1);
- Eye wash station; and
- Fire Extinguisher.

2) Field Equipment:

- pen and/or pencil;
- Indelible felt marker;
- field forms and/or field book (soil log);
- site map, property information;
- soil auger;
- hand trowel;
- sealable sample bags;

- DI Water and spray bottle;
- replacement soil and grass seed; and
- camera.

PROCEDURE

1. Confirm source soil backfill sampling location and access information with the *Remediation Contractor* prior to completing field sampling. Ensure site owners have been contacted prior to work.
2. Determine the approximate volume of the stockpile and prepare sample bags for stockpile composite sampling where one sample bag represents a maximum of 50 m³ cell of the stockpile and 1 composite sample is made up of 5 aliquots from that cell.
3. Label sample bags as follows Sample ID: SSYY-LOCA-CELL#-YYMMDD where LOCA is a 4 letter abbreviation of the source soil location and the cell number is 01, 02, 03 etc. Note: Blind duplicates follow the same nomenclature as the sample being duplicated; with the cell number AA, BB, etc. Ensure that 2 duplicate samples of any variety, which are collected on the same date, do not have the same number or letter.
4. Using a soil auger and/or hand trowel collect soil at 5, ~250 ml samples at discrete locations from cell with a maximum volume of 50 m³ and place into a single labeled sample bag to comprise the aliquot for that cell. Excluding minimal surface vegetation (i.e., grass and rootlets). Collect a minimum of 1250 ml of soil. Carefully homogenize soil and remove air space before sealing bag. (Direct bag away from you to avoid inhaling fine dust particles). Complete the soil log.
5. Collect additional samples for each 50 m³ cell of soil.
6. Screen samples for metals using an XRF. XRF screening on soil assessment samples should take place in the Trail office XRF lab, utilizing the protective shield and therefore minimizing radiation exposure risks as much as possible. Refer to OP: Shielded XRF operation and handling procedures.
7. Divide sample into two sample bags with at least 1000 ml of soil in one bag for soil nutrient analysis and 250 ml sample in another for metals analysis. Where, duplicate samples are analyzed, care should be taken that the soil is homogeneous prior to dividing.
8. For metals analysis; submit samples to CARO Analytics in Richmond BC. Prepare COCs for the backfill source location and assign a COC number (LOCA-yymmdd) using the sample date. Ensure that the appropriate project number and Trail Health and Environment Program Pricing is indicated on the COC. DO NOT select any applicable regulatory limits. Digital copies of COCs are stored under a file name using the COC number followed by the date relinquished. Once analytical results have been received and reviewed, remaining soil samples can be placed in long-term soil storage.
9. For soil nutrient analysis; submit a 1000 ml bag of soil to Pacific Soil Analysis Inc. in Richmond BC.
10. Provide an accurate completion date in the database for each task as it has been completed. Ensure all field documents, photographs and location data points have been electronically filed appropriately and all hard copies are filed by PID. Refer to OP: Data Management Procedures.

TECHNICAL NOTES

Studies completed on sample preparation show that for the purposes of this program it is not necessary to dry and sieve the soil prior to XRF soil screening and it may be screened directly through the soil bag.

XRF results can be skewed if the soil is excessively moist or wet. Sample collection during heavy rain events should be avoided where possible.

Operating Procedures – Garden Remediation Monitoring

SCOPE

Soil remediation of residential vegetable gardens is offered to home owners when soil metals exceed the Trail Area Health and Environment Committee’s Action Level of 1,000 ppm lead in vegetable garden soil.

SAFETY PRECAUTIONS

A Health and safety program for the remediation and yard improvement program is provided by the Remediation Contractor. SNC-Lavalin adheres to the health and safety program of the Remediation Contractor and completes internal health and safety protocols for independent tasks such as; soil sample collection and XRF use.

QUALITY CONTROL

Detailed quality control procedures are provided in the XX OP – Quality Control. Relevant QC procedures for Remediation and Yard Improvement are:

- › Avoiding Cross Contamination during sample collection;
- › Blind Duplicate sampling; and
- › Backfill soil sampling.

MATERIALS, EQUIPMENT, FORMS, REQUIRED

- 1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):
 - high visibility safety vest;
 - gloves (appropriate to potential contaminants of concern; typically nitrile);
 - CSA steel toe footwear;
 - hard hat;
 - safety glasses;
 - coveralls (where contaminated soils are exposed);
 - First Aid Kit (OFA Level 1);
 - Eye wash station; and
 - Fire Extinguisher.
- 2) Field Equipment:
 - pen and/or pencil;
 - Indelible felt marker;
 - field forms and/or field book (garden soil log);
 - site map, property information;
 - soil auger;
 - hand trowel;
 - sealable sample bags;
 - DI Water and spray bottle or pressurized sprayer;
 - replacement soil and grass seed; and
 - digital camera.
- 3) Forms:
 - Remediation Soil Log;
 - Remediation Completion Sign-Off; and

- Complaint Form.

PROCEDURE

1. Complete preparation work consistent with the *OP R01 - Preparation for Remediation and Yard Improvement Work*.
2. Meet with the Remediation Contractor on the property at the start of the remediation work and review the Remediation Plan.
 - a. In vegetable gardens, the scope of work is to remove at least 60 cm of soil across the garden area.
 - b. For raised bed vegetable gardens, remove sufficient soil to allow 60 cm of clean replacement soil to cover any existing soil.
3. Throughout the remediation, record changes to the scope of the work on the Remediation Plan. Have the Property Owner, the Home and Garden Representative and the Remediation Contractor approve all changes and ensure the change is communicated to the team (excavator operator, soil assessment crew, etc.).
4. Once excavation is complete, confirm the excavation depth and record on the Remediation Plan drawing.
5. Collect samples from the base of the excavation to record soil metal concentrations that will be below the demarcation layer:
 - Screen soil at the base of the excavation with an X-ray fluorescence analyzer (XRF) to screen for metal concentrations in compliance with the *OP: Handheld XRF Use*. Confirm soil at the base of the excavation does not exceed Ministry of Environment Upper Cap Concentration (UCC) for metals as outlined in Protocol 11¹⁶.
 - If soil is greater than UCC, direct the Remediation Contractor to dig deeper (approximately 10 cm). If soil is below UCC, collect a composite sample from the base of the garden excavation to screen for metal.
 - Label the base sample as EXCyy-0PID-VG#-yymmdd: where EXC represents a composite confirmatory sample of excavation base vegetable garden soil followed by the year of sampling, a four digit property ID (per program database), a VG sample number (per soil assessment sample ID), and the sample date.
 - Mark the location of the sample and record the depth in the survey 123 app on your smartphone.
 - Screen soil for metals using procedures outlined in the *OP: Shielded XRF* and record metal concentrations on the remediation soil log.
 - On properties where soil is greater than UCC and the site is designated as High Risk, excavation base samples are submitted for laboratory analysis as per *SA 01: Composite Soil Assessment*.
6. Confirm installation of a Demarcation Layer at the base of the garden excavation and record on Remediation Plan drawing. The demarcation layer is a geotextile fabric that is used as a visual barrier to delineate the depth of the remediation work for future reference.
7. Observe the placement of backfill soil and the addition of soil amendments as per specification outlined through backfill soil assessment

¹⁶ Protocol 11; Protocol for Contaminated Sites - *Upper Cap Concentrations for Substances Listed in the Contaminated Sites Regulation*, BC Ministry of Environment & Climate Change Strategy, Version 3, November 1, 2017

8. Collect a composite post remediation sample of the replaced garden soil as follows:
 - Collect the sample as per the sample collection methods referred to in the *SA 01: Composite Soil Sample Collection*.
 - Label the post-remediation sample as PRyy-0PID-VG#-yymmdd. Where PR represents a composite sample of post remediation garden soil followed by the year of sampling, a four digit property ID (per program database), a VG sample number (per excavation sampling ID), and sample date.
 - Mark the sample location using the survey 123 app on your smartphone.
 - Screen the PR samples for metals using methods outlined in the *OP: Shielded XRF*.
 - Prepare a COC and submit the sample for laboratory analysis using the Strong Acid Leachable Metals (SALM) laboratory method as described in *SA 01: Composite Soil Sample Collection*.
9. Measure the garden to determine the area and calculate the volume of the remediation work completed. The remediation contractor is paid based on the area, volume and quantity of the work completed. Remediation costs and details for each property are recorded in THE Database after the final invoice is received from the Remediation Contractor.
10. Obtain signed remediation completion from the Property Owner once the work is complete. Deficiencies with the work can be brought up and recorded on the completion sign-off form. Newly installed, disturbed or transplanted plants (i.e., shrubs, trees and flowers) are under warranty for 1 year following installation.
11. Record remediation information in the Database including, remediation start and end dates, XRF and laboratory results, and costs and volumes of soil remediated. Ensure field documents, photographs and location data points have been electronically filed appropriately and all hard copies filed by PID and linked to the Database.
12. Prepare a summary letter documenting the garden remediation work. Letters are generated in the Database and sent to each Property Owner with a summary of the remediation work and post remediation soil results. A summary report including all soil assessments and results is provided to Teck at the end of the sampling year.

Operating Procedures – Yard Improvement Monitoring

SCOPE

Yard improvement of residential properties is provided when remediation cannot be achieved for a variety of reasons. Yard improvement is offered as a risk management measure to reduce potential exposure of heavy metals to residents. This is done by improving areas of poor ground cover and/or covering areas where heavy metal concentrations exceed the Action Levels for the given property but remediation cannot be carried out. Current Action Levels set by the THEC are:

- › Vegetable garden soils exceeding 1,000 ppm in lead are eligible for garden remediation;
- › Residential yards exceeding a UCLM¹⁷ 4,000ppm in lead are eligible for yard remediation; and
- › Residential yards part of the Healthy Homes Program where there is poor ground cover are eligible for yard improvement.

This OP addresses monitoring of yard improvement work on properties part of the Healthy Homes Program.

SAFETY PRECAUTIONS

A Health and safety program for the remediation and yard improvement program is provided by the Remediation Contractor. SNC-Lavalin adheres to the health and safety program of the Remediation Contractor but completes internal health and safety protocols for independent tasks such as; sample collection and handling and XRF.

QUALITY CONTROL

Relevant QC procedures for Remediation and Yard Improvement are:

- › Avoiding Cross Contamination during sample collection;
- › Blind Duplicate; and
- › Backfill and stockpile sampling.

MATERIALS, EQUIPMENT, FORMS, REQUIRED

- 1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):
 - high visibility safety vest;
 - gloves (appropriate to potential contaminants of concern; typically nitrile);
 - CSA steel toe footwear;
 - hard hat;
 - appropriate eyewear (safety glasses on active remediation sites);
 - coveralls (where contaminated soils are exposed);
 - First Aid Kit (OFA Level 1);
 - Eye wash station; and
 - Fire Extinguisher.
- 2) Field Equipment:
 - pen and/or pencil;

¹⁷ Refers to the 95% Upper Confidence Limit of the Mean as described in POP – Statistical Evaluation for Soil Assessment.

- Indelible felt marker;
- field forms and/or field book (garden soil log);
- site map, property information;
- soil auger;
- hand trowel;
- sealable sample bags;
- DI Water and spray bottle;
- replacement soil and grass seed; and
- video and digital camera.

3) Forms:

- Consent to Access Property for Remediation;
- Remediation Plan;
- Remediation Drawing;
- Remediation Soil Log;
- Remediation Completion Sign-Off; and
- Complaint Form.

PROCEDURE

1. Complete preparation work as outlined in *OP R01 – Preparation for Remediation and Yard Improvement*.
2. **Monitor the yard improvement** work and record changes on the Remediation/Yard Improvement Plan. Communicate and approve changes in writing with both the Property Owner and the Remediation Contractor on the Remediation/Yard Improvement Plan.
3. **Provide Oversight of the Remediation Contractor:** Before the work starts, ensure:
 - **Job Set-Up:** The remediation contractor provides safe access and egress to the property for residents. Residents are briefed on safety precautions with regards to the equipment and exposed soil and dust during the work.
 - **Soil Disposal:** Direct the Remediation Contractor on soil disposal requirements for the property. Soil less than the Leachate Quality Standards of the Hazardous Waste Regulation is disposed of at the Teck Stoney Creek Landfill. In cases where metals exceed the Leachate Quality Standards, soil is sent to Teck Trail Operations for re-processing. Prior to hauling to Teck Trail Operations, soil analysis is provided to Teck for assay and the location for dropping the soil is coordinated with Teck's Materials Handling department.
4. **Excavation Monitoring and Sampling:** Yard improvement work generally requires an excavation depth of 10 – 15 cm to remove existing organic matter and provide a base for new ground cover. Collect excavation base samples to confirm the depth of the excavation and to record soil metal concentrations below any backfill soil or landscaping. At the final depth of any excavations, base samples are collected at locations similar to sample locations recorded on the property condition checklist. The samples are analyzed with an X-ray fluorescence analyzer (XRF) to screen for metal concentrations. On properties where soil is greater than THEP Action Levels, refer to *OP R05: Remediation Monitoring*.
5. **XRF Soil Screening:** Screen samples collected for metals from the excavation base in-situ using an X-Ray Fluorescence Analyzer (XRF).
 - For yard improvement base sampling:

- EXCyy-0PID-##-yymmdd - where EXC represents a discrete or composite confirmatory sample of excavation base soil followed by the year of sampling, a four digit property ID (per program database), a sample number (typically 01 through 10; per soil assessment sample IDs), and sample date.
6. **Monitor, photograph and record excavation details on the Remediation Soil Log:** including: excavation base screening information, the depth of excavation and areas of the yard where a demarcation layer or landscape fabric has been placed. Note that a geotextile fabric is placed at the bottom of any excavations of 30 cm or deeper (i.e., full remediation). The geotextile fabric is used as a visual barrier to delineate the depth of the remediation work for future reference. In areas where less than 30 cm of soil is removed (i.e., yard improvement work), no demarcation layer is placed.
 7. **Post Remediation Monitoring and sampling:** Record the soil source and ensure tested and approved backfill material is placed on the property. Following the placement of backfill soil, collect Post Remediation samples (PR) prior to replacing landscape features such as sod. PR samples are screened for metals using the XRF and submitted for laboratory analysis of metals using the Strong Acid Leachable Metals (SALM) laboratory method.
 - PRyy-0PID-##-yymmdd, PRyy-0PID-VG#-yymmdd, PRyy-0PID-FG#-yymmdd - where PR represents a composite sample of post remediation soil followed by the year of sampling, a four digit property ID (per program database), a sample number (typically 01), VG or FG sample number (per excavation sampling ID), and sample date.

For blind duplicates:

- Blind duplicates follow the same nomenclature as the sample being duplicated; however, the sample number for yard samples will follow an A, B, C scheme with a PID of 000A, 000B, and 000C, respectively. Garden samples are given a number; VG1, VG2 and a PID of 000A, 000B, respectively. Ensure that 2 duplicate samples of any variety, which are collected on the same date, do not have the same number or letter.
8. **Restoring Landscaping and Landscape features:** Photograph and record the installation of new landscape features such as sod, gravel, stone, replacement plants, etc. Maintenance (i.e., watering sod and plants) is provided by the Remediation Contractor for 2 weeks before passing it over to the Property Owner and/or tenant.
 9. **Job Clean Up:** At the end of the work, ensure the property is left clean and in good condition. Pavement areas are washed off, material stockpiles are hauled off-site and equipment and tools are removed from the property.
 10. **Laboratory analysis:** Submit a composite sample of post remediation soil for laboratory analysis. In cases where only part of the yard is remediated, only samples from that part of the yard are submitted. Samples are submitted to the lab in the clean sealable plastic bag in which they were collected. A Chain of Custody (COC) is filled out for the property and samples are shipped to a pre-approved laboratory for analysis of metals using BC SALM method. The metals analysis is received on a Certificate of Analysis (COA) from the lab.
 11. **Measurement Confirmation:** Confirm measurements of yard improvement areas based on the work completed. Payment to the Remediation Contractor is on a per unit basis. Depending on the material this is either volume (m³), area (m²) or quantity (i.e., 2 shrubs) as outlined on the unit rate bid form. Measurement of the property is completed by the Remediation Contractor and the Home and Garden representative to provide accurate measurements and billing to Teck. Costs and details for each property are recorded in THE Database.

12. **Completion:** The Property Owner is requested to sign off on the completed yard improvement work. Deficiencies with the work can be brought up and recorded on the completion sign-off form. Newly installed, disturbed or transplanted plants (i.e., shrubs, trees and flowers) are under warranty for 1 year following installation.
13. **Data Management:** Information from the yard improvement work is recorded in THE Database including, XRF and laboratory results from the excavation, costs and volumes of soil removed, project start and end dates and regulatory information. Information on THE Database is included in Data Management Operating Procedures. In the database, provide an accurate completion date for each task as it has been completed. Ensure all field documents, photographs and location data points have been electronically filed appropriately and all hard copies filed by PID.
14. **Laboratory results** are reviewed and uploaded to the database then correlated to the XRF screening values to determine a regression coefficient and correct XRF values.
15. **Reporting:** Letters are generated in THE Database and sent to each Property Owner with a summary of the yard improvement work and the post remediation soil results. A summary report including all the yard improvement properties and results is provided to Teck.
16. **Regulatory Documentation:** For remediation and yard improvement work that is completed on areas with soil above the THEC Action Levels, refer the OP R05: Remediation Monitoring as notification to the Ministry of Environment may be needed.

Operating Procedures – Yard Remediation Monitoring

SCOPE

Soil remediation on residential yards is offered when the Upper Confidence Limit of the Mean (UCLM) of the metals found on the property exceeds the THEC Action Level for lead or exceeds upper cap concentration for any metal as set out by the Ministry of Environment. Current remediation Action Levels set by the THEC are:

- › Vegetable garden soils exceeding 1,000 ppm in lead are eligible for garden remediation; and
- › Residential yards exceeding a UCLM¹⁸ 4,000ppm in lead are eligible for yard remediation.

This OP addresses monitoring of Yard Remediation work on properties.

SAFETY PRECAUTIONS

A Health and safety program for the remediation program is provided by the Remediation Contractor. SNC-Lavalin adheres to the health and safety program of the Remediation Contractor and completes internal health and safety protocols for independent tasks such as; sample collection, sample handling and XRF use.

QUALITY CONTROL

Detailed quality control procedures are provided in the OP for QAQC. Relevant QC procedures for Remediation and Yard Improvement are:

- › Avoiding Cross Contamination during sample collection;
- › Blind Duplicate sampling; and
- › Backfill soil sampling.

MATERIALS, EQUIPMENT, FORMS, REQUIRED

- 1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):
 - high visibility safety vest;
 - gloves (appropriate to potential contaminants of concern; typically nitrile);
 - CSA steel toe footwear;
 - hard hat;
 - appropriate eyewear (safety glasses on active remediation sites);
 - coveralls (where contaminated soils are exposed);
 - First Aid Kit (OFA Level 1);
 - Eye wash station; and
 - Fire Extinguisher.
- 2) Field Equipment:
 - pen and/or pencil;
 - Indelible felt marker;
 - field forms and/or field book (garden soil log);
 - site map, property information;
 - soil auger;

¹⁸ Refers to the 95% Upper Confidence Limit of the Mean as described in POP – Statistical Evaluation for Soil Assessment.

- hand trowel;
- sealable sample bags;
- DI Water and spray bottle or pressurized sprayer;
- replacement soil and grass seed; and
- video and digital camera.

3) Forms:

- Remediation Soil Log;
- Remediation Completion Sign-Off; and
- Complaint Form.

PROCEDURE:

- 1: **Complete preparation work** as outlined in OP – Preparation for Yard Remediation and Improvement.
- 2: **Prepare and submit Regulatory Documents:** Notification of Independent Remediation documents are submitted to the Ministry of Environment, Site Advisor within 3 days of starting a remediation project. Identify if the property is High Risk.
- 3: **Monitor the remediation** work and record changes on the Remediation Plan. Communicate and approve changes in writing with both the Property Owner and the Remediation Contractor on the Yard Remediation Plan.
- 4: **Provide Oversight of the Remediation Contractor:** Before the work starts, ensure:
 - **Job Set-Up:** The remediation contractor provides safe access and egress to the property for residents. Residents are briefed on safety precautions with regards to the equipment and exposed soil and dust during the work.
 - **Soil Disposal:** Direct the Remediation Contractor on soil disposal requirements for the property. Soil less than the Leachate Quality Standards of the Hazardous Waste Regulation is disposed of at the Teck Warfield Landfill. Where metals exceed the Leachate Quality Standards, soil is sent to Teck Trail Operations for re-processing. Prior to hauling to Teck Trail Operations, soil analysis is provided to Teck for assay and the location for dropping the soil is coordinated with Teck's Materials Handling department. Refer to OP – Leachable metals assessment.
- 5: **Excavation Monitoring and Sampling:** Ensure the remediation standards are met by removing a minimum of 30 cm from the yard. Collect excavation base samples to confirm the depth of the excavation and to record soil metal concentrations below any backfill soil or landscaping. At the final depth of any excavations, base samples are collected and the depth and location are recorded in Survey 123 app on your smartphone. The samples are analyzed with an X-ray fluorescence analyzer (XRF) to screen for metal concentrations. On properties where soil is greater than THEP Action Levels, ensure UCC metals have been sufficiently removed from the property. Instruct deeper excavation in 15 cm increments until removed. Record the depth of the final excavation.
- 6: **XRF Soil Screening:** Screen excavation base samples in-situ using an X-Ray Fluorescence Analyzer (XRF) and following *OP: Handheld XRF Use*.
 - For remediation base sampling:
 - EXCyy-0PID-##-yymmdd - where EXC represents a discrete or composite confirmatory sample of excavation base soil followed by the year of sampling, a four digit property ID (per program database), a sample number (typically 01 through 10; per soil assessment sample IDs), and sample date.

- EXCyy-0PID-VG#-yymmdd - where EXC represents a composite confirmatory sample of excavation base vegetable garden soil followed by the year of sampling, a four digit property ID (per program database), a VG sample number (per soil assessment sample ID), and sample date.
- EXCyy-0PID-FG#-yymmdd - where EXC represents a composite confirmatory sample of excavation base flower garden soil followed by the year of sampling, a four digit property ID (per program database), a FG sample number (per soil assessment sample ID), and sample date.

7: Monitor, photograph and record excavation details on the Remediation Soil Log: including: excavation base screening information, the depth of excavation and areas of the yard where a demarcation layer has been placed. A geotextile fabric is placed at the bottom of any excavations of 30 cm or deeper (i.e., full remediation). The geotextile fabric is used as a visual barrier to delineate the depth of the remediation work for future reference. In areas where less than 30 cm of soil is removed (i.e., yard improvement work), no demarcation layer is placed. This is recorded and identified on the property record drawing.

8: Post Remediation Monitoring and sampling: Record the soil source and ensure tested and approved backfill material is placed on the property. Following the placement of backfill soil, collect Post Remediation samples (PR) prior to replacing landscape features such as sod. PR samples are screened for metals using the XRF and submitted for laboratory analysis of metals using the Strong Acid Leachable Metals (SALM) laboratory method.

- PRyy-0PID-##-yymmdd, PRyy-0PID-VG#-yymmdd, PRyy-0PID-FG#-yymmdd - where PR represents a composite sample of post remediation soil followed by the year of sampling, a four digit property ID (per program database), a sample number (typically 01), VG or FG sample number (per excavation sampling ID), and sample date.

For blind duplicates:

- Blind duplicates follow the same nomenclature as the sample being duplicated; however, the sample number for yard samples will follow an A, B, C scheme with a PID of 000A, 000B, and 000C, respectively. Garden samples are given a number; VG1, VG2 and a PID of 000A, 000B, respectively. Ensure that 2 duplicate samples of any variety, which are collected on the same date, do not have the same number or letter.

9: Restoring Landscaping and Landscape features: Photograph and record the installation of new landscape features such as sod, gravel, stone, replacement plants, etc. Maintenance (i.e., watering sod and plants) is provided by the Remediation Contractor for 2 weeks before passing it over to the Property Owner and/or tenant.

10: Job Clean Up: At the end of the work, ensure the property is left clean and in good condition. Pavement areas are washed off, material stockpiles are hauled off-site and equipment and tools are removed from the property.

11: Laboratory analysis: Submit a composite sample of post remediation soil for laboratory analysis. In cases where only part of the yard is remediated, only samples from that part of the yard are submitted. Samples are submitted to the lab in the clean sealable plastic bag in which they were collected. A Chain of Custody (COC) is filled out for the property and samples are shipped to a pre-approved laboratory for analysis of metals using BC SALM method. The metals analysis is received on a Certificate of Analysis (COA) from the lab.

- 12: Measurement Confirmation:** Confirm measurements of remediation areas based on the work completed. Payment to the Remediation Contractor is on a per unit basis. Depending on the material this is either volume (m³), area (m²) or quantity (i.e., 2 shrubs) as outlined on the unit rate bid form. Measurement of the property is completed by the Remediation Contractor and the Home and Garden representative to provide accurate measurements and billing to Teck. Remediation costs and details for each property are recorded in THE Database.
- 13: Completion:** The Property Owner is requested to sign off on the completed yard improvement work. Deficiencies with the work can be brought up and recorded on the completion sign-off form. Newly installed, disturbed or transplanted plants (i.e., shrubs, trees and flowers) are under warranty for 1 year following installation.
- 14: Data Management:** Information from the yard improvement work is recorded in THE Database including, XRF and laboratory results from the excavation, costs and volumes of soil remediated, remediation start and end dates and regulatory information. Information on THE Database is included in Data Management Operating Procedures. In the database, provide an accurate completion date for each task as it has been completed. Ensure all field documents, photographs and location data points have been electronically filed appropriately and all hard copies filed by PID.
- 15: Laboratory results** are reviewed and uploaded to the database then correlated to the XRF screening values to determine a regression coefficient and correct XRF values.
- 16: Reporting:** Letters are generated in THE Database and sent to each Property Owner with a summary of the yard improvement work and the post remediation soil results. A summary report including all the remediation properties and results is provided to Teck by the end of January following the remediation season.
- 17: Regulatory Documentation:** For remediation and yard improvement work that is completed on areas with soil above the THEC Action Levels, complete regulatory documentation as needed. This includes the Notification of the Completion of Remediation and High Risk Site Re-classification, where necessary.

Op Handheld XRF Use – Operating Procedure – Handheld XRF Use

Soil sample handling procedures for handheld X-Ray Fluorescence (XRF) analysis of heavy metals.

SCOPE: This procedure describes the handling of soil samples during analyses for heavy metals using an x-ray fluorescence analyzer (XRF) in handheld mode. The XRF may be used in hand held mode by a certified operator, when timely results are necessary (i.e., directing remediation activities) or for in situ screening, when sample collection is not possible (i.e., paint testing). Soil samples are screened for heavy metals using an XRF and a subset of samples are submitted for laboratory analysis. For collection and handling of other parameters, refer to the appropriate POPs.

SAFETY PRECAUTIONS: Potential contaminants of concern in soils include lead and other heavy metals, which can be harmful if ingested or inhaled. Physical contact with potential contaminants of concern should be avoided by wearing appropriate gloves while handling soil. Good hygiene should also be practiced to minimize exposure to heavy metals and transfer of contaminants to other sites.

Additional training and certification from the Non-destructive testing (NDT) branch of the Canadian Ministry of Natural Resources is required for anyone operating an X-ray tube XRF device in handheld mode to minimize ionizing radiation exposure for oneself and the public. A survey meter such as a Geiger-Mueller (GM) tube radiation detector must be used to ensure unsafe levels of radiation are not present during operation. The survey meter must be responsive to very low energy – approximately 5 keV.

QUALITY CONTROL: Quality control is provided by a logged pre-operation check of the XRF device, homogenization of soil samples, and careful documentation of XRF values during analysis. . Quality assurance is provided by submitting a subset of soil samples for laboratory analysis and through the determination and monitoring of a constantly updated regression relationship between lab and XRF analysis results.

MATERIALS, EQUIPMENT REQUIRED

- 1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):
 - Survey Meter (e.g., Radiation Alert Monitor 4EC);
 - high visibility safety vest;
 - gloves (appropriate to potential contaminants of concern; typically nitrile);
 - designated footwear (CSA steel toe footwear on active remediation sites);
 - hard hat (on active remediation sites);
 - appropriate eyewear (safety glasses on active remediation sites);
 - coveralls (on remediation sites where contaminated soils are exposed);
 - First Aid Kit (OFA Level 1);
 - Eye wash station; and
 - Fire Extinguisher.
- 2) Field Equipment:
 - Delta XRF Analyzer;
 - pen and/or pencil;
 - Indelible felt marker;
 - XRF forms and/or field book;

- site map, property information; and
- Calibration medallion.

PROCEDURE

For the purposes of directing and monitoring remediation activities, preliminary excavation base screening is carried out using the XRF in handheld mode and base soil is screened, in situ, at multiple points across the excavation. The XRF may also be used in handheld mode for in situ paint testing, where a sample of the paint cannot be removed for screening.

1. While transporting the XRF, ensure that the device is switched off and in a secure pelican case. Non-certified personnel may not transport or use the XRF while detached from the protective shield. Perform Safety check of XRF and record in the Radiation Safety Log Book. Observe for external damage, X-Radiation labels, indicator light operation, prolene window condition, survey meter check, and ensure that a safe work zone is created. Also record test mode, beam count and duration, mode of use, XRF model serial number, any comments, duration of use, date and operator signature.
2. Press the power button on top rear of XRF. Press “CONTINUE” twice in the X-Radiation caution window and press “START” if you are a certified XRF operator. After start-up enter in user name and password.
3. In the Login interface enter the appropriate information in the User text box and in the Password text box. Click the *Login* button.
4. Perform Calibration (Cal) check by placing a 316 stainless steel calibration medallion on the ground and placing the analyzer window flat on top. Ensure all body parts are clear of the direction of analysis (e.g., do not perform Cal check on a table while standing with feet underneath). Ensure the analyzer is unlocked by pressing the lock symbol in the top right corner. Press the Cal symbol in the lower left corner only when analyzer is in contact with medallion. Calibration will be Pass or Fail. Safe and danger zone can be verified with survey meter while calibration check is performed.
5. To choose the test mode click the Home icon (a house). Choose the “Mode” icon and then “Soil” icon. Press “OK”.
6. Back in the Home screen click the “Setup” icon. Click the “Trigger HW” icon, then “Trigger Settings” and check “Enable Deadman Trigger” (trigger must be pressed and held throughout the test) and “Enable Trigger Lock” after 5 minutes. Press “Save”, then “Back” to return to Setup screen. Press the “Test” icon (red and blue wavy lines and circle) to go to the test screen or the “Home” icon to return to the Home screen.
7. Go to the Test Setup page by clicking the Tools icon (a screw driver and wrench) in the lower left of the Test Screen. In the Beams table ensure 1, 2 and 3 have a Min = 0 and Max = 30 seconds and that Beam 1 and 2 are checked and Beam 3 is unchecked under the Enable column. This configuration is for general soil analysis. Elements can be added or removed from the elements displayed in the “Customize Display”. Press “OK” button when done.
8. Normal analysis is carried out using the Test screen. To create a sample identification click on the “Tools” icon to enter the Test Setup screen and then the “Label Defaults” button in the lower left hand corner. Enter the proper Prefix (e.g., SS14), PROPID (property ID) and the SAMPLE number (which will be the start of a sequence). Ensure each label is checked under the Enable column. Press OK to exit Label Defaults and OK again to exit Test Setup and return to Test screen.
9. Place analyzer window flat on the sample area and press and hold trigger until sixty second analysis is complete.

10. To view previously analyzed samples open the Results screen by clicking on the pie chart icon. Here previous results can be observed by run number and day and SAMPLE number. Errors cannot be deleted and must be recorded and removed from the exported data.
11. When the XRF unit is returned to the office, export XRF results to PC desktop and save onto P Drive in the appropriate folder. Place analyzer in charging cradle. Ensure power and USB cords are connected. With analyzer in the cradle turn on power and ensure ActiveSync is installed on computer and that the status is connected. On the analyzer screen go to the Results screen (Pie chart icon) and click on the Tools icon. Click on the “Export” button and select Auto name and choose desired result dates to be exported from the results list. Click the export icon, a page with a green arrow.
12. To view exported results open Windows Explorer and go to Mobile Device\My Documents\Innovx\Data\Export. The export file name will be Res_mm_dd_yr_R.csv.

TECHNICAL NOTES

Previous sample screening and laboratory analysis has shown the regression coefficient between the two is very close to 1.0. Regression coefficients are updated routinely.

XRF results can be slightly skewed if the soil is excessively moist or wet.

Op Shielded XRF Use – Operating Procedure – Shielded XRF Use

Soil sample handling procedures for shielded X-Ray Fluorescence (XRF) screening for heavy metals.

SCOPE

This procedure describes the handling of soil samples during analyses for heavy metals using an x-ray fluorescence analyzer (XRF) in a protective shield. Metals, heavy metals in particular, are screened using an XRF and samples are submitted for laboratory analysis. For collection and handling of samples for other parameters, refer to the appropriate operating procedures (OPs).

SAFETY PRECAUTIONS

Potential contaminants of concern in soils include lead and other heavy metals, which can be harmful if ingested or inhaled. Physical contact with potential contaminants of concern should be avoided by wearing appropriate gloves while handling soil. Good hygiene and cleanliness should also be practiced to minimize exposure to heavy metals and transfer of contaminants throughout the office.

Additional precautions must be followed to minimize ionizing radiation exposure while operating an XRF. The XRF must be used in its protective shield unless additional training and certification is acquired. The use of a survey meter such as a Geiger-Mueller (GM) tube radiation detector is required to ensure unsafe levels of radiation are not present during operation. The survey meter must be responsive to very low energy – approximately 5 keV.

QUALITY CONTROL

Quality control is provided by careful documentation of XRF values and homogenization of soil samples. Quality assurance is provided by submitting a subset of samples for laboratory analysis and determining a regression coefficient for the XRF.

MATERIALS, EQUIPMENT REQUIRED

- 1) Personal Protective Equipment (PPE) and Safety Equipment (as applicable):
 - gloves (appropriate to potential contaminants of concern; typically nitrile);
 - First Aid Kit (OFA Level 1);
 - Eye wash station; and
 - Survey Meter (e.g., Radiation Alert Monitor 4EC).
- 2) Field Equipment:
 - Delta XRF Analyzer and protective shield;
 - Computer with ActiveSync and Innov-X Delta Software installed;
 - pen and/or pencil;
 - Indelible felt marker;
 - XRF forms and/or field book;
 - site map, property information; and
 - Calibration medallion.

PROCEDURE

1. Confirm property ID (PID) on sample bags correspond to the Property Condition Checklist and Soil Log.
2. Prior to operation, inspect the XRF for damage. Check polypropylene film has no holes or tears. Confirm warning labels are intact. Ensure all cords are connecting XRF shield to the computer and power source. Connect XRF to protective shield ensuring screws correctly line up.
3. Turn on computer. Once computer is running, turn on XRF. Confirm warning lights operate correctly, once device has been switched on. Ensure ActiveSync is installed and that the XRF device is connecting to the software. Open *Innov-X Delta Advanced PC Software* icon. In the PC Software window click *Close Device App* button. Click *Start* which will open the advanced software in a separate window. **DO NOT** click *Import from Unit*, as this will overwrite and erase all data collected in shield mode.
4. In Advanced PC Software interface enter login information and click the *Login* button.
5. Perform Calibration check by placing a 316 stainless steel calibration medallion over analyzer window, inside the analyzer shield. Close hatch and click *Cal Check* button. Calibration will be Pass or Fail. (While operating the XRF in protective shield mode, the analyzer will not trigger if the protective shield is not closed properly).
6. Go to the Setup tab and click the *Test Condition* icon. Under the Test Time sub-tab ensure Beam 1, 2 and 3 have a Min = 0 and Max = 30 seconds. Under the Beam Setup sub-tab check Beam 1 and 2 and uncheck Beam 3. This configuration is for general soil analysis. Do not change User Factor sub-tab.
7. Normal analysis is carried out under the Analysis tab. Type the sample ID with date sampled into the text bar in the upper left corner under “Soil” (e.g., SampletypeYY-PID#-Sample#-YYMMDD). Click *Start* button to begin analysis. The orange radiation safety light on top of the shield will blink while radiation is being produced. After completion, ensure orange safety light is not blinking and is solid or off. Remove sample.
8. Record analysis run number and date under the *XRF Run #* column and XRF values on Soil Log form. Record Lead (Lead), Zinc (Zn), Arsenic (As) and Cadmium (Cd).
9. To view previously analyzed samples open the View Data tab. Here, previous results can be observed by run number and day. Errors cannot be deleted within the PC software and must be recorded and removed from the exported data. Return to Analysis tab before running next sample.
10. At the end of each day, export XRF results to desktop and save onto P Drive. Go to the Set Up tab and click the *Data Management* icon. The export file name should be ExportData-MM-DD-YYYY.csv. Export file to C:\Documents & SettingsProfiles Folder.
11. From the recorded XRF values (typically lead), a subset of samples are selected for laboratory analysis. Although special considerations may occur, samples selected for analysis include the maximum and median lead concentration samples. All vegetable garden samples are submitted for analysis.

Special considerations:

- › Samples exceeding 3500 ppm lead and 60 ppm cadmium should be considered for Toxicity Characteristic Leaching Procedure and Synthetic Precipitation Leaching Procedure (TCLP/SPLP) submission, requiring an additional 250 ml of sample.

12. Soil is placed into clean soil jars provided by the laboratory and labeled appropriately. Where duplicate samples are analyzed, care should be taken that the soil is homogeneous between the two sample jars.
13. Prepare individual COCs for each property and assign a COC number (0PID-yyymmdd) using the sample date. Vegetable garden samples are submitted with yard assessment samples from the same property, on the same COC. (Note: the COC number for remediation samples at the same property will differ by the sample date, as is the case for annual LTS sampling events). Ensure to indicate the appropriate project number, Trail Health and Environment Program Pricing and DO NOT select any applicable regulatory limits. Digital copies of COCs are stored under a file name using the COC number followed by the date relinquished (e.g., 0PID-130509_130602). Once analytical results have been received and reviewed, remaining soil samples can be placed in long-term soil storage.
14. Provide an accurate completion date in the database for each task as it has been completed. Ensure all field documents, photographs and location data points have been electronically filed appropriately and all hard copies are filed by PID. Refer to OP for data management procedures.

TECHNICAL NOTES

Previous XRF sample screening and laboratory analysis has shown the regression coefficient between the two is very close to 1.0. XRF coefficients are calculated and updated on a regular basis.

XRF results can be skewed if the soil is excessively moist or wet. Sample collection during heavy rain events should be avoided where possible.

Use plastic bags when screening samples and not glass. The XRF will not penetrate through glass.



Appendix III

Health and Safety Plan

III-A. Resident Health and Safety Plan

Introduction

The purpose of this Landowner/Resident Health and Safety Plan is to provide an overview of health and safety considerations for landowners, residents and property visitors as they relate to the Trail Residential Remediation Project. The following sections outlines the health and safety considerations related to the remediation activities as outlined in the attached letter. Specific responsibilities for contractors and landowners to address these considerations are outlined below.

Physical Hazards

Heavy equipment, including front-end loaders, skid-steers, and other equipment will be used on the site, individually or in conjunction with others. Areas where heavy equipment is operating will be secured with the use of traffic delineators and caution tape. It is important for residents to keep clear of these work zones.

Keep clear of the excavation area, as excavation depths will extend to depths of at least 0.30 m adjacent to sidewalks, porches, decks, and stairs. Sides of the excavation may be unstable depending upon the soil conditions, creating potential fall hazards for residents. Residents are requested to not enter work zones after hours.

Heavy equipment will be removed from the property and stored off site each night. As such, although it may appear that work has been completed, residents are requested to not enter the work zones until remediation activities are completed (as indicated by the Site Supervisor).

Air Quality

Residents will be required to keep doors, windows, and skylights closed during work hours to minimize soils/dust entering the building as a result of excavation/restoration activities.

Dust control measures will be implemented during the remediation activities and will include the following:

- › Exposed soils (excavation/stockpile areas) will be sprayed with water during dry conditions; and
- › Vehicles (off site and on site) will be sprayed down with water to minimize tracking soils within the property and along transportation routes.

Although every reasonable effort will be made to control dust during remediation activities, residents are requested to identify any dust concerns to the Site Supervisor. Respiratory or other health conditions, which may be complicated by increased dust, should be identified to the Site Supervisor.

Air monitoring will be implemented throughout remediation activities. Contractor employees working on residential properties will be wearing personal sampling pumps to measure dust exposure during remedial activities.

Pets

Pets should remain inside during excavation and remediation activities. When exiting the house or when in the vicinity of the work zone, pets should remain on a leash to reduce potential encounters with heavy equipment. Residents should refrain from allowing pets to enter the work zone after hours until remediation activities are complete.

Emergencies

Contractors and subcontractors will be following their designated Health and Safety Plans, which include Emergency Response Plans in the case of an emergency. Should you witness an emergency, please inform the Site Supervisor or phone 911, as is required.

Responsibilities

Contractor Responsibilities

- › Familiarize themselves with, implement, and promote the site specific Project Environmental Health and Safety Plan (EHSP) and relevant governmental regulations;
- › Work in compliance with all existing environmental health and safety laws and regulations;
- › Use traffic delineators and caution tape to secure the work zone (including exposed soils, utilities and fall hazards) and prevent public access;
- › Implement dust control measures as described in the Project EHSP;
- › Maintain good housekeeping practices at sites on which they are working and leave the work site in a safe condition;
- › Stop work until the work zone is clear when residents or visitors need access to the home;
- › Follow decontamination procedures when leaving the work zone with personnel or equipment; and
- › Remove equipment from the property at the end of each day.

Resident Responsibilities

- › Ensure that visitors to the property are aware of and adhere to this Landowner/Resident Health and Safety Plan herein described;
- › Ensure that children do not play or enter the work zone during and after work hours;
- › Do not enter the work zone until the Contractor has stopped work. Use only the normal walkway to enter/exit the home;
- › Be aware of fall hazards adjacent to edges of sidewalks, decks, porches, and stairs;
- › Alert Contractors' personnel when leaving or arriving home;
- › After work hours, do not enter the work zone, as physical hazards may be present;
- › Keep doors, windows and skylights closed when work is in progress; and
- › Keep pets inside. Pets needing exercise should be walked on a leash.

If you see any unmarked hazards, identify the hazard to the Site Supervisor.

III-B. Contractor Health and Safety Plan

The following details the general aspects of The Contractor's Site Specific Safe Work Plan, including environmental awareness, for the Trail Area Health and Environment Program's Residential Soil Remediation Project.

Hazard Risk Assessment and Job Hazard Analysis

The Contractor's site supervisor (the Site Supervisor) will go through a Hazard Risk Assessment through the use of a Job Hazard Analysis (JHA) prior to the start of the work. The goal of the JHA is to identify hazards or risks related to the work area and to eliminate or control those hazards and risks while work is underway. This would include such things as, but not exclusive to, a review of any unrelated work nearby that may present a risk, identification of utility lines or overhead power lines, issues related to the physical remediation work, operation of mobile equipment and trucks and review of the condition of equipment and tools on the worksite.

The Site Supervisor is qualified to perform all required risk assessments, operate all equipment on site, and is familiar with WorkSafeBC regulations. The Site Supervisor will monitor activities of employees on site to ensure safe work practices are followed and that additional tasks are performed safely as work progresses. The JHA will be reviewed and adjusted as necessary.

Safety Equipment

The Contractor will ensure its employees wear all required safety protective gear and clothing. This will include hard hats, steel toed boots, reflective safety vests, coveralls when digging out soil, gloves, ear protection, safety glasses and dust masks where required. Safety gear, such as dust masks, safety glasses and hearing protection, will be provided to the homeowner if necessary.

Training

The Contractor will comply with the required and necessary federal, provincial and local training requirements. The Contractor will provide qualified employees to safely and competently complete the work scope. Training records will be retained and provided if required.

Emergency Response

In any emergency situation, the immediate response is to call for the required emergency services, assist anyone injured, make the area safe and to address any uncontrolled release (i.e., in the event of a ruptured utility line) to the extent that it is safe to do so and without endangering workers. SNC-Lavalin and Teck must be contacted as soon as possible after the event, and no later than the end of the day during which the event occurred, and be provided with an Incident Investigation Report.

- › Each work truck is equipped with a Level 1 WCB first aid kit; and
- › Each work crew will have a cell phone to call emergency services if needed.

Environmental Awareness

The Contractor will maintain worker awareness of any environmental requirements relating to the work and will include any environment issues as a component of its tailboard meetings.

All equipment will be in good operating condition, appropriately serviced to prevent leakage of operating fluids. Persons refueling equipment will exercise care to prevent spills, using drip trays if necessary in cases where spills could occur. When engaged in refueling and fluid top-up activities, workers will have a supply of absorbent materials on hand to meet all needs in containing and/or soaking up spills.

Communication Devices and Tobacco Products

The Contractor and employees will not use cell phones or related hands-free devices while operating equipment or vehicles. Additionally, the use tobacco products is not permitted in work vehicles or on worksites.

III-C. SNC-Lavalin Health and Safety Plans

The following are attached below:

- › 2018 Soil Assess-Health and Safety Plan – HASP 2018;
- › 2018 Soil Remediation Monitoring HASP September;
- › Contractor H&S;
- › Contractor JSA; and
- › Resident H&S.

HASP SECTION 1: PROJECT RISK REGISTER

Site Location: Various residential properties in Trail, BC		Project #: 655059
Name of Contractor/Subcontractor(s): SNC		Date: 2019/01/15
Job Scope: Soil testing at various residential properties in Trail, BC and surrounding area		
PM: Bruce Enns		Prime Contractor Co. & Contact: n/a
Client: Teck Metals Ltd.		Client PM: Clare North
<p>APPLICABLE/ANTICIPATED CRITICAL RISK ACTIVITY - Refer to SNC-Lavalin Critical Risk Control Protocols (CRCP)*: <i>Where work involves any of the following hazards, the applicable SNC-Lavalin Critical Risk Control Protocol must be incorporated into the HASP.</i></p>		
<input checked="" type="checkbox"/> 1. Vehicles	<input type="checkbox"/> 5. Working at Heights	
<input type="checkbox"/> 2. Hazardous Materials	<input type="checkbox"/> 6. Lifting Operations	
<input type="checkbox"/> 3. Equipment Safeguarding	<input type="checkbox"/> 7. Confined Space	
<input type="checkbox"/> 4. De-Energization	<input type="checkbox"/> 8. Excavations	

<p>OTHER APPLICABLE OR ANTICIPATED HSSE HAZARDS: <i>Where work involves the following health and safety hazards, appropriate controls should be incorporated into the HASP.</i></p>	
<input type="checkbox"/> 1. Work In Remote Location / Working Alone	<input checked="" type="checkbox"/> 8. Ergonomic / Physical Strain
<input type="checkbox"/> 2. Working On / Near Water	<input type="checkbox"/> 9. Air / Water Discharge
<input checked="" type="checkbox"/> 3. Equipment / Tool Use (e.g. specialized power/hand tools)	<input type="checkbox"/> 10. Noise / Dust Generation
<input checked="" type="checkbox"/> 4. Activities In Or Near Traffic Areas	<input type="checkbox"/> 11. Work in Sensitive Area / Wildlife Disturbance
<input checked="" type="checkbox"/> 5. Underground / Overhead Utilities	<input type="checkbox"/> 12. International Travel
<input type="checkbox"/> 6. Hot Work	<input checked="" type="checkbox"/> 13. Local Crime Activity
<input checked="" type="checkbox"/> 7. Nature / Animals / Inclement Weather	<input type="checkbox"/> 14. Other?
Project Manager Signature:	

* Ensure that all hazards identified are addressed in subsequent pages

HASP SECTION 2: EMERGENCY RESPONSE PLAN

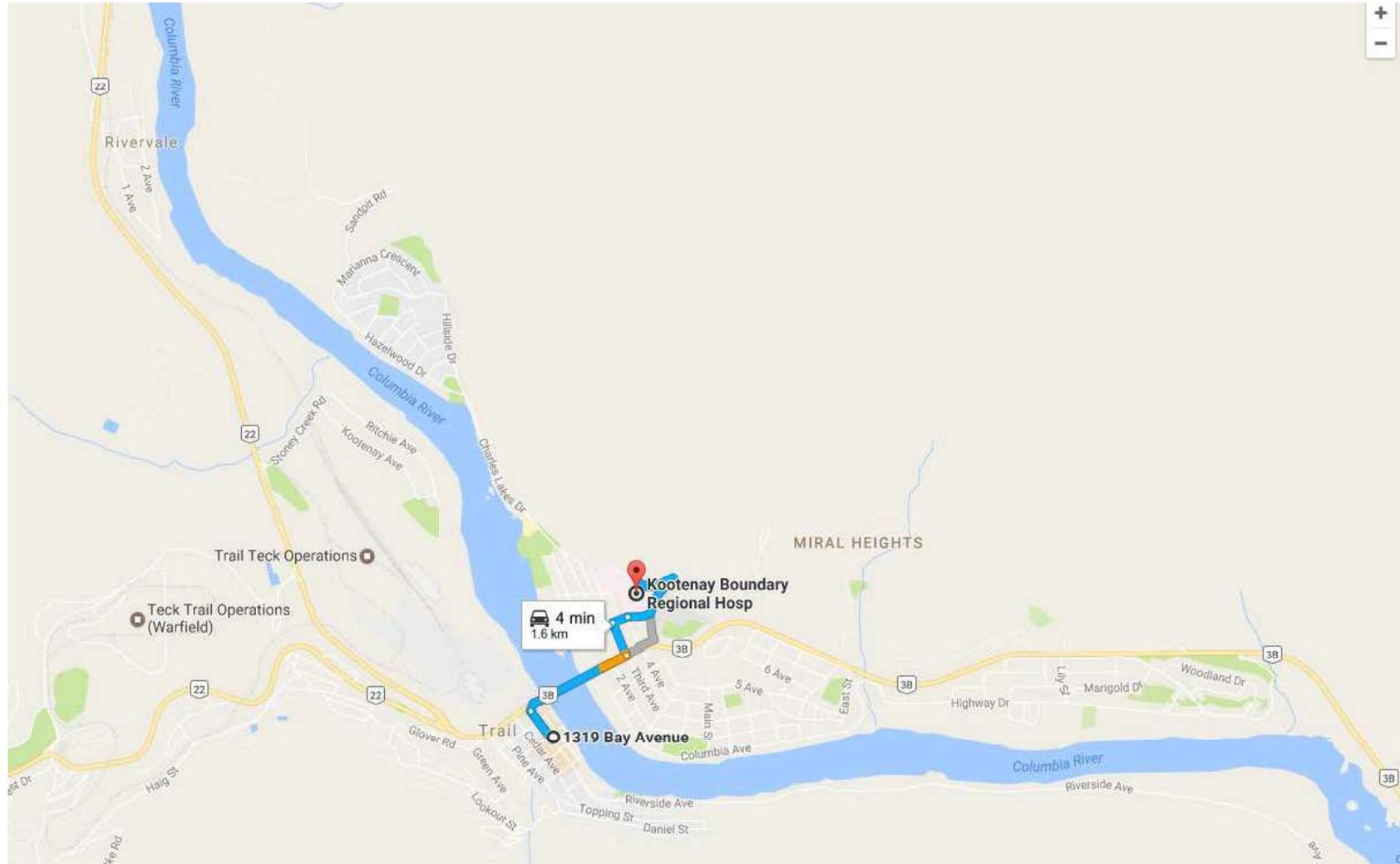
Date: September 13, 2018	Project #: 655059
Site Supervisor: Alexa Matthes	Prime Contractor: SNC Lavalin

EMERGENCY CONTACT INFORMATION

Managing Office & Phone #:	Trail: 250-368-3256		
HSE Primary Contact	Jason Goossens Tel: 1-604-515-5151 X 55154, Cell: 778-238-8148		
HSE Alternate Contact	Tony Kavelaars (Sr. H&S Specialist) – Office: 604-515-5195; Cell: 604-786-1001		
Primary First Aid Attendant	Alexa Matthes Cell: 250-921-5909		
Alternate First Aid Attendant			
Site Contact & Phone Number	n/a		
CONTACT(S):	Name	Primary Phone #	Alternate Phone #
Project Manager	Bruce Enns	250-368-3256 X53251	250-231-1464
Alternate	Andrea McCormick	250-368-3256 X53256	250-231-1424
2nd Alternate	Cindy Hall	250-368-3256 X53257	250-231-4184
CLIENT CONTACT(S):	Name	Primary Phone #	
Client Project Manager	Clare North	250-364-4392	250-512-1571
Alternate	Dan Bouillon	250-364-4743	250-231-3927
OTHER CONTACT(S) (Co. Name)	Contact's Name	Primary Phone #	Alternate Phone #
EMERGENCY SERVICE CONTACT	Primary Phone Number	Alternate Phone Number(s)	
Fire Department	911 (If not applicable, enter alternate)	250-364-1737	
Police	911 (If not applicable, enter alternate)	250-364-2566	
Ambulance	911 (If not applicable, enter alternate)		
Emergency Electrical Calls	Fortis (BC): 1-866-436-7847		N/A <input type="checkbox"/>
Natural Gas Trouble	Fortis (BC): 1-800-663-9911		N/A <input type="checkbox"/>
Spill Control	BC PEP: 1-800-663-3456		N/A <input type="checkbox"/>
Other:	WCB (BC) 24 hr Emergency: 1-888-621-7233 (afterhours call 1-866-922-4357)		
	HOSPITAL	CLINIC	
Name:	Kootenay Boundary Regional Hospital		
Address:	1200 Hospital Bench		
Phone Number:	250-368-3311		

EMERGENCY ROUTE TO HOSPITAL AND/OR CLINIC

Map:



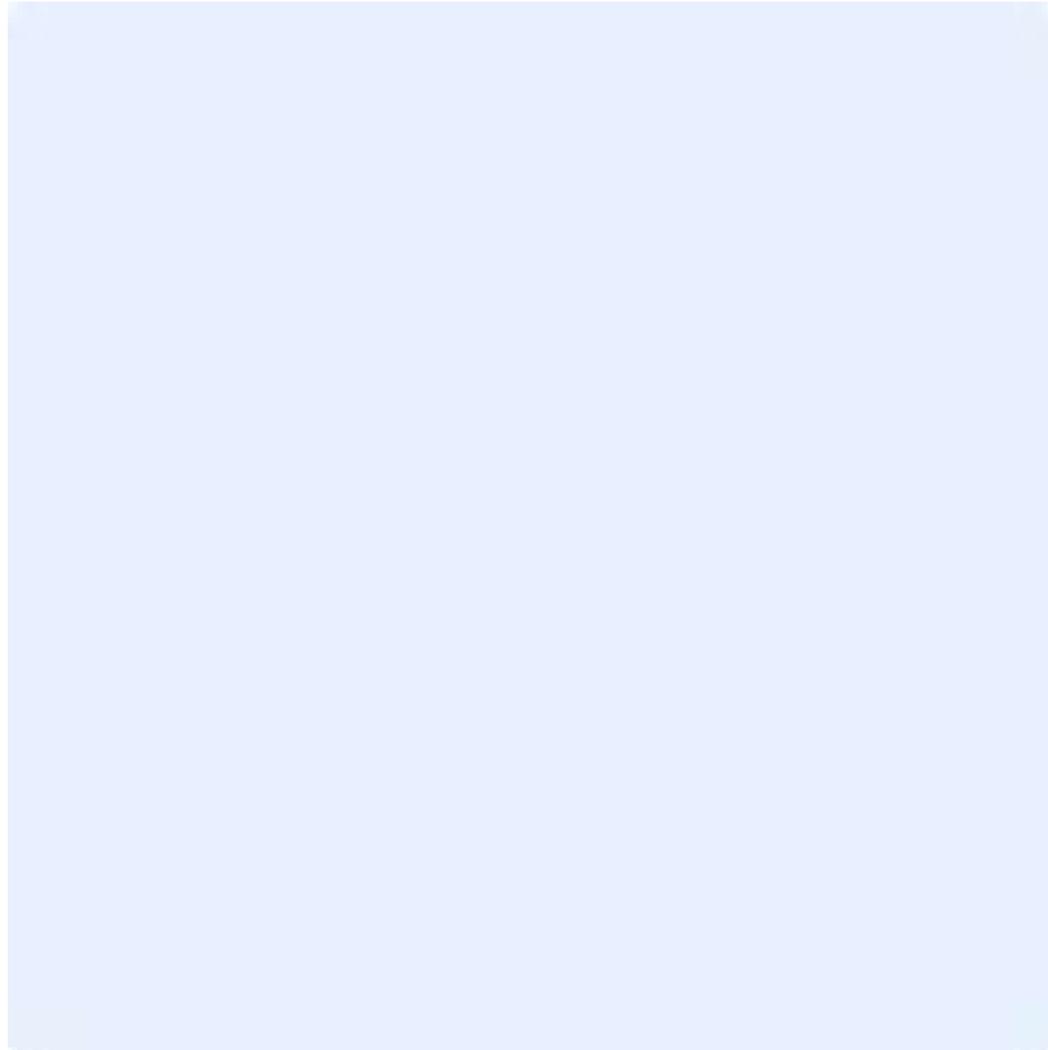
Written Directions:
The map shows directions from the SNC-Lavalin office at 1319 Bay Ave to the KBRH hospital in Trail. For each property in Trail, review the route to the hospital from that location.

HASP SECTION 2: EMERGENCY RESPONSE PLAN

Project #: 655059

Date: Sept 13, 2018

SITE PLAN- Plans vary from site to site. The muster point is the van. Park it in a safe location. With easy egress from property. First aid kits and fire extinguishers are in the van. At each property, identify a safe egress route through the LMRA process.



(Showing Muster Area, First Aid Kits and Facilities, Fire Extinguisher(s), Known Hazard Areas, and Spill Kits [if applicable])

NOTE: If applicable, use a separate page for Traffic Control Plans
(Include exclusion zones for traffic and heavy equipment as appropriate).

Project #: 655059

Date: Sept 13, 2018

EMERGENCY RESPONSE PROCEDURES - SAFETY

- ☒ Ensure site is safe. Stop work if deemed necessary
- ☒ Get prompt, adequate and appropriate medical care for the injured person:
 - ☒ Conduct an assessment of the emergency situation. Determine the extent of injuries.
 - ☒ First Aid Attendant(s) will provide first aid and/or, where required, contact emergency services. **DO NOT ATTEMPT TO MOVE PATIENTS WHO APPEAR TO HAVE SUFFERED HEAD, NECK OR BACK INJURIES.**
 - ☒ If required to go to a Medical facility for treatment, the Site Supervisor or delegate will accompany the injured person.
- ☒ As required:
 - ☒ All other workers to assemble at muster point. Site Supervisor or delegate to account for all site personnel.
 - ☒ Site Supervisor or delegate to cordon off the incident area to prevent access by others and to preserve the incident scene.
- ☒ Site Supervisor or delegate to notify Project Manager as soon as initial emergency response is complete and site is safe.
 - ☒ PM to contact HSE immediately as per the HSSE Incident Management and Reporting Procedure.
 - ☒ PM / HSE to initiate A&D testing as required. PM will advise the Site Supervisor of the need for testing and the steps to take.
 - ☒ PM to contact Client and/or subcontractor's management / supervisor if required.
 - ☒ If applicable, PM / HSE to advise governmental agencies as per regulation.
 - ☒ PM or Site Supervisor to complete HSSE Incident Notification Form and submit to HSE within 24 hours.
- ☒ Site Supervisor to begin collecting relevant information and documented statements required for incident investigation (e.g. who, what, where, and when). Remember to take pictures of the scene.

Project #: 655059

Date: September 13, 2018

EMERGENCY RESPONSE PROCEDURES – ENVIRONMENT

- ☒ As soon as the incident is noticed, **STOP** work as necessary and initiate response
- ☒ Site Supervisor or delegate to consult SDS to assess exposure risks to choose the appropriate protective equipment and the management plan.
- ☒ Do NOT intervene if it compromises the health and safety of personnel or the integrity of the chemical container.
- ☒ If safe for onsite personnel to respond, control the leak/spill:
 - ☒ Ensure workers are aware of the safe handling requirements for the spilled chemical and wear the appropriate PPE;
 - ☒ Stop leak or stop the spill if possible;
 - ☒ Confine spill/leak;
 - ☒ Prevent contaminant to reach sensitive areas;
 - ☒ Cover the affected area with a tarp if there are chances of rain;
 - ☒ If required, use the service of an external specialized firm;
 - ☒ Recover the product;
 - ☒ Identify the container according to local legislation;
 - ☒ Temporarily store containers according to local legislation;
 - ☒ Dispose of the contaminated material off-site via a specialized firm and according to local legislation.
- ☒ If NOT safe for onsite personnel to respond, Site Supervisor or delegate to contact appropriate emergency response as per the Contact List.
- ☒ Site Supervisor or delegate to notify Project Manager as soon as initial emergency response is complete and site is safe.
 - ☒ PM to contact HSE immediately as per HSSE Incident Management and Reporting Procedure.
 - ☒ PM / HSE to initiate A&D testing as required.
 - ☒ PM / HSE to advise governmental agencies as per regulation.
 - ☒ PM or Site Supervisor to complete HSSE Incident Notification Form and submit to HSE within 24 hours.
- ☒ Site Supervisor to begin collecting relevant information and documented statements required for incident investigation (e.g. who, what, where, and when). Remember to take pictures of the scene.

2. Assess RISK

Determine the risk for each task by identifying the PROBABILITY (how often this could occur) and the CONSEQUENCES (what could be the result if it occurred). Use this to determine the appropriate control and follow up action.

		Risk level		Consequence				
		Low	Medium	Negligible	Minor	Moderate	Major	Catastrophic
Probability	High	Extreme						
	Almost impossible							
	Conceivable							
	Possible							
	Has Happened							
	Almost Certain							

ASK yourself:

- Have we looked and identified all hazards?
- Are we trained and competent to conduct this task?
- Can we do the job as planned in the JHA and/or safe work permit?
- Are the resources (equipment, tools, PPE, and personnel) available?
- Have we identified all the hazards since we last did the task?
- Are other persons protected from our activities in the area?
- Do we know what to do in case of an emergency?
- Do we have safe access and egress to and from the work area?
- Can we do this job without putting ourselves or others at risk?
- Is our work area clean and tidy?

3. Take appropriate ACTION

Discuss CONTROLS and follow up ACTIONS

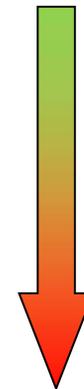
Hierarchy of CONTROLS

If risks identified are medium or above, the following must be considered:

- Stop Work
- Ask a **MANAGER, SUPERVISOR** or **SPECIALIST** to identify appropriate controls.
- Discuss with a **COLLEAGUE** to assist.
- Change the **CONDITIONS** of the task.
- Do the job in **ANOTHER WAY** – think creatively.

Determine the most appropriate control to mitigate the hazards.

Most Effective



Elimination

Substitution

Engineering

Administrative

PPE

Least Effective

HASP SECTION 3: JOB HAZARD ANALYSIS (JHA)

JOB DESCRIPTION	In-situ Soil Testing	DATE PREPARED	September 13, 2018
LOCATION	Trail, BC (Various Locations)	PROJECT NUMBER	655059
CONTRACTOR	SNC	ESTIMATED CREW SIZE	1 – 2
WRITTEN BY	Alexa Matthes	SIGNATURE	
REVIEWED BY	Andrea McCormick	SIGNATURE	
APPROVED BY	Bruce Enns	SIGNATURE	

CRITICAL RISK CONTROL PROTOCOLS (Mark each box as applicable)

<input checked="" type="checkbox"/> #1 – Vehicles and Mobile Equipment	<input type="checkbox"/> #2 - Hazardous Materials	<input type="checkbox"/> #3 – Equipment Safeguarding	<input type="checkbox"/> #4 – Energy Isolation
<input type="checkbox"/> #5 – Working at Heights	<input type="checkbox"/> #6 – Lifting Operations	<input type="checkbox"/> #7 – Confined Space	<input type="checkbox"/> #8 – Excavations <input type="checkbox"/> NA

REQUIRED SAFE WORK PERMIT (Mark each box as applicable)

<input type="checkbox"/> Confined Space	<input type="checkbox"/> Hot Work	<input type="checkbox"/> Excavation	<input type="checkbox"/> Electrical Work	<input type="checkbox"/> NA
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COMMON HAZARD CATEGORIES (Mark each box as applicable)

Work Area	Equipment & Tools (Powered)	Equipment & Tools (Non Powered)	Weather Conditions	Hazardous Materials	Energy	Environment
<input checked="" type="checkbox"/> Communications	<input type="checkbox"/> Aerial mobile platform	<input type="checkbox"/> Elevated platforms	<input checked="" type="checkbox"/> Heat/cold	<input type="checkbox"/> Compressed gas	<input type="checkbox"/> Electrical	<input type="checkbox"/> Contaminant release to water
<input checked="" type="checkbox"/> Working alone	<input type="checkbox"/> Boom lifts / Scissor lifts	<input type="checkbox"/> Man-basket	<input checked="" type="checkbox"/> Windy	<input type="checkbox"/> Flammable / Combustible	<input type="checkbox"/> Mechanical	<input type="checkbox"/> Contaminant release to soil
<input type="checkbox"/> Remote location	<input type="checkbox"/> Forklifts	<input type="checkbox"/> Scaffolding	<input type="checkbox"/> Tidal	<input type="checkbox"/> Oxidizing	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Atmospheric emission
<input type="checkbox"/> Simultaneous operations	<input type="checkbox"/> Hoes / Bobcats	<input type="checkbox"/> Ladders	<input type="checkbox"/> Sea storm	<input type="checkbox"/> Toxic	<input type="checkbox"/> Hydraulic	<input type="checkbox"/> Erosion / sedimentation
<input type="checkbox"/> Superposed works	<input type="checkbox"/> Excavators	<input checked="" type="checkbox"/> Hand tools	<input type="checkbox"/> Snowing / freezing	<input type="checkbox"/> Corrosive	<input type="checkbox"/> Thermal	<input type="checkbox"/> Noise/vibration/light
<input type="checkbox"/> Landslide	<input type="checkbox"/> Cranes		<input type="checkbox"/> Foggy	<input type="checkbox"/> Biological / Biomedical	<input type="checkbox"/> Radiation	<input type="checkbox"/> Wastewater generation / disposal
<input checked="" type="checkbox"/> Traffic	<input type="checkbox"/> Trucks / Trailers			<input type="checkbox"/> Explosives	<input type="checkbox"/> Chemical	<input type="checkbox"/> Waste generation / disposal
	<input checked="" type="checkbox"/> Light trucks / Vehicles				<input type="checkbox"/> Potential	<input type="checkbox"/> Disturbance / removal of plants or animals
	<input type="checkbox"/> Powered Hand Tools				<input type="checkbox"/> Residual	<input type="checkbox"/> Work in or near sensitive areas

PERSONAL PROTECTIVE EQUIPMENT, SPECIAL TOOLS AND OTHER EQUIPMENT REQUIRED

Sturdy non-slip footwear to be worn while sampling. Safety glasses and a high-vis vest. Nitrile gloves and leather gloves on hand for appropriate tasks .

ADDITIONAL TRAINING REQUIRED

Teck induction recommended but not necessary for residential soil sampling

HASP SECTION 3: JOB HAZARD ANALYSIS (JHA)

JOB STEPS / ACTIVITIES	HAZARDS	Initial Risk Level	CONTROL MEASURES	PERSON
Before you go to site	Working alone, accessing an unknown property	Low	Discuss with the owners property or review database comments regarding access, pets, etc. to help assess risks before you arrive. Set up a specific time in outlook calendar and let Reception know your location, especially if working after regular hours. Share location with Reception in iphone so you can be tracked.	A.Matthes
Loading van	Pinch points, slip/trips, strains	Medium	Wear non-slip sturdy footwear while loading van and ensure that pathway is clear of clutter and note the ground conditions (i.e. wet, icy, etc). Use proper lifting techniques.	A.Matthes
Driving to site	Traffic incident, distracted driving	High	Walk around vehicle and visual inspect condition (e.g. flat tire, etc) and obstructions. Obey rules of the road and speed. Plan route and look at map prior to leaving so you are not distracted looking for house numbers. If necessary, park to look up where you are going.	A.Matthes
Parking	Traffic congestion, busy roadways	Medium	Find a place to park where you can safely unload equipment. You may need to move the van afterward to a safe location. Back into parking spacing when possible.	A.Matthes
Approaching Property	Slips trips on stairs, uneven walkways, clutter in yard, working alone	Medium	Use LMRA as you approach and change route as necessary, use handrails and make sure you have a clear path. Ensure that cell phone is on hand and easy to access if you need support.	A.Matthes
Meeting tenant or property owner	Meeting a person that could potentially harm you or put you at risk	Low	Use your judgement to assess the safety of the person you are meeting. For example, suspected drug or alcohol use, questionable mental stability, etc. If there is any sense about the safety of the person you are meeting, leave and/or call for support.	A.Matthes
Working in the yard	Clutter, slips trips, pets, children.	Low	Use LMRA as you are walking around the yard. Pay attention to objects that may be in your path. Children and pets should be kept away from where you are working. When safety control measures can not be met stop work and arrgange another time.	A.Matthes

Collecting soil samples	Strain from twisting auger	High	If soil auger is not easily turning, try another location. Do not try and muscle through rocks and rough ground.	A.Matthes
Collecting soil samples	Exposure to contaminants in soil	Medium	Wear PPE including nitrile gloves and safety glasses while sampling. Wash hands when you return to office. Wipe down hands, steering wheel, equipment after work.	A.Matthes
Collecting soil samples	Using the GPS	Low	While using the GPS and Phone setup, be extra aware of surroundings and make sure to use phone when stationary only. Use GPS backpack so that visibility is not reduced from wearing a cap with GPS attachment.	A.Matthes
Leaving site	Changes in Vehicle surroundings	Medium	Walk around vehicle to make sure nothing on site has moved and could be hit or run over by the van (i.e. toys).	A.Matthes
Check in	Working alone - failure to call in following visit or assessment resulting in activating emergency response	Medium	Set reminders on phone to check in following the visit. Ensure that iphone GPS locator is in enabled. Share location with reception when working alone. Check in if headed to another site or plans change and you will not be back at your expected time.	A.Matthes
Driving back to office	Traffic	High	Obey rules of the road and do not speed upon return. If you are going somewhere else after the visit ensure to let the office know	A.Matthes

HASP SECTION 4: DAILY SAFETY MEETING

Project #: 655059

Date: September 13, 2018

On-Site Checklist:

Job Scope discussed and understood by all (i.e. JHA [Section 3 of HASP] & Critical Checklists, StepBack, relevant SDS’):	Yes	<input checked="" type="checkbox"/>
Site rules discussed (i.e., applicable Blue Rules; relevant CRCPs; smoking/eating/drinking areas; zero tolerance for drugs & alcohol; ethical conduct at all times; no cell phone use while operating vehicles/equipment/tools or while working in the defined areas/PPE):	Yes	<input checked="" type="checkbox"/>
Site Specific Orientations have been provided for SNC-Lavalin Personnel and Contractors prior to work commencing:	Yes	<input checked="" type="checkbox"/>
HSE training certification has been verified for SNC-Lavalin Personnel and Contractors:	Yes	<input checked="" type="checkbox"/>
Emergency Procedures reviewed, communicated and posted:	Yes	<input checked="" type="checkbox"/>
Location of Muster Point(s):		
Location of First Aid Kit and/or Station:		
Name(s) of First Aid Attendant(s) on site identified (specify level of training):	Yes	<input checked="" type="checkbox"/>
Location of Fire Extinguisher(s) on site: in SA Van	N/A	<input type="checkbox"/>
All Fire Extinguishers present on site are certified and inspected:	Yes	<input checked="" type="checkbox"/>
Alarm or signal that will initiate evacuation:	N/A	<input checked="" type="checkbox"/>
Location of spill response equipment:	N/A	<input checked="" type="checkbox"/>
Appropriate PPE selected, PPE has been visually inspected and is in good working condition.	Yes	<input checked="" type="checkbox"/>
If Young/Inexperienced workers on site, are all workers aware of these workers and the Young worker	Yes	<input type="checkbox"/>
Name(s) of SSW (if applicable):		
Call-In Procedures established and communicated (e.g., when working alone or in isolation):	Yes	<input checked="" type="checkbox"/>
Site Walk-Around conducted to ensure all site hazards are identified and controlled (i.e., StepBack completed).	Yes	<input type="checkbox"/>
Other relevant information discussed & procedures implemented (i.e., industry, or site specific safety information/procedures [e.g., ground disturbance, lock out-tag out, traffic safety control, work permits, site security, decontamination procedures for tools/equipment/PPE]):	Yes	<input type="checkbox"/>

HASP SECTION 4: DAILY SAFETY MEETING

Project #: 655059

Client: Teck Metals Ltd.

Date: September 13, 2018

Daily Information:

Applicable Safety Share:

Toolbox Topics:

Weather Forecast:

General Discussion around Daily Scope:

Concerns or Issues Raised:

HASP SECTION 1: PROJECT RISK REGISTER

Site Location: Various residential properties in Trail, BC	Project #: 655059 Remediation and Yard Improvement
Name of Contractor/Subcontractor(s): various Contractors (on contract to Teck)	Date: 17 January 2019

Job Scope: Excavation monitoring and soil screening at remediation properties in Trail.

E&G PM: Bruce Enns	Prime Contractor Co. & Contact: Alpine Contracting, Rob Worosz
Client: Teck Metals Ltd	Client PM: Clare North

APPLICABLE/ANTICIPATED CRITICAL RISK ACTIVITY - Refer to SNC-Lavalin Critical Risk Control Protocols (CRCP)*:
Where work involves any of the following hazards, the applicable SNC-Lavalin Critical Risk Control Protocol must be incorporated into the HASP.

- 1. Vehicles (e.g., Driving, ATV, Snowmobile, etc.)
- 2. Hazardous Materials (e.g., chemical handling and storage, etc.)
- 3. Equipment Safeguarding (e.g., Machine guarding etc.)
- 4. De-Energization (Electrical Hazards)
- 5. Working at Heights (1.8 metres) (e.g., Scaffolds & Platforms, Stairs & Ladders, scissor lift, boom lift etc.)
- 6. Lifting Operations (e.g., HIAB Truck, Hoisting, Cranes etc.)
- 7. Confined Space (e.g., inspecting/maintaining confined spaces, etc.)
- 8. Excavations (e.g. shoring, tunnels etc.)

HASP SECTION 1: PROJECT RISK REGISTER

OTHER APPLICABLE OR ANTICIPATED HEALTH AND SAFETY HAZARDS*:

Where work involves the following health and safety hazards, appropriate controls should be incorporated into the HASP.

<input type="checkbox"/> 1. Work In Remote Location	<input checked="" type="checkbox"/> 9. Activities In Or Near Traffic Areas
<input checked="" type="checkbox"/> 2. Working Alone	<input checked="" type="checkbox"/> 10. Underground / Overhead Utilities
<input type="checkbox"/> 3. Working On Or Near Water	<input type="checkbox"/> 11. Hot Work
<input checked="" type="checkbox"/> 4. Nature/Animal Hazards	<input type="checkbox"/> 12. Respiratory Hazards
<input checked="" type="checkbox"/> 5. Extreme Weather Conditions (e.g. hot, cold, windy, snowing)	<input checked="" type="checkbox"/> 13. Physical Exertion/Ergonomics
<input checked="" type="checkbox"/> 6. Biohazards	<input checked="" type="checkbox"/> 14. Hazardous Energy
<input checked="" type="checkbox"/> 7. Equipment and Tools – Powered E.g. Heavy Mobile Equipment, Scissor lift, Powered Hand Tools, etc. Specify: Excavators, bobcats, dump trucks on site	Includes: Radiation, Pneumatic, Thermal, Hydraulic, Electrical, Mechanical, Chemical, Potential or Residual) Specify: XRF Device
<input checked="" type="checkbox"/> 8. Equipment and Tools – Non-Powered E.g. Manual hand tools, Ladders, etc. Specify: shovels	<input type="checkbox"/> 15. Other:

APPLICABLE OR ANTICIPATED ENVIRONMENTAL HAZARDS*:

Where work may involve or result in the following environmental aspects, appropriate controls should be incorporated into the HASP.

<input checked="" type="checkbox"/> 1. Noise/Vibration	<input type="checkbox"/> 5. Chemical Use/Storage
<input checked="" type="checkbox"/> 2. Dust Generation	<input type="checkbox"/> 6. Hazardous Waste Generation/Storage
<input type="checkbox"/> 3. Air Discharge/Emissions	<input type="checkbox"/> 7. Wildlife Disturbance
<input type="checkbox"/> 4. Work in Sensitive Area	<input type="checkbox"/> 8. Other:

APPLICABLE OR ANTICIPATED SECURITY THREATS*:

Where workers may encounter the following security threats, appropriate planning and controls should be incorporated into the HASP.

<input type="checkbox"/> 1. International Travel	<input type="checkbox"/> 4. Vandalism/Sabotage
<input checked="" type="checkbox"/> 2. Local Criminal Activity	<input type="checkbox"/> 5. Other:
<input checked="" type="checkbox"/> 3. High Value Assets: XRF Device	

E&G Project Manager Signature:

*** Ensure that all hazards identified are addressed in subsequent pages**

HASP SECTION 2: EMERGENCY RESPONSE PLAN

Date: 17 January 2019		Project #: 655059 Remediation and Yard Improvement	
Site Supervisor: Andrea McCormick		Prime Contractor: Alpine/Simm	
EMERGENCY CONTACT INFORMATION			
E&G Managing Office & Phone Number:	Trail: 250-368-3256		
H&S Primary Contact (and 24 hr. Emergency Contact)	Brett Jullion (Prairies H&S Mgr) - Office: 306-668-6800; Cell: 306-229-0344		
H&S Alternate Contact	Tony Kavelaars (Sr. H&S Specialist) – Office: 604-515-5195; Cell: 604-786-1001		
Primary First Aid Attendant	Andrea McCormick		
Alternate First Aid Attendant	Bruce Enns		
Site Contact & Phone Number	Rob Worosz 250-368-1433		
E&G CONTACT(S):	Name	Primary Phone Number	Alternate Phone Number(s)
E&G Project Manager	Bruce Enns	250-368-3256 x53251	250-231-1464
Alternate	Andrea McCormick	250-368-3256 x53256	250-231-1424
2nd Alternate	Kayla Johnson	250-368-2356 x53257	250-921-4844
CLIENT CONTACT(S):	Name	Primary Phone Number	
Client Project Manager	Clare North	250-364-4392	250-512-1571
Alternate	Dan Bouillon	250-364-4743	250-231-3927
OTHER CONTACT(S) (Co. Name)	Contact's Name	Primary Phone #	Alternate Phone #
Teck	Andrew Chewter	250364-4315	250-921-4370
EMERGENCY SERVICE CONTACT	Primary Phone Number	Alternate Phone Number(s)	
Fire Department	911 (If not applicable, enter alternate)	250-364-1737	
Police	911 (If not applicable, enter alternate)	350-364-2566	
Ambulance	911 (If not applicable, enter alternate)		
Emergency Electrical Calls	Fortis (BC): 1-866-436-7847		N/A <input type="checkbox"/>
Natural Gas Trouble	Fortis (BC): 1-800-663-9911		N/A <input type="checkbox"/>
Emergency Spill Control	BC PEP: 1-800-663-3456		N/A <input type="checkbox"/>
Provincial Regulator	WCB (BC) 24 hr Emergency: 1-888-621-7233 (afterhours call 1-866-922-4357)		N/A <input type="checkbox"/>
Other:			
Other:			

*Ensure E&G Project Manager and Alternate(s) receive a copy of HASP Section 2: Emergency Response

HASP SECTION 2: EMERGENCY RESPONSE PLAN

Project #: 655059 Remediation and Yard Improvement

Date: 17 January 2019

EVACUATION ROUTE TO HOSPITAL & CLINIC

NOTE: Injured or ill workers are only to be transported to hospital or clinic by co-worker if it can be done so safely without causing further injury or trauma. Otherwise, ambulance or other emergency service should be utilized.

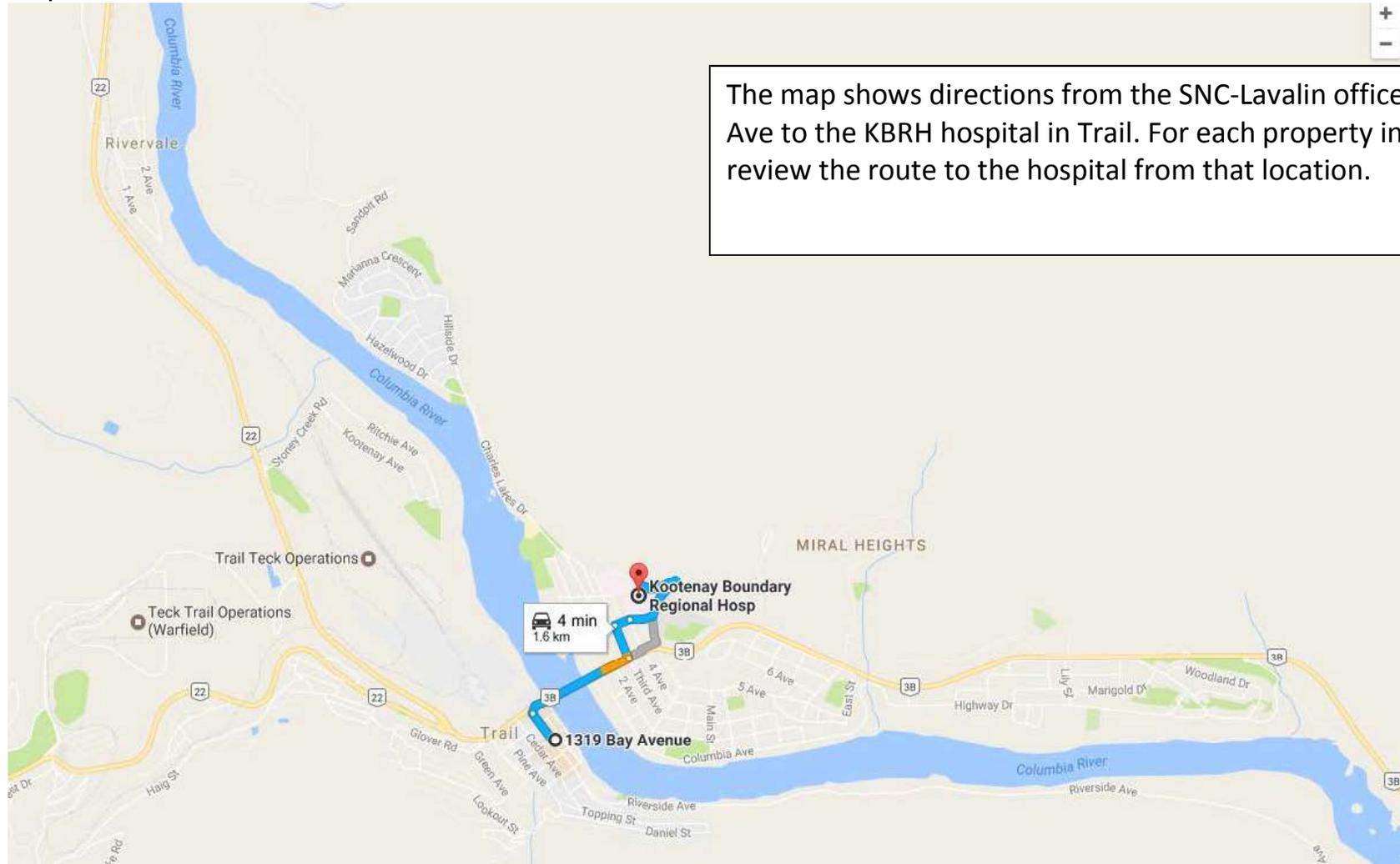
HOSPITAL	CLINIC
Name: Kootenay Boundary Regional Hospital	
Address: 1200 Hospital Bench	
Phone Number: (250) 368-3311	

SEE MAPS AND WRITTEN DIRECTIONS ON FOLLOWING TWO PAGES

Emergency Route to Hospital:

Map:

Written
Directions:



The map shows directions from the SNC-Lavalin office at 1319 Bay Ave to the KBRH hospital in Trail. For each property in Trail, review the route to the hospital from that location.

HASP SECTION 2: EMERGENCY RESPONSE PLAN

Project #: 655059 Remediation and Yard Improvement

Date: 17 January 2019

SITE PLAN

Plans vary from site to site. The muster point is the van. Park it in a safe location. With easy egress from property. First aid kits are in rental car. At each property, identify a safe egress route through the LMRA process.

(Showing Muster Area, First Aid Kits and Facilities, Fire Extinguisher(s), Known Hazard Areas, and Spill Kits [if applicable])

NOTE: If applicable, use a separate page for Traffic Control Plans (include exclusion zones for traffic and heavy equipment as appropriate).

HASP SECTION 2: EMERGENCY RESPONSE PLAN

Project #: 655059 Remediation and Yard Improvement

Date: 17 January 2019

EMERGENCY RESPONSE PROCEDURES – SAFETY

- ❑ As soon as the incident is noticed, **STOP** the work.
- ❑ Ensure site is safe.
- ❑ Get prompt, adequate and appropriate medical care for the injured person:
 - ❑ Trained First Aid Attendant(s) will conduct an assessment of the emergency situation to determine the extent of injuries that already have been manifested and injuries which may occur due to the emergency situation.
 - ❑ As per assessment, First Aid Attendant(s) will either provide first aid or call emergency response as per the Contact List if attention beyond first aid is required. **DO NOT ATTEMPT TO MOVE PATIENTS WHO APPEAR TO HAVE SUFFERED HEAD, NECK OR BACK INJURIES.**
 - ❑ If required to go to a Medical facility for treatment, the Site Supervisor or delegate will accompany the injured person.
- ❑ As required:
 - ❑ All other workers to assemble at muster point. Site Supervisor or delegate to account for all site personnel.
 - ❑ Site Supervisor or delegate to cordon off the incident area to prevent access by others and to preserve the incident scene.
- ❑ Site Supervisor or delegate to notify E&G Project Manager as soon as initial emergency response is complete and site is safe.
 - ❑ PM to contact H&S immediately as per E&G's HSSE Incident Management and Reporting Procedure.
 - ❑ PM / H&S to initiate A&D testing as required. PM will advise the Site Supervisor of the need for testing and the steps to take.
 - ❑ PM to contact Client and/or subcontractor's management / supervisor if required.
 - ❑ If applicable, PM / H&S to advise governmental agencies as per regulation.
 - ❑ PM or Site Supervisor to complete HSSE Incident Notification Form and submit to H&S within 24 hours.
- ❑ Site Supervisor to begin collecting relevant information and documented statements required for incident investigation (e.g. who, what, where, and when). Remember to take pictures of the scene.

HASP SECTION 2: EMERGENCY RESPONSE PLAN

Project #: 655059 Remediation and Yard Improvement

Date: 17 January 2019

EMERGENCY RESPONSE PROCEDURES – ENVIRONMENT

- ❑ As soon as the incident is noticed, **STOP** the work, and cordon off the area to prevent access by others.
- ❑ Site Supervisor or delegate to consult MSDS to assess exposure risks to choose the appropriate protective equipment and the management plan.
- ❑ Do NOT intervene if it compromises the health and safety of personnel or the integrity of the chemical container.
- ❑ If safe for onsite personnel to respond, control the leak/spill:
 - ❑ Ensure workers are aware of the safe handling requirements for the spilled chemical and wear the appropriate PPE;
 - ❑ Stop leak or stop the spill if possible;
 - ❑ Confine spill/leak;
 - ❑ Prevent contaminant to reach sensitive areas;
 - ❑ Cover the affected area with a tarp if there are chances of rain;
 - ❑ If required, use the service of an external specialized firm;
 - ❑ Recover the product;
 - ❑ Identify the container according to local legislation;
 - ❑ Temporarily store containers according to local legislation;
 - ❑ Dispose of the contaminated material off-site via a specialized firm and according to local legislation.
- ❑ If NOT safe for onsite personnel to respond, Site Supervisor or delegate to contact appropriate emergency response as per the Contact List.
- ❑ Site Supervisor or delegate to notify E&G Project Manager as soon as initial emergency response is complete and site is safe.
 - ❑ PM to contact H&S immediately as per E&G's HSSE Incident Management and Reporting Procedure.
 - ❑ PM / H&S to initiate A&D testing as required.
 - ❑ PM / H&S to advise governmental agencies as per regulation.
 - ❑ PM or Site Supervisor to complete HSSE Incident Notification Form and submit to H&S within 24 hours.
- ❑ Site Supervisor to begin collecting relevant information and documented statements required for incident investigation (e.g. who, what, where, and when). Remember to take pictures of the scene.

2. Assess RISK

Determine the risk for each task by identifying the PROBABILITY (how often this could occur) and the CONSEQUENCES (what could be the result if it occurred). Use this to determine the appropriate control and follow up action.

Risk Level		Consequence				
		First Aid	Medical Aid	Modified Work	Lost Time	Fatality
Low	Medium					
High	Extreme					
Probability	Almost Impossible	L	L	L	L	M
	Conceivable	L	L	M	M	H
	Possible	L	M	M	H	E
	Has Happened	M	M	H	H	E
	Almost Certain	M	H	H	E	E

ASK yourself:

- Have we looked and identified all hazards?
- Are we trained and competent to conduct this task?
- Can we do the job as planned in the JSA and/or safe work permit?
- Are the resources (equipment, tools, PPE, and personnel) available?
- Have we identified all the hazards since we last did the task?
- Are other persons protected from our activities in the area?
- Do we know what to do in case of an emergency?
- Do we have safe access and egress to and from the work area?
- Can we do this job without putting ourselves or others at risk?
- Is our work area clean and tidy?

3. Take appropriate ACTION

Discuss CONTROLS and follow up ACTIONS

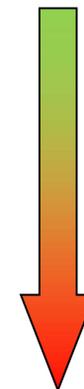
If risks identified are medium or above, the following must be considered:

- Stop Work
- Ask a **MANAGER, SUPERVISOR or SPECIALIST** to identify appropriate controls.
- Discuss with a **COLLEAGUE** to assist.
- Change the **CONDITIONS** of the task.
- Do the job in **ANOTHER WAY** – think creatively.

Hierarchy of CONTROLS

Determine the most appropriate control to mitigate the hazards.

Most Effective



Elimination

Substitution

Separation

Engineering

Administrative

PPE

Least Effective

HASP SECTION 3: JOB SAFETY ANALYSIS (JSA) / JOB ENVIRONMENTAL IMPACT ANALYSIS (JEIA)

JOB DESCRIPTION	Remediation Monitoring and In-Situ Soil Screening	DATE PREPARED	Oct 3, 2018
LOCATION	Trail, BC	PROJECT NUMBER	655059 Remediation and Yard Improvement
CONTRACTOR		ESTIMATED CREW SIZE	1
WRITTEN BY	Andrea McCormick	SIGNATURE	
REVIEWED BY	Bruce Enns	SIGNATURE	
APPROVED BY	Bruce Enns	SIGNATURE	

CRITICAL RISK CONTROL PROTOCOLS *(Mark each box as applicable)*

- | | | | |
|--|---|--|---|
| <input checked="" type="checkbox"/> #1 – Vehicles and Mobile Equipment | <input type="checkbox"/> #2 - Hazardous Materials | <input type="checkbox"/> #3 – Equipment Safeguarding | <input type="checkbox"/> #4 – Energy Isolation |
| <input type="checkbox"/> #5 – Working at Heights | <input type="checkbox"/> #6 – Lifting Operations | <input type="checkbox"/> #7 – Confined Space | <input type="checkbox"/> #8 – Excavations <input type="checkbox"/> NA |

REQUIRED SAFE WORK PERMIT *(Mark each box as applicable)*

- | | | | | |
|---|-----------------------------------|-------------------------------------|--|--|
| <input type="checkbox"/> Confined Space | <input type="checkbox"/> Hot Work | <input type="checkbox"/> Excavation | <input type="checkbox"/> Electrical Work | <input checked="" type="checkbox"/> NA |
|---|-----------------------------------|-------------------------------------|--|--|

COMMON HAZARD CATEGORIES *(Mark each box as applicable)*

Work Area	Equipment & Tools (Powered)	Equipment & Tools (Non Powered)	Weather Conditions	Hazardous Materials	Energy
<input checked="" type="checkbox"/> Communications	<input type="checkbox"/> Aerial mobile platform	<input type="checkbox"/> Elevated platforms	<input checked="" type="checkbox"/> Heat/cold	<input type="checkbox"/> Compressed gas	<input type="checkbox"/> Electrical
<input checked="" type="checkbox"/> Working alone	<input type="checkbox"/> Boom lifts / Scissor lifts	<input type="checkbox"/> Man-basket	<input type="checkbox"/> Windy	<input type="checkbox"/> Flammable / Combustible	<input type="checkbox"/> Mechanical
<input type="checkbox"/> Remote location	<input type="checkbox"/> Forklifts	<input type="checkbox"/> Scaffolding	<input type="checkbox"/> Tidal	<input type="checkbox"/> Oxidizing	<input type="checkbox"/> Pneumatic
<input type="checkbox"/> Simultaneous operations	<input type="checkbox"/> Hoes / Bobcats	<input type="checkbox"/> Ladders	<input type="checkbox"/> Sea storm	<input type="checkbox"/> Toxic	<input type="checkbox"/> Hydraulic
<input type="checkbox"/> Superposed works	<input checked="" type="checkbox"/> Excavators	<input type="checkbox"/> Hand tools	<input type="checkbox"/> Snowing / freezing	<input type="checkbox"/> Corrosive	<input type="checkbox"/> Thermal
<input type="checkbox"/> Landslide	<input type="checkbox"/> Cranes		<input type="checkbox"/> Foggy	<input type="checkbox"/> Biological / Biomedical	<input checked="" type="checkbox"/> Radiation
<input checked="" type="checkbox"/> Traffic	<input checked="" type="checkbox"/> Trucks / Trailers			<input type="checkbox"/> Explosives	<input type="checkbox"/> Chemical
	<input checked="" type="checkbox"/> Light trucks / Vehicles				<input type="checkbox"/> Potential
	<input type="checkbox"/> Powered Hand Tools				<input type="checkbox"/> Residual

PERSONAL PROTECTIVE EQUIPMENT, SPECIAL TOOLS AND OTHER EQUIPMENT REQUIRED

Steel-toed footwear to be worn on site. Safety glasses and a high-vis vest. Nitrile and leather gloves on hand for various uses. Use a survey meter (portable radiation detection device) . Hard hat and hearing protection when mobile equipment is active onsite.

ADDITIONAL TRAINING REQUIRED

NRCan XRF Operator Certification, Teck Induction

HASP SECTION 3: JOB SAFETY ANALYSIS (JSA) / JOB ENVIRONMENTAL IMPACT ANALYSIS (JEIA)

JOB STEPS / ACTIVITIES	HAZARDS	Initial Risk Level	CONTROL MEASURES	PERSON
Before you go to site	Working alone, accessing an unknown property	Low	Discuss with the owners property access, pets, etc. to help assess risks before you arrive. Set up a specific time in outlook calendar to ensure someone knows where you are, especially if working after regular hours.	Andrea
Preparing for soil screening	Damaged device, working alone, theft	Low	Inspect XRF before leaving the office looking for obvious signs of damage and battery life. Allow enough time to organize and load materials to avoid rushing. Ensure van is <u>always</u> locked while XRF is inside.	Andrea
Loading van	Pinch points, slip/trips, strains	Medium	Wear non-slip sturdy footwear while loading van and ensure that pathway is clear of clutter and note the ground conditions (i.e. wet, icy, etc). Use proper lifting techniques.	Andrea
Driving to site	Traffic incident, distracted driving	High	Walk around vehicle and visual inspect condition (e.g. flat tire, etc) and obstructions. Obey rules of the road and speed. Plan route and look at map prior to leaving so you are not distracted looking for numbers. If necessary, park to look up where you are going.	Andrea
Parking	Traffic congestion, busy roadways	Medium	Find a place to park where you can safely unload equipment. You may need to move the van afterward to a safe location. Back into parking spacing when possible.	Andrea
Approaching Property	Slips trips on stairs, uneven walkways, clutter in yard, working alone	Medium	Use LMRA as you approach and change route as necessary, use handrails and make sure you have a clear path. Ensure that cell phone is on hand and easy to access.	Andrea
Meeting tenant or property owner	Meeting a person that could potentially harm you or put you at risk	Low	Use your judgement to assess the safety of the person you are meeting. For example, suspected drug or alcohol use, questionable mental stability, etc. If there is any sense about the safety of the person you are meeting, leave and/or call for support.	Andrea

Working in the yard	Clutter, slips trips, pets, children.	Low	Use LMRA as you are walking around the yard. Pay attention to objects that may be in your path. Children and pets should be kept away from the area where screening is being conducted. When safety control measures can not be met stop work and arrgange another time.	Andrea
Excavation Monitoring	Slips/ trips, falls	Low	Use LMRA while walking around the house. Do not walk backwards, do no enter areas that are not safe (crawlspaces, attics, unsafe stairs). Use handrails. Watch for shallow excavation and trips. Do not use phone while walking.	Andrea
Excavation Base Sampling	Working around mobile equipment	Low	Make eye contact with operator when approaching mobile equipment. Avoid being in blind spot. Make sure operators gear down before you approach or walk around them. Have hearing protection available.	Andrea
Radiation protection while operating portable XRF	Radiation exposure	Medium	Review XRF Safety Briefing with anyone who may be in the proximity of the work area and establish clear communication. Visually inspect device before powering up. Turn on survery meter and enable automatic trigger lock. In areas where there may be traffic from a passerby designate a staff member to keep watch.	Andrea
Soil Sampling	Exposure to contaminants	Low	Wear nitrile gloves while sampling, wash hands after work and before break	Andrea
GPS soil location	Slips/trips	Low	Pay attention to walking, do not look at phone or GPS while moving around the yard to collect samples.	Andrea
Leaving site	Changes in Vehicle	Medium	Walk around vehicle to make sure nothing on site has moved and could be hit or run over by the van (i.e. toys).	Andrea
Check in	Working alone - failure to call in following visit resulting in activating emergency response	Medium	Set reminders on phone to check in following the visit. Ensure that iphoneGPS locator is in enabled. Follow up with reception if there is a change of plans and you will not be back at your expected time	Andrea
Driving back to office	Traffic incident	High	Obey rules of the road and do not speed upon return.	Andrea
		Choose an item.		

HASP SECTION 4: DAILY SAFETY MEETING

Project #: 655059 Remediation and Yard Improvement

Date: Sept 13, 2018

On-Site Checklist:

Emergency Procedures reviewed, communicated and posted:	Yes <input checked="" type="checkbox"/>	
Job Scope discussed and understood by all (i.e. JSA [Section 3 of HASP] & Critical Checklists, StepBack, relevant MSDS’):	Yes <input checked="" type="checkbox"/>	
Site rules discussed (i.e., applicable Blue rules, relevant CRCPs, smoking/eating/drinking areas; zero tolerance for drugs & alcohol; ethical conduct at all times; no cell phone use while operating vehicles/equipment/tools or while working in the defined areas):	Yes <input checked="" type="checkbox"/>	
Appropriate PPE selected & listed (e.g., necessary gloves available for each site worker such as nitrile, leather, cut-resistant, other?)	Yes <input checked="" type="checkbox"/>	
Relevant HSE events and lessons learned from previous days on site reviewed and discussed:	Yes <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
If Short Service Worker (SSW) on site, are all workers aware of SSW and SSW Program?	Yes <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Name(s) of SSW (if applicable):		
Location of First Aid Kit and/or Station:		
Name(s) of First Aid Attendant(s) on site identified (specify level of training): Andrea McCormick	Yes <input checked="" type="checkbox"/>	
Location of Fire Extinguisher(s) on site: in van		N/A <input checked="" type="checkbox"/>
All Fire Extinguishers present on site are verified:	Yes <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
Alarm or signal that will initiate evacuation:		N/A <input checked="" type="checkbox"/>
Location of spill response equipment:		N/A <input checked="" type="checkbox"/>
Site Walk-Around conducted to ensure all site hazards are identified and controlled: as approaching site and doing walkaround. Address concerns with homeowner.	Yes <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>
Call-In Procedures established and communicated (e.g., when working alone or in isolation): set up appointments and check out following	Yes <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>
Other relevant information discussed & procedures implemented (i.e., industry, or site specific safety information/procedures [e.g., ground disturbance, lock out-tag out, traffic safety control, work permits, site security, decontamination procedures for tools/equipment/PPE]): XRF log and calibration check, survey meter functional and in use	Yes <input type="checkbox"/>	N/A <input checked="" type="checkbox"/>
All Personnel have completed all necessary E&G, client-specific and industry-specific training and orientations (If applicable: list client and industry required training/orientation and verify each person’s training records are on site before ticking “yes” box): Valid Level 1 XRF Certification	Yes <input checked="" type="checkbox"/>	N/A <input type="checkbox"/>

StepBack – Instructions for Completion

- ❑ Day 1 of field work:
 - ✓ During the JSA process use the following blank StepBack card to document any hazards and control measures not identified on the pre-completed JSA; and,
 - ✓ Use another blank StepBack card anytime throughout the day when scope of work and/or hazard conditions change.

- ❑ Subsequent days, use StepBack card:
 - ✓ As daily JSA renewal; and,
 - ✓ When scope of work and/or hazard conditions change.

StepBack

2x2

Step back 2 meters for 2 minutes

Look and see the hazards | Assess the risk | Take appropriate action

Supervisors Name:

Signature:

Employer:

Project / Site:

Date and Time:

Location:

Job Description:

Safe Work Permit (SWP) Required? Yes No

1 Look and see the Hazards

Below is a list of common hazards to help trigger you to potential ones you may encounter while doing your job.

Vehicles

- Interaction with pedestrians or other equipment
- Poor visibility and/or road conditions
- Poor vehicle condition (seatbelts not available, tires, etc.)
- Driver distractions exist (cell phone, food, fatigue, etc.)

Hazardous Materials

- Extensive accumulation of dust/mist/fumes
- Inadequate information (labels/data sheets)
- Improper storage/containment/handling of chemicals
- Sources of ignition nearby

Equipment Safeguarding

- Exposed rotating parts
- Improper guards
- Interlock bypassed/poor condition
- Pinch points or crushing

De-Energization

- Overhead/underground power lines/utilities involved
- Strong magnetic fields/induction
- Systems under pressure or not isolated
- Not at Zero Energy State

Working at Heights

- No proper anchor point
- Improper use of elevated work platforms
- Lack of guards/barricades/toe boards
- Falling objects

Lifting Operations

- Lack of exclusion zones
- Lift plans not available
- Overloading/reaching required
- Excessive wind

Confined Space

- Confined space not identified and/or no watch person
- Inadequate gas testing
- Inadequate rescue equipment/plan
- Lack of proper access/egress

Excavations

- Buried utilities
- Insufficient protection (sloping/shoring)
- Spoil piles/equipment stored too close to the edge
- Unstable soil conditions could exist

Occupational Health and Hygiene

- Inadequate work environment
- Lifting, twisting, and/or repetitive movements
- Potential for slips, trips and falls
- Poor air/water quality

2 Assess the Risk

1. Have we looked and identified all hazards?
2. Are we trained and competent to conduct this task?
3. Can we do the job as planned in the JSA and/or safe work permit?
4. Are the resources (equipment, tools, PPE, and personnel) available?
5. Have we identified all the hazards since we last did the task?

Yes No

-
-
-
-
-

6. Are other persons protected from our activities in the area?
7. Do we know what to do in case of an emergency?
8. Do we have safe access and egress to and from the work area?
9. Can we do this job without putting ourselves or others at risk?
10. Is our work area clean and tidy?

Yes No

-
-
-
-
-

If you answered NO to any of these questions, consult your immediate supervisor for assistance.

Probability	Risk level		Consequence				
	Low	Medium	First Aid	Medical Aid	Modified Work	Lost Time	Fatality
Almost impossible	L	L	L	L	L	L	M
Conceivable	H	E	L	L	M	M	H
Possible	L	M	M	M	H	H	E
Has Happened	M	M	H	H	H	H	E
Almost Certain	M	H	H	H	E	E	E

Hazards: How can we get hurt?

Controls: What can we do about it?

What is the overall risk level for this job (post controls)?

● Extreme
 ● High
 ● Medium
 ● Low

Signing below indicates that all personnel understand the potential hazards that exist and agree that proper controls have been put in place.

Name	Signature	Name	Signature
Name	Signature	Name	Signature
Name	Signature	Name	Signature
Name	Signature	Name	Signature
Name	Signature	Name	Signature
Name	Signature	Name	Signature

Contractor Remediation Health and Safety

SNC-Lavalin Inc. (SNC-Lavalin) follows strict quality assurance/quality control (QA/QC) protocols for all sampling and analysis and will ensure that all data is handled accordingly. As a minimum, the QA/QC program will include the following.

The following outlines the Contractor's Site Control Plan as part of the Health and Safety plan for the THEP Residential Remediation Project.

Dust Control

The Contractor will carry out remediation work with methods that minimize dust arising from excavation activities and the handling of soil. Primarily, the contractor will request the resident water the lawn areas in the evenings prior to and during the remediation. During the work, the Contractor will request residents keep windows and doors closed to avoid excess dust entering the home. This may be needed for neighbours too; however every effort will be made to keep dust down during the work. As the excavation progresses, the Contractor will provide watering of remediation activities (i.e., loading soil out) site as necessary to prevent airborne dust, ensuring excess water is controlled and does not impact any aspect of the yard or related structures.

The Contractor will also monitor the weather forecast for high wind warnings. In the event of an extreme wind situation, work will stop until the wind subsides. In cases where work is being carried out during wind events, employees and residents will be provided with dust masks.

Erosion and Sediment Control

In the event of heavy rains, the Contractor will install temporary measures such as straw bales, berms and dikes to prevent heavy water flow from causing erosion and to prevent sediment from leaving the site. The physical remediation work will be stopped in heavy rain conditions.

Clean Access

The Contractor will ensure clean access and egress to and from the property at all times during the remediation for both the resident and workers. At the end of each day, pathways, walkways and roadways will be swept clean of any dirt or debris and washed with water if necessary. Note that sweeping can also create dust and a wet washing is preferred wherever possible. Clean access will also include identifying work areas to keep residents out of the excavation areas and may also involve laying down rubber matting or plywood to serve as walking paths to ensure safe access and the tracking in of soil into homes. The access and egress will be discussed with the resident prior to and during changes in the remediation work.

Health and Safety

The Contractor has the responsibility to provide a safe and healthy work environment for its employees and others exposed to our job sites (i.e., residents and neighbours) and equipment and to make all necessary effort to prevent injuries to our employees and the public. We will comply with all WorkSafeBC health and safety regulations. Additionally, the Contractor must have their own health and safety policy that drives the performance.

The Contractor will endeavour to fulfill Teck Metals Ltd.'s mandate of "Everyone Going Home Safe and Healthy Every Day". Part of the Health and Safety Plan is a Site Specific Health and Safety Plan for each property that involves a Job Hazard Analysis (see attached), the Contractor and SNC-Lavalin will monitor work activities and communicate any issues and concerns to its workers and/or the homeowner.

At the start of work at each remediation site, the Job Hazard Analysis will be reviewed to ensure its scope is inclusive of all issues and the Daily Safe Work Permit completed. Subsequently, at the start of every day, the Job Hazard Analysis and Daily Safe Work Permit will be reviewed and adjusted if necessary.

Should any safety incidents occur, the SNC-Lavalin and Teck must be contacted as soon as possible after the event, and no later than the end of the day during which the event occurred, and be provided with details of the incident and a completed Incident Investigation Report.

The Contractor will monitor compliance with the safety requirements of the work and ensure our workforce follows safe work practices. The Contractor will maintain equipment in a safe operating condition and ensure excavation and related work is conducted in a safe manner.

The Contractor will ensure its employees wear all proper safety protective gear and clothing. This will include hard hats, steel toed boots, reflective safety vests, coveralls when digging out soil, gloves, ear protection, safety glasses and dust masks where required. If required or needed, we will also provide homeowners with hearing protection, dust masks or safety glasses.

The Contractor will make every effort to minimize the amount of time between excavation completion and the time to backfill with clean soil to reduce potential exposure. If necessary in excavation areas, appropriate fencing or barricades will be installed to prevent access to the excavated property (i.e., over weekends).

As the remediation work is in residential areas in which the use of excavation equipment is of great interest to children, the Contractor will take particular care in conducting their work while children are present and communicate this concern to parents.

The Contractor will report all accidents and near misses. The Job Hazard Analysis and the Site Specific Health and Safety Plan will be reviewed and revised as necessary to address all such incidents.



Site Specific Health and Safety Plan

The following details the general aspects of The Contractor's Site Specific Safe Work Plan, including environmental awareness, for the Trail Area Health and Environment Program's Residential Soil Remediation Project.

Hazard Risk Assessment and Job Hazard Analysis

The Contractor's site supervisor (the Site Supervisor) will go through a Hazard Risk Assessment through the use of a Job Hazard Analysis (JHA) prior to the start of the work. The goal of the JHA is to identify hazards or risks related to the work area and to eliminate or control those hazards and risks while work is underway. This would include such things as, but not exclusive to, a review of any unrelated work nearby that may present a risk, identification of utility lines or overhead power lines, issues related to the physical remediation work, operation of mobile equipment and trucks and review of the condition of equipment and tools on the worksite.

The Site Supervisor is qualified to perform all required risk assessments, operate all equipment on site, and is familiar with WorkSafeBC regulations. The Site Supervisor will monitor activities of employees on site to ensure safe work practices are followed and that additional tasks are performed safely as work progresses. The JHA will be reviewed and adjusted as necessary.

Safety Equipment

The Contractor will ensure its employees wear all required safety protective gear and clothing. This will include hard hats, steel toed boots, reflective safety vests, coveralls when digging out soil, gloves, ear protection, safety glasses and dust masks where required. Safety gear, such as dust masks, safety glasses and hearing protection, will be provided to the homeowner if necessary.

Training

The Contractor will comply with the required and necessary federal, provincial and local training requirements. The Contractor will provide qualified employees to safely and competently complete the work scope. Training records will be retained and provided if required.

Emergency Response

In any emergency situation, the immediate response is to call for the required emergency services, assist anyone injured, make the area safe and to address any uncontrolled release (i.e., in the event of a ruptured utility line) to the extent that it is safe to do so and without endangering workers. SNC-Lavalin and Teck must be contacted as soon as possible after the event, and no later than the end of the day during which the event occurred, and be provided with an Incident Investigation Report.

- › Each work truck is equipped with a Level 1 WCB first aid kit; and
- › Each work crew will have a cell phone to call emergency services if needed.

Environmental Awareness

The Contractor will maintain worker awareness of any environmental requirements relating to the work and will include any environment issues as a component of its tailboard meetings.

All equipment will be in good operating condition, appropriately serviced to prevent leakage of operating fluids. Persons refueling equipment will exercise care to prevent spills, using drip trays if necessary in cases where spills could occur. When engaged in refueling and fluid top-up activities, workers will have a supply of absorbent materials on hand to meet all needs in containing and/or soaking up spills.

Communication Devices and Tobacco Products

The Contractor and employees will not use cell phones or related hands-free devices while operating equipment or vehicles. Additionally, the use tobacco products is not permitted in work vehicles or on worksites.

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
GENERAL		
Define scope of work with employees	<ul style="list-style-type: none"> ▪ lack of understanding regarding job and safe work practices 	<ul style="list-style-type: none"> ▪ tailboard meeting at start of each remediation job ▪ conduct a hazard risk assessment ▪ Project Manager monitors work
Sharp objects	<ul style="list-style-type: none"> ▪ puncture wounds 	<ul style="list-style-type: none"> ▪ thorough search of immediate area before any handwork is done ▪ wear gloves
Cellular phone use	<ul style="list-style-type: none"> ▪ injuries or accidents due to lack of attention 	<ul style="list-style-type: none"> ▪ no talking on cellular or hands free device while driving or operating equipment
Exposure related injuries	<ul style="list-style-type: none"> ▪ possible heat/cold stress 	<ul style="list-style-type: none"> ▪ monitor weather conditions ▪ appropriate clothing and headwear ▪ water available ▪ schedule work hours appropriately ▪ stop work in extreme weather conditions
Extreme weather	<ul style="list-style-type: none"> ▪ injury due to working in extreme weather conditions 	<ul style="list-style-type: none"> ▪ monitor weather conditions ▪ stop work in extreme weather conditions

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
GENERAL (cont'd)		
Site security	<ul style="list-style-type: none"> ▪ theft /vandalism 	<ul style="list-style-type: none"> ▪ ensure all equipment put away and mobile equipment secure
Fatigue	<ul style="list-style-type: none"> ▪ injury resulting from lack of attention due to fatigue/repetitive task hazard 	<ul style="list-style-type: none"> ▪ daily job meetings identify anyone unfit to work
Contact with contaminants	<ul style="list-style-type: none"> ▪ inhalation of dust ▪ ingestion of contaminants 	<ul style="list-style-type: none"> ▪ wear dust mask as required ▪ use provided hand washing supplies when taking breaks and prior to lunch/drinking fluids
Lift-twist or strain related to back injury	<ul style="list-style-type: none"> ▪ back injury due to improper lift technique 	<ul style="list-style-type: none"> ▪ follow proper lift techniques ▪ lift by bending from knees
Equipment/hand tool inspection	<ul style="list-style-type: none"> ▪ injury or equipment/tool failure 	<ul style="list-style-type: none"> ▪ inspect tools to ensure they are in good working order
Housekeeping (slip/trip/fall)	<ul style="list-style-type: none"> ▪ Various injuries cause by slip/trip/fall 	<ul style="list-style-type: none"> ▪ Have a clean jobsite

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
GENERAL (cont'd)		
Cuts and blisters	<ul style="list-style-type: none"> ▪ injury resulting from being cut using hand tool, sharp objects in soil 	<ul style="list-style-type: none"> ▪ employees instructed in proper use of hand tools ▪ thorough search of immediate area before any handwork is done ▪ wear leather gloves
Using hand tools	<ul style="list-style-type: none"> ▪ hand injuries (pinch, crush, cuts) while using hand tools 	<ul style="list-style-type: none"> ▪ employees instructed in proper use of hand tools
Biological	<ul style="list-style-type: none"> ▪ animals, insects, thorny plants 	<ul style="list-style-type: none"> ▪ use bug spray ▪ stay clear of dogs exhibiting aggressive behaviour/try to identify owners ▪ ideally dogs kept in residence ▪ use leather gloves
TRAFFIC		
Safe access and regress to and from job site	<ul style="list-style-type: none"> ▪ oncoming vehicle traffic 	<ul style="list-style-type: none"> ▪ post signs and barricades warning of worksite ahead
Driving to landfill, between job sites	<ul style="list-style-type: none"> ▪ accident 	<ul style="list-style-type: none"> ▪ use safe driving practices ▪ no talking on cellular or hands free device while driving or operating heavy equipment

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
TRAFFIC (cont'd)		
Work on roadway or areas with on-site traffic	<ul style="list-style-type: none"> ▪ employee struck by vehicle 	<ul style="list-style-type: none"> ▪ employees wearing safety vests ▪ always be watching for people walking near equipment ▪ use signs, barricades
Vehicle operation	<ul style="list-style-type: none"> ▪ vehicle accidents 	<ul style="list-style-type: none"> ▪ use safe driving practices ▪ no talking on cellular or hands free device while driving or operating heavy equipment
ABOVE GROUND AND UNDERGROUND UTILITIES/STRUCTURES		
Underground utilities related hazards	<ul style="list-style-type: none"> ▪ injury or damage due to contact with underground utilities 	<ul style="list-style-type: none"> ▪ locate prior to excavation ▪ hard dig what cannot be located
Overhead utilities related hazards	<ul style="list-style-type: none"> ▪ injury or damage due to contact with overhead power lines and/or other utilities/structures 	<ul style="list-style-type: none"> ▪ identify above ground utilities

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
REMEDATION WORK		
Access	<ul style="list-style-type: none"> ▪ Difficult terrain 	<ul style="list-style-type: none"> ▪ Develop a safe route before starting work
Bringing equipment onto job site and performing excavation	<ul style="list-style-type: none"> ▪ underground utilities ▪ danger of electrocution from contact of overhead power lines 	<ul style="list-style-type: none"> ▪ locate underground utilities ▪ observe safe work practices and approach limits when under or near overhead wires
Working in residential yards	<ul style="list-style-type: none"> ▪ stepping on rakes or shovels that are left on the ground 	<ul style="list-style-type: none"> ▪ put tools away so they are not a hazard
Running equipment in residential area	<ul style="list-style-type: none"> ▪ someone coming too close to equipment 	<ul style="list-style-type: none"> ▪ employees wearing safety vests ▪ always be watching for people walking near equipment ▪ use signs, barricades
Operating equipment in residential area	<ul style="list-style-type: none"> ▪ noise 	<ul style="list-style-type: none"> ▪ provide hearing protection to employees and homeowners

Contractor Job Hazard Analysis

Site Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
REMEDATION WORK (cont'd)		
Remove surface features (vegetation)	<ul style="list-style-type: none"> ▪ use of equipment ▪ thorny plants 	<ul style="list-style-type: none"> ▪ wear leather gloves ▪ make eye contact ▪ wait until bucket comes down before approaching ▪ operator will gear down
Digging in yard	<ul style="list-style-type: none"> ▪ homeowner tracking or exposure to contaminated material 	<ul style="list-style-type: none"> ▪ provide clean access to property at all times
Digging out contaminated soil	<ul style="list-style-type: none"> ▪ use of equipment ▪ excess spillage ▪ creation of dust ▪ cross contamination 	<ul style="list-style-type: none"> ▪ make eye contact ▪ wait until bucket comes down before approaching ▪ operator will gear down ▪ dig from within yard ▪ load out soil from one spot to dump truck or pickup truck ▪ water as necessary to prevent airborne dust from dispersing into atmosphere ▪ wear dust masks as required ▪ make sure tools and equipment are clean when new soil goes in or when moving to next job site ▪ use provided hand washing supplies when taking breaks and prior to lunch

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
REMEDIATION WORK (cont'd)		
Digging out yard	<ul style="list-style-type: none"> ▪ leaving large hole to fall into 	<ul style="list-style-type: none"> ▪ flag area off when not working in the yard ▪ minimize time between excavation and backfill ▪ take extra care in presence of children
Place landscape fabric	<ul style="list-style-type: none"> ▪ using hand tools ▪ cutting 	<ul style="list-style-type: none"> ▪ use appropriate tool for the job ▪ wear leather gloves ▪ cut in appropriate direction ▪ keep free hand clear
Backfill with topsoil	<ul style="list-style-type: none"> ▪ equipment ▪ dust 	<ul style="list-style-type: none"> ▪ make eye contact ▪ wait until bucket comes down before approaching ▪ operator will gear down ▪ water as necessary to prevent airborne dust from dispersing into atmosphere ▪ wear dust masks as required
Soil sampling	<ul style="list-style-type: none"> ▪ soil handling 	<ul style="list-style-type: none"> ▪ wear nitrile gloves when handling soil ▪ decontaminate prior to eating or drinking

Contractor Job Hazard Analysis

Site/Project: Trail Health and Environment Program Residential Soil Remediation		
Project Manager:		
Task/Activity: Excavation of Soil		
RISK ASSESSED	HAZARDS	CONTROL/MITIGATION
REMEDIATION WORK (cont'd)		
Loading out material on laneway or on street	<ul style="list-style-type: none"> ▪ cross contamination by vehicles driving by or pedestrians 	<ul style="list-style-type: none"> ▪ barricade area and clean up area thoroughly before removing barricaded loading area
Hauling contaminated soil to landfill	<ul style="list-style-type: none"> ▪ creating dust 	<ul style="list-style-type: none"> ▪ cover load ▪ make sure truck is clean in box and side of box when leaving landfill
Shutting down jobsite for the night	<ul style="list-style-type: none"> ▪ tripping hazards ▪ tools left lying around ▪ excess dirt around jobsite 	<ul style="list-style-type: none"> ▪ clean all tools from around work site ▪ thorough cleaning by sweeping or washing areas with water that were contaminated ▪ barricade off all potential trip hazards

Contractor Job Hazard Analysis

Signature Page

Prepared by:

Position:

Date:

Names of person(s)
carrying out work:

Signed:

Date:

JSA approved by
(Project Manager):

Signed:

Date:

Contractor Job Hazard Analysis Daily Renewal Form

Date:		Weather:	
Identify changes (e.g. new location, new crew, weather, etc.):			
Supervisor:			
Participants:			
Date:		Weather:	
Identify changes (e.g. new location, new crew, weather, etc.):			
Supervisor:			
Participants:			
Date:		Weather:	
Identify changes (e.g. new location, new crew, weather, etc.):			
Supervisor:			
Participants:			
Date:		Weather:	
Identify changes (e.g. new location, new crew, weather, etc.):			
Supervisor:			
Participants:			

Resident Health and Safety Plan

Introduction

The purpose of this Landowner/Resident Health and Safety Plan is to provide an overview of health and safety considerations for landowners, residents and property visitors as they relate to the Trail Residential Remediation Project. The following sections outline the health and safety considerations related to the remediation activities as outlined in the attached letter. Specific responsibilities for contractors and landowners to address these considerations are outlined below.

Physical Hazards

Heavy equipment, including front-end loaders, skid-steers, and other equipment will be used on the site, individually or in conjunction with others. Areas where heavy equipment is operating will be secured with the use of traffic delineators and caution tape. It is important for residents to keep clear of these work zones.

Keep clear of the excavation area, as excavation depths will extend to depths of at least 0.30 m (12 inches) adjacent to sidewalks, porches, decks, and stairs. Sides of the excavation may be unstable depending upon the soil conditions, creating potential fall hazards for residents. Residents are requested to not enter work zones after hours.

Heavy equipment will be removed from the property and stored off site each night. As such, although it may appear that work has been completed, residents are requested to not enter the work zones until remediation activities are completed (as indicated by the Site Supervisor).

Air Quality

Residents will be required to keep doors, windows, and skylights closed during work hours to minimize soils/dust entering the building as a result of excavation/restoration activities.

Dust control measures will be implemented during the remediation activities and will include the following:

- › Exposed soils (excavation/stockpile areas) will be sprayed with water during dry conditions; and
- › Vehicles (off site and on site) will be sprayed down with water to minimize tracking soils within the property and along transportation routes.

Although every reasonable effort will be made to control dust during remediation activities, residents are requested to identify any dust concerns to the Site Supervisor. Respiratory or other health conditions, which may be complicated by increased dust, should be identified to the Site Supervisor.

Air monitoring will be implemented throughout remediation activities. Contractor employees working on residential properties will be wearing personal sampling pumps to measure dust exposure during remedial activities.

Pets

Pets should remain inside during excavation and remediation activities. When exiting the house or when in the vicinity of the work zone, pets should remain on a leash to reduce potential encounters with heavy equipment. Residents should refrain from allowing pets to enter the work zone after hours until remediation activities are complete.

Emergencies

Contractors and subcontractors will be following their designated Health and Safety Plans, which include Emergency Response Plans in the case of an emergency. Should you witness an emergency, please inform the Site Supervisor or phone 911, as is required.

Responsibilities

Contractor Responsibilities

- › Familiarize themselves with, implement, and promote the site specific Project Environmental Health and Safety Plan (EHSP) and relevant governmental regulations;
- › Work in compliance with all existing environmental health and safety laws and regulations;
- › Use traffic delineators and caution tape to secure the work zone (including exposed soils, utilities and fall hazards) and prevent public access;
- › Implement dust control measures as described in the Project EHSP;
- › Maintain good housekeeping practices at sites on which they are working and leave the work site in a safe condition;
- › Stop work until the work zone is clear when residents or visitors need access to the home;
- › Follow decontamination procedures when leaving the work zone with personnel or equipment; and
- › Remove equipment from the property at the end of each day.

Resident Responsibilities

- › Ensure that visitors to the property are aware of and adhere to this Landowner/Resident Health and Safety Plan herein described;
- › Ensure that children do not play or enter the work zone during and after work hours;
- › Do not enter the work zone until the Contractor has stopped work. Use only the normal walkway to enter/exit the home;
- › Be aware of fall hazards adjacent to edges of sidewalks, decks, porches, and stairs;
- › Alert Contractors' personnel when leaving or arriving home;
- › After work hours, do not enter the work zone, as physical hazards may be present;
- › Keep doors, windows and skylights closed when work is in progress; and
- › Keep pets inside. Pets needing exercise should be walked on a leash.

If you see any unmarked hazards, identify the hazard to the Site Supervisor.



Appendix IV

Statistical Methods for Determining 95% UCLM Soil Lead Concentration

Statistical Methods for Determining 95% UCLM Soil Lead Concentration

Statistical Methods for determining 95% upper confidence limit of the mean (UCLM) from surface soil samples for properties within the THEP area.

Ten or more discrete (grab) samples are taken from the yard portion of each property to a depth of 15 cm, such that the top 15 cm of the entire accessible yard is represented in the sample set.

Vegetable and flower gardens are sampled separately by compositing multiple grab samples from the top 15 cm into single samples for each garden area (the actual number depends on garden size, the maximum number would be 10 for a single large garden area). There may be multiple composited garden soil samples per property (e.g., 2 veg gardens, 3 flower gardens).

All soil samples undergo XRF analysis using an Olympus Delta Premium XRF Analyzer, and a subset of 2 yard samples from each property are submitted to a certified laboratory for SALM and pH analysis. Vegetable garden samples are always all sent to the lab for analysis, while flower garden samples are rarely sent to the lab.

Upon receiving results back from the lab, samples with both XRF and lab analysis are appended to a dataset that contains all of the XRF-lab sample pairs analyzed since the most recent factory recalibration or hardware repair of the XRF device. These data are then subjected to a regression analysis using the Fit Y by X platform of the latest version of JMP statistical software. The statistical relationship between the XRF and lab analyses of lead is significant and the best fit is achieved with natural-log transformed XRF and lab lead results. It changes slightly each time when the new data is added. As an example, the figure below shows the results of the regression analysis from October 31, 2018. Each analysis also includes a review of the residuals to ensure that the assumptions for least-squares fit are upheld.

The slope and intercept from the regression are then used to predict the 'lab' lead for all of the yard samples that were not lab-analyzed. These predicted lab lead values are then combined with the actual lab lead values from the other yard samples from the same property, and then subjected to a 95% UCLM analysis using the UCLs/EPCs/All platform in the latest version of ProUCL. ProUCL's analysis presents a recommended UCL based on the statistical distribution of the lead values, and this is the 95% UCLM that is assigned to the property.

It is important to note that vegetable and flower garden samples are excluded from the process of determining a 95% UCLM for a property's yard soil lead.

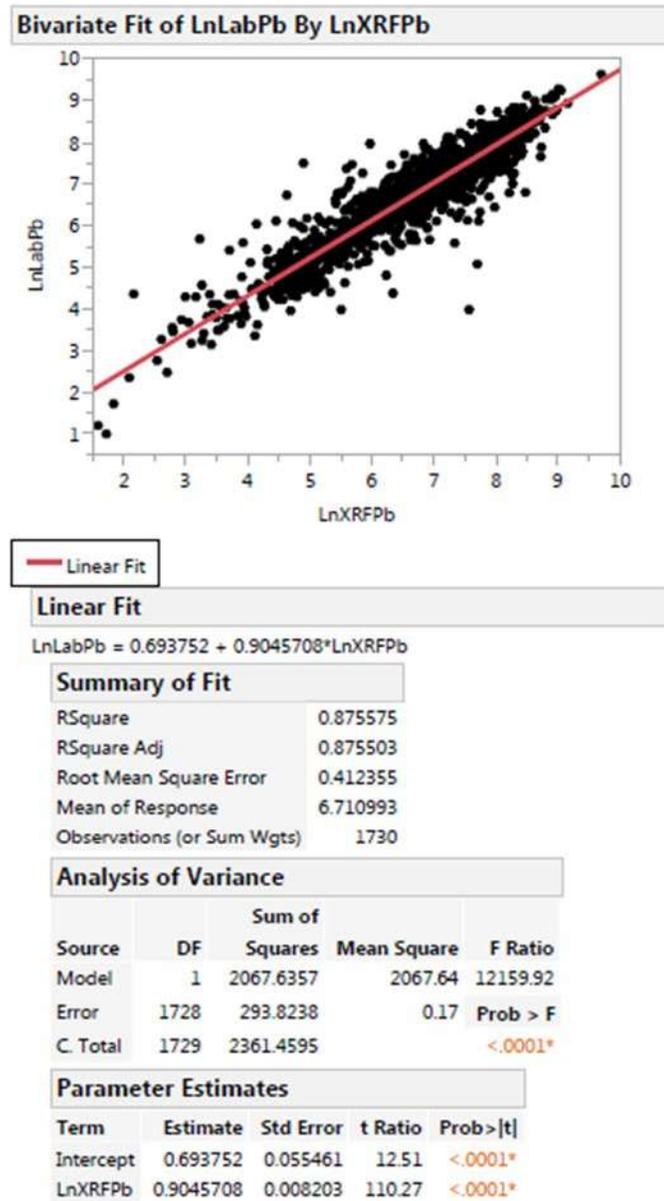


Figure IV-A: Example of Pro UCL output

Interpolation Methods for lead concentrations over property areas

All soil samples taken currently have location and depth information electronically recorded at the time of sampling using ESRI's Survey 123 app and Geneq SX Blue II+ sub-metre GPSes. Paper soil logs are

currently also filled out. Prior to 2017, sample locations were drawn on a paper sample aerial photo map of the property and later transcribed to the GIS.

To predict the lead concentrations in areas of a property between sample locations, the appropriate lead concentrations consisting of 'predicted lab' and actual lab lead concentrations are first linked to the GPS sample locations in GIS. A spline interpolation is then applied to these data using ESRI's Spatial Analyst software. This software starts with the values at the measured locations and then fits a curved surface through the remaining area by interpolating between them to create a smooth surface that follows the trends in the measured data to create a complete raster-based coverage of the property. The area in square metres can then be calculated by counting the number of raster cells for any desired range of lead values.

This method is used to determine if the area with lead in soil greater than Upper Cap Concentrations on any given property qualifies it.



Appendix V

SNC-Lavalin, 2019. Prioritization Strategy for Remediation of Lead (Pb) in Residential Soil of Trail, British Columbia, April 1, 2019



Prioritization Strategy for Remediation of Lead (Pb) in Residential Soil of Trail, British Columbia

April 1, 2019

Internal Ref: 655246

Prepared for:

Teck Metals Ltd.

Prepared By:



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Senior Toxicologist

Environment & Geoscience
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Reviewed By:



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Environment & Geoscience
Infrastructure



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Executive Summary

A risk-based approach for prioritization of soil remediation of highest risk properties in Trail, BC was recently requested by the BC Ministry of Environment and Climate Change Strategy (ENV). As no provincial or federal agency in Canada has recommended a clear approach for addressing potential health effects associated with lead (Pb), it is difficult to recommend a risk-based soil concentration that will receive health agency endorsement. However, Teck Metals Ltd. (Teck) wishes to continue with remediation activities in Trail, BC while they await further direction from the health agencies. As a result, SNC-Lavalin was requested to develop an approach to identify highest risk properties for remediation prioritization in 2019 while provincial and federal agencies develop their approaches and recommendations.

The objective of the prioritization strategy is to provide a scientifically-defensible approach that will identify and prioritize those properties for which remediation in 2019 is most important. For this exercise, the United States Department of Housing and Urban Development (US HUD) was identified as an agency to have a recent approach for identifying Pb in soil that may pose greatest risk to children. Nevertheless, certain aspects of the US HUD (2012) approach were considered to require modification due to certain site-specific aspects of Trail, BC and more recent scientific positions on risk assessment. Consequently, a modification to US HUD (2012) approach was identified as the most appropriate basis for the prioritization of Pb in residential soils at Trail, BC.

Using the modified-US HUD approach, residential lots can be categorized into 3 groups of prioritization. Consistent with US HUD (2012), properties without children are considered to pose much lower risks and were not considered as part of the overall prioritization. Aside from the Pb concentration measured in the soil, the two key property characteristics which were more likely to result in a property being considered highest priority for remediation were: 1) if soils were bare versus covered with grass or other materials; and 2) if young children used the property 2 days per week or more (children less than 6 years of age (i.e., “young child”) were particularly important but children 6 to less than 12 years of age (i.e., “older child”) were still considered). It is intended that residential lots with the highest risk from Pb (i.e., Priority 1 properties) should receive prioritization for remediation in 2019. It is intended that Priority 2 and 3 properties still require oversight and may require remediation in the future (i.e., the prioritization approach did not develop risk-based soil clean-up concentrations). Additionally, it is important to note that the lower rankings do not equate to acceptable risks.

Overall, we view the modified-US HUD approach as a reasonable and appropriately conservative approach that offers more protection than directly adopting the US HUD (2012) approach. Using the modified-US HUD approach, the prioritization of the sites for remediation can be completed in a scientifically defensible manner according to the following rationale:

- › Significance of Priority 1 Properties: A property is a Priority 1 if:
 - 1: it does not have good ground cover (i.e., soils are bare and not covered with grass or other materials); and
 - 2: the soil Pb concentration exceeds 400 ppm where children less than 6 years of age (i.e., young children) are present or 2,800 ppm where children 6 to less than 12 years of age (i.e., older children) are present. In addition to these, certain ornamental gardens may be included in this category when soil Pb concentrations exceed 1,200 ppm if young child-occupied or 8,400 ppm if older child-occupied (see below).

These properties represent the greatest risk and, thus, should receive the most immediate attention.

› Significance of Priority 2 Properties: A property is a Priority 2 if:

- 1: it has good ground cover (i.e., soils are covered with grass or other materials); and
- 2: the soil Pb concentration exceeds 1,200 ppm if young child-occupied or 8,400 ppm if older child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover creates a situation where the risk is not considered to be as the highest priority (indeed, under the US HUD [2012] approach, these sites would be ranked as not posing risk provided the ground cover exists).

› Significance of Priority 3A Properties: A property is a Priority 3A if:

- 1: it has good ground cover; and
- 2: the soil Pb concentration is less than 1,200 ppm if young child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover and lower concentrations than Priority 2 creates a situation where the risk is not considered to be as high priority.

› Significance of Priority 3B Properties: A property is a Priority 3B if:

- 1: it has good ground cover; and
- 2: the soil Pb concentration is less than 8,400 ppm if older child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover and lower concentrations than Priority 2 creates a situation where the risk is not considered to be as high priority.

› Significance of Priority 3C Properties: A property is a Priority 3C if:

- 1: the soil Pb concentration less than 400 ppm if young child-occupied regardless of ground cover.

These properties may still require remediation in the future; however, they represent lower risk sites due to their lower concentrations and age-group considerations.

› Significance of Priority 3D Properties: A property is a Priority 3D if:

- 1: it has soil Pb concentration less than 2,800 ppm if older child-occupied regardless of ground cover.

These properties may still require remediation in the future; however, they represent lower risk due to their lower concentrations and age-group considerations.

Ornamental garden areas (i.e., areas that contain flower or other decorative plants and where it is reasonable to assume that children would be discouraged from regular play) should be identified at child-occupied properties. Since there are a range of possibilities available for consideration, it is suggested that discussion of interim measures should occur with the occupants when soil concentrations exceed the Priority Screening Concentrations for ornamental gardens (i.e., 1,200 ppm if young child-occupied or 8,400 ppm if older child-occupied). These measures include that children should not garden or conduct other activities that result in frequent contact with soil in these areas. Depending on the outcome of these discussions, certain ornamental gardens may be considered to be Priority 1, 3A or 3B properties.

The garden produce pathway is not specifically addressed in this prioritization strategy and requires further consideration. There is the potential for garden produce consumption to represent significant exposure; however, there are currently insufficient data available to address this pathway. It is recommended that an appropriate methodology for assessing garden produce be developed in the near future. Evaluation of this pathway may form part of a study being developed by provincial agencies; however, as this is not currently defined, in the interim Teck will coordinate with Trail Area Health and Environment Program (THEP) in 2019 to undertake the following:

- › Teck will test garden produce obtained from the community on a voluntary basis to compare to previous data obtained prior to implementation of fugitive dust emissions improvements;
- › Teck will inform residents that an approach is being developed to assess the potential for exposure via the garden produce ingestion pathway and that, in the meantime, there are certain produce gardening and preparation techniques that may reduce Pb exposure;
- › Vegetable gardens will be assessed/remediated in conjunction with yard soil assessment/remediation according to the prioritization approach presented herein with the refinement that vegetable gardens will be considered Priority 1 when soil Pb concentration exceeds 400 ppm for properties occupied by younger or older children (i.e., <12 years old); and
- › When requested by a property owner, Teck will continue to offer to assess and remediate (if necessary) vegetable gardens at properties that do not fit the Priority 1 classification, provided that doing so will not delay assessment/remediation of Priority 1 properties (yards or gardens).

It is recommended that occupancy (i.e., age groups) should be tracked for Priority 1, 2, 3B and 3D properties. Where grass or ground cover is a key determinant in the ranking results (i.e., Priority 2, 3A and 3B properties), it is recommended that such cover should also be monitored. Finally, it is recommended that communication with the community occurs that continues to encourage the maintenance of lawns and other ground covering and that updates people on the status of garden produce monitoring.

Finally, in the case of public areas such as parks, playgrounds, schoolyards, daycare centres and other public spaces that may contain elevated soil Pb concentrations, the same principles described for prioritization of private properties will apply for these public spaces (namely that bare soils where children sit and play offer greater exposure potential than soils with grass or other coverings). Nevertheless, receiving permission to assess and manage/remediate public spaces may involve a different approval process. Consequently, additional assessment and consultation with the municipal representatives is planned for 2019 before prioritization of public areas is completed.

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Appendix

I: Technical Details Related to the Development of Prioritization Screening Concentrations

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1 Introduction

A risk-based approach for prioritization of soil remediation of highest risk properties in Trail, BC was recently requested by the BC Ministry of Environment and Climate Change Strategy (ENV). As no provincial or federal agency in Canada has recommended a clear approach for addressing potential health effects associated with lead (Pb), it is difficult to recommend a risk-based soil concentration that will receive health agency endorsement. However, Teck Metals Ltd. (Teck) wishes to continue with remediation activities in Trail, BC while they await further direction from the health agencies. As a result, SNC-Lavalin was requested to develop an approach to identify highest risk properties for remediation prioritization in 2019 while provincial and federal agencies develop their approaches and recommendations.

The objective of the prioritization strategy was to provide a scientifically-defensible approach that will identify and prioritize those properties for which remediation in 2019 is most important.

The key aspects of the approach are described in sections below and Appendix I provides the technical rationale for the approach.

2 Overview of the Rationale for the Approach

A Modification of the US Housing and Urban Development (2012) Approach for Use in Trail, BC.

For this exercise, the United States Department of Housing and Urban Development (US HUD) was identified as an agency to have a recent approach for identifying Pb in soil that may pose greatest risk to children. Certain aspects of the US HUD (2012) approach were considered to require modification due to site-specific aspects of Trail, BC, as well as more recent scientific positions on risk assessment. Consequently, a modification to US HUD (2012) approach was identified as the most appropriate basis for the prioritization of Pb in residential soils at Trail, BC.

Provided that the approach is used as part of a prioritization strategy rather than establishing remedial soils concentrations, the US HUD (2012) approach is considered to be relevant and appropriate, as well as offering some clear advantages to achieving defensible prioritization. Although released after the World Health Organization (WHO) (2011) toxicity assessment, it is recognized that US HUD (2012) may not be based on the most recent toxicological information and consensus on Pb. Nevertheless, the US HUD (2012) approach has not been used to define a risk-based cleanup concentration; rather, it is used in a prioritization strategy only. In addition, US HUD (2012) provides exposure assessment that is current and provides certain concepts that are extremely useful in a prioritization strategy including: 1) young children are more susceptible to higher Pb intake from soil than older children; 2) bare areas are more important than grassed or other covered areas; and 3) bare play areas are more important than bare non-play areas. Incorporation of these concepts increases the likelihood that the properties where exposures due to soil is likely to be highest will be prioritized appropriately.

It is also recognized that US HUD (2012) was developed with Pb paint as a primary, but not exclusive, source of Pb contamination at residential sites. When paint is the source of Pb in soils, it is expected to have relatively high bioaccessibility due to Pb oxides (US EPA, 2007); however, this would also be the case for Pb in soils from smelter emissions (as indicated by site-specific bioaccessibility testing in the Trail soils). Consequently, it is anticipated that Pb in soil from paint would have approximately equal efficiency at entering the body as Pb in soil from smelter emissions. Moreover, because the US HUD (2012) principles are not being used to develop cleanup levels, it is not anticipated the source of Pb is critical to the prioritization strategy.

US HUD (2012) provides an approach for identifying residential properties where soil concentrations may present greater risk. This approach is relatively recent and incorporates key aspects of Pb risk assessment including:

- › children less than 6 years of age are at greatest risk and, thus, become the only age group of key concern;
- › properties used by children less than 6 years of age at a rate of 2 days per week or more should be the key focus;
- › bare soils pose appreciably greater risk than soils with grass or other coverings; and
- › Pb in soils covered by grass do not pose any appreciable risk provided they do not have significant bare areas (lawns cannot have bare areas greater than 9 square feet and the bare areas, no matter the size, cannot be the primary play area of young children).

Based on this, US HUD (2012) essentially determined that soil concentrations of Pb represent greatest concern when greater than 400 ppm in play areas and 1,200 ppm in non-play areas if children less than 6 years are present at a frequency of 2 days per week or more.

Although the US HUD (2012) approach was considered to be a reasonable starting point, certain aspects were considered to require some modification. It was concluded that the play area approach used by US HUD (2012) was not appropriate for Trail, BC. In the US HUD (2012) approach, play areas are defined as those that are: 1) bare soils; and 2) where there are clear indications of activities where children will preferentially sit in soils and play (e.g., sandboxes, toys, etc.). For the prioritization of properties at Trail, BC, in most cases, it was considered that any area with bare soil would be considered a primary play area due to the potential for children to be present, and the expected difficulties in tracking play areas (see Key Definitions in Section 3.1).

Furthermore, based on recent studies that support that older children (up to <12 years of age) may incidentally ingest soil at a rate approximately equal to that of young children, SNC-Lavalin determined that older children of 6 to less than 12 years of age should also be considered in the prioritization of the properties. Consequently, as shown in Appendix I, SNC-Lavalin calculated a Priority Screening Concentration of 2,800 ppm for children in the 6 to less than 12 years age group exposed to bare soils.

Finally, due to concerns about ensuring that grass areas remain covered by grass, SNC-Lavalin did not adopt the US HUD (2012) conclusion that a good grass covering prevents any appreciable risk to young children. Instead, SNC-Lavalin conservatively adopted the US HUD (2012) non-play area soil concentration of 1,200 ppm for areas covered by grass when children less than 6 years old are present (8,400 ppm was used for soils covered by grass when children 6 to less than 12 years old are present; see Appendix I). Overall, this was considered to be a reasonable approach provided that it only applied to areas with well-established lawns (or other cover materials) and that people are informed of the importance of lawn maintenance.

2.1 Key Principles of the Modified Approach

Scientific and Regulatory Status for Lead (Pb) Risk Assessment

In 2009, Health Canada withdrew its toxicity reference value (TRV) for Pb and since that time, there has been little guidance on key aspects of Pb risk assessment in Canada. As described in WHO (2011) and EFSA (2013), the key concerns of elevated Pb intake are IQ decrement in children and increased systolic blood pressure in adults. Although WHO (2011) and EFSA (2013) have concluded that certain dose response relationships exist, there has been little indication from agencies on the acceptable intakes that can arise from Pb when present in soil. Specifically, since the withdrawal of the Health Canada TRV, there is a paucity of guidance on key aspects of Pb risk assessment that include:

- › the appropriate TRVs that should be used (i.e., WHO [2011]? EFSA [2013]?);
- › the acceptable risk level that can arise from soil (i.e., 1 IQ point decrement on an individual level? Or 0.5 IQ point at a population level?); and
- › appropriateness of US EPA IEUBK modelling (i.e., flaws in the model have been noted by US EPA itself).

As a result, it is very difficult at this time to recommend a risk-based concentration for Pb in soil that will receive health agency endorsement. Notwithstanding this regulatory uncertainty, it is still possible to

utilize the scientific aspects of Pb risk assessment literature to assist in prioritization of properties for remediation. Accordingly, the key aspects of Pb risk assessment science that are most important to remedial prioritization are discussed below.

Children are Most Susceptible to Exposures from Pb in Soil

It is widely accepted that children are more susceptible to Pb than older age groups (WHO, 2011; EFSA, 2013). This further extends to making decisions regarding Pb in soil. As compared to older age groups, children are considered to be more susceptible to Pb in soil for key reasons that include: 1) with their developing brains, they are considered to be more susceptible than adults to IQ effects (i.e., for adults, changes in systolic blood pressure is considered to be the more sensitive endpoint); and 2) children consume more soil and have lower body weights than teenagers or adults. Consequently, when these two factors are considered, it can be expected that children will need much more protection from Pb in soil than older age groups.

Young Children are More Susceptible to Exposures from Pb in Soil than Older Children

Within the child age group, it can also be predicted that young children (less than 6 years of age) will be more susceptible than older children (6 to less than 12 years of age) for key reasons that include: 1) although they consume similar amounts of soil, young children weigh less (i.e., 11.4 kg for the most sensitive age group of 1 to 2 years of age versus 31.8 kg for the 6 to less 12 years age group); and 2) young children absorb appreciably more Pb than older children (as discussed in Appendix I, young children may absorb Pb at a rate that is 2.5-times more efficient than older children). Consequently, when these two factors are considered, it can be expected that young children require about 7 times the protection as older children.

Soils Covered by Grass or Other Materials Present Lower Risks

The primary mechanism for soil ingestion to occur in children is considered to be inadvertent intake that occurs from hand-to-mouth activity (Özkaynak et al., 2011; Wilson et al., 2013; US EPA, 2017). Thus, the amount of soil adhering to hands during play activities is expected to be lower when play activities occur in well-established lawns or on soils beneath other covering materials as compared to bare soils. Consequently, the presence of grass or other covering materials is another key variable in prioritization of risks from Pb in soil at residences.

Overall, the approach recommended by SNC-Lavalin is a modification of the US HUD (2012) approach and is presented as a scientifically-defensible approach for prioritization of sites. Aside from the Pb concentration measured in the soil, the two key property characteristics which were more likely to result in a substance being considered higher priority for remediation were: 1) if soils were bare versus covered with grass or other materials; and 2) if children used the property 2 days per week or more (children less than 6 years of age were particularly important but children less than 12 years were still considered).

2.2 Compilation of Site Investigation Information

To enter the process, site investigators must be reasonably satisfied that the site investigation data is representative of soil concentrations for: 1) the entire property; and 2) areas within the property that children have a higher propensity to play. The data collection and evaluation approach for assessing Pb concentrations at yards includes:

- › Collect ten or more discrete samples from yard portion of the subject property (the number of samples collected will depend on the size of the property). Produce garden areas are excluded as they are not considered potential play areas – these areas are assessed and managed separately.
- › All soil samples are assessed via X-Ray Fluorescence (XRF) analysis and at least two yard samples are submitted for laboratory analysis of metals concentrations.
- › The subject property data added to a data set that includes all XRF and laboratory data collected since the latest calibration date of the XRF instrument, and a regression analysis is performed to correlate XRF and laboratory results. The correlated data for the subject property is then used to calculate the 95% Upper Confidence Limit of the Mean (UCLM) for the property, which will be used in the ranking of the properties.

A detailed methodology for data collection, management and evaluation for the purposes of assessing soil Pb concentrations at properties is provided in Section 3.2 of the main 2019 Workplan document.

3 Application of the Approach

3.1 Key Definitions

The following key definitions are provided and are essential to understanding the approach used to prioritize sites.

Bare Soils: For the purposes of the approach and consistent with US HUD (2012), an area is considered to be bare soil if it not covered by grass or other coverings that could include moss (or other live coverings), wood chips, gravel and/or artificial turf.

Child-occupied: A property where children (less than 12 years of age) either reside or regularly visit (two days per week or more – see below for full definition of “regularly visits”).

Grass Areas: For an area to be considered a grass area, it must be a well-established lawn or newly sodded area. Areas that have been recently seeded and/or with emerging shoots are not considered to be grass areas and should be considered bare soils. If an area within a well-established lawn contains bare patches, it can still be considered a grass area provided that: 1) it is not an area that contains a sandbox, play equipment (e.g., swing set, seesaw, etc.) or toys; and 2) the total area of patches is not bigger than 1 square metre.

Gardens – Ornamental: Garden areas of the yard that contain flowers or other decorative plants and where it is reasonable to assume that children would be discouraged from regular play. Ornamental gardens may have little or no ground cover unless mulch is applied and soils may have amendments added to improve growing conditions.

Gardens – Vegetable: Garden areas of the yard that are used to grow produce for human consumption including leafy, root or fruiting vegetables, fruits and herbs (hereafter referred to as “vegetable gardens”). Vegetable gardens typically have little or no ground cover and soils may have amendments added to improve growing conditions.

Good Ground Cover: An area with a well-established lawn or other cover materials such as moss (or other live coverings), wood chips, gravel and/or artificial turf. If the area is a primary play area, the covering must be total. If the area is not a primary play area, the total area of bare soil must be less than $< 1 \text{ m}^2$.

Primary Play Area: An area within a yard that has a sandbox, play equipment (e.g., swing set, seesaw, etc.), toys, children’s possession or that caregivers have provided information suggesting frequent activities involving playing/sitting in soils by children.

Regularly Visits: Consistent with US HUD (2012), a child who regularly visits a property is considered to be present 2 days per week or more (as long as each visit is at least 3 hours or at least 60 hours per year – which is equivalent to at least 10 weeks per year of visits).

Remediation of Soil: For the purposes of this document, remediation may involve removal of contaminated soil and replacement with clean backfill soil; however, it may also involve institution of various risk management measures that involve leaving contaminated soil.

Young Child: Child less than 6 years of age. Although infants are generally not considered to have direct contact with soil, infants are included in this group since they would enter the age group of greatest concern (i.e., children 1 to less than 6 years of age).

Older Child: Child between ages of 6 to less than 12 years of age.

3.2 Key Risk Management Assumptions

The following key risk management assumptions are integral to the approach used. If it is determined that the below assumptions do not apply at a property, the status of the property should be revisited on a site-specific basis to ensure that the prioritization remains valid.

- › Gardens: It is assumed that children do not use ornamental gardens as regular play areas.
- › Ages of Occupants: It is assumed that occupancy age is tracked and regularly updated at the properties. It is recommended that occupants be asked to report new births, as well as the sale of their property.
- › Lawn-Maintenance: It is assumed that lawns and other cover materials will be maintained so as to prevent exposure with bare soils. At properties where lawns were key to a site not being defined as Priority 1, it is recommended that the occupants are informed of the importance of lawn-maintenance. If possible, exemptions to water use restrictions for such lawns and regular seeding with drought resistant strains should be encouraged.

3.3 Evaluation of Properties

Briefly, the following steps are applied in determining the prioritization of a property for remediation.

Step 1: Determination of Whether a Property is Child-Occupied

For each property, determine whether children reside at or regularly visit the property. As summarized earlier and discussed in technical detail in Appendix I, only child-occupied properties are considered to be prioritized properties. Consistent with US HUD (2012) approach, a child-occupied property refers to any property where children live or regularly visit. As per the HUD definition, regular visits are 2 days per week or more (as long as each visit is at least 3 hours or at least 60 hours of visits per year – which is equivalent to at least 10 weeks per year of visits). In contrast to the US HUD (2012) approach, children in this step include both those less than 6 years of age and those 6 to less than 12 years of age.

Through the Trail Area Health and Environment Program (THEP), Teck has established a reliable approach for identifying properties for assessment/remediation where children 1 to 3 years of age reside. In order to expand the program to include properties with children aged less than 6 years and 6 to less than 12 years (resident or regularly visiting), Teck will need to develop additional avenues for identifying these properties. This may include engagement with Interior Health or others to facilitate outreach to families with children. Teck will develop a strategy to address this during Q1 2019 so that these additional properties are identified for the 2019 field season.

Step 2: Determination of the Ground Cover

For each property, determine the type and quality of ground cover. Consistent with US HUD (2012), a property with a well-established lawn or some other covering with no bare patches totaling more than 1 square metre is considered to have good ground cover. It is recognized that within a given property,

there may be certain areas with good ground cover and other areas without good ground cover. In such cases, the locations with good ground cover and without good ground cover should be identified, with the prioritization based on the bare areas. As discussed, produce gardens will not be considered in this evaluation; however, there is the option of considering ornamental gardens in the manner discussed below.

For child occupied properties, the neighbourhood data would be used to determine properties of focus. All yards that fall into these neighbourhoods will be assessed to determine the quality of ground cover. Teck will determine an appropriate methodology assessing ground cover quality at each yard in Q1 – 2019 so that these properties can be appropriately prioritized for the 2019 field season. Ground cover assessment may include telephone surveys, site inspections or a combination of these or other approaches.

Step 3: Identify the Prioritization Screening Concentration for Pb in Soil

With Steps 1 and 2 complete, the Prioritization Screening Concentration is identified for properties identified to have children residing or regularly visiting. As discussed in technical detail in Appendix I, the following Prioritization Screening Concentrations for Pb in soil are used depending on the age of the children present and the ground cover:

- › For soil collected from properties with young children (less than 6 years of age) and a lack of good ground cover: 400 ppm.
- › For soil collected from properties with young children (less than 6 years of age) and good ground cover: 1,200 ppm.
- › For soil collected from properties with older children (6 to less than 12 years of age) and a lack of good ground cover: 2,800 ppm.
- › For soil collected from properties with older children (6 to less than 12 years of age) and good ground cover: 8,400 ppm.
- › For soil collected from properties within ornamental gardens and young children (less than 6 years of age): 1,200 ppm.
- › For soil collected from properties within ornamental gardens and older children (6 to less than 12 years of age): 8,400 ppm.

It is important to stress that the above Prioritization Screening Concentrations are not considered to represent risk-based cleanup concentrations. For example, it is not the intent to indicate that a soil Pb concentration of 8,400 ppm is acceptable if present under grass covering. Instead, these Prioritization Screening Concentrations were developed to be used as part of the prioritization strategy. In other words, based on the most recent science:

- › Bare/exposed soils at 400 ppm with young children present would be expected to contribute a similar risk as bare/exposed soils at 2,800 ppm with older children present; and
- › Grass covered soils at 1,200 ppm with young children present would be expected to contribute a similar risk as grass covered soils at 8,400 ppm with older children present.

Appendix I provides further details on the Prioritization Screening Concentrations and expected equivalent risks of different soil concentrations depending on soil covering and age of children present.

Step 4: Compare Soil Data to the Prioritization Screening Concentrations

In this step, the soil data are compared to the Prioritization Screening Concentrations. The use of statistics for soil concentrations is encouraged provided it is completed in a defensible manner. The use of 95% UCLM concentration is widely accepted as a reasonable approach for estimation of risks and it is

reasonable to use this value in the prioritization. Nevertheless, there remains some concern that this must be used in a defensible manner with particular attention to ensure that any statistical representation does not underestimate the soil concentrations at either bare areas or where children spend significant time.

It is realized that within a given property, there may be some areas that have different priorities than other areas. In these cases, it is recommended that the priorities are recorded for the various subareas of the property.

Step 5: Prioritization Categorization

In this step, the properties are placed into their respective categories; the following outcomes are possible:

- › Priority 1 Properties:
 - Young child-occupied sites with Pb concentrations greater than 400 ppm for soils without good ground cover; and
 - Older child-occupied sites with Pb concentrations greater than 2,800 ppm for soils without good ground cover.

In the event that more properties are classified as Priority 1 than can feasibly be risk managed in a field season, further prioritization of the properties could be conducted. The basis of this further prioritization would include consideration of the magnitude of the concentration (i.e., currently there is no consideration for the magnitude of the exceedance) and the frequency of visits (i.e., currently there is no distinction for persons who spend 2 days per week versus 7 days per week). In this manner, Screening Quotients could be estimated as:

$$SQ = \frac{SC \times ET}{PSC}$$

where:

SQ = Screening Quotient (unitless)

SC = Soil concentration (ppm)

ET = Exposure Term (unitless) = fraction of the week or month that the property is used by children for season it is most used (other than winter)

PSC = Prioritization Screening Concentration (ppm) (i.e., 400 ppm for properties with young children; 2,800 ppm for properties with older children)

In this manner, properties within Priority 1 could be further ranked such that the properties with the highest Screening Quotients are addressed in 2019.

Key risk management recommendations: These child-occupied properties have areas of bare exposed soils that present the greatest risk that should be addressed as highest priority in 2019.

- › Priority 2 Properties:
 - Young child-occupied sites with Pb concentrations greater than 1,200 ppm for soils with good ground cover; and
 - Older child-occupied sites with Pb concentrations greater than 8,400 ppm for soils with good ground cover.

Similar to that described earlier for Priority 1 properties, the Priority 2 properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits. In this manner, Screening Quotients could be estimated as:

$$SQ = \frac{SC \times ET}{PSC}$$

where:

SQ = Screening Quotient (unitless)

SC = Soil concentration (ppm)

ET = Exposure Term (unitless) = fraction of the week or month that the property is used by children for season it is most used (other than winter)

PSC = Prioritization Screening Concentration (ppm) (i.e., 1,200 ppm for properties with young children; 8,400 ppm for properties with older children)

In this manner, properties within Priority 2 could be further ranked such that the properties with the highest Screening Quotients are next in line to be addressed once all Priority 1 properties have been addressed.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks provided they remain covered, it is recommended that these child-occupied properties be addressed after Priority 1 properties as it could be difficult to ensure that the cover remains over time. Due to the presence of good ground cover, these present a lower concern than Priority 1 properties. Nevertheless, while they await further risk management, it is considered important that the good ground cover remains in place and that age classification remains accurate and thus, it is recommended that these aspects will be regularly monitored.

› Priority 3 Properties:

Priority 3 categories detailed below are for properties that have concentrations that are less than the Priority Screening Concentrations discussed above for Priority 1 and 2 properties; the different categories under Priority 3 are associated with the differing key management actions, as outlined below:

› Priority 3A Properties:

- Young child-occupied sites with Pb concentrations less than 1,200 ppm for soils with good ground cover or is an ornamental garden.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks provided they remain covered, it is possible that some of these properties will need to be addressed in the future as it could be difficult to ensure that the cover remains over time. Nevertheless, it is recommended that these would be addressed after Priority 1 and 2 properties. These properties present a lower concern than Priority 1 properties (due to good ground cover) and Priority 2 properties (due to lower concentrations). While they await decisions regarding further risk management and/or remediation, it is considered important that the good ground cover remains in place; ground cover should therefore be monitored on a regular basis. Since this group was based on assumed occupancy with a young child, the tracking of occupancy age is not required. Similar to that described earlier, properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits.

› Priority 3B Properties:

- Older child-occupied sites with Pb concentrations less than 8,400 ppm for soils with good ground cover or is an ornamental garden.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks provided they remain covered, it is possible that some of these properties will need to be addressed in the future as it could be difficult to ensure that the cover remains over time. Nevertheless, it is recommended that these be addressed after Priority 1 and 2 properties since these present a lower concern than Priority 1 properties (due to good ground cover) and Priority 2 properties (due to lower concentrations). While they await decisions regarding further risk management and/or remediation, it is considered important that the good ground cover remains in place; ground cover should therefore be monitored on a regular basis. Since this group was based on only older children being present, it is also important that occupancy age is tracked for the prioritization classification to remain valid. Similar to that described earlier, properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits.

› Priority 3C Properties:

- Young child-occupied sites with Pb concentrations less than 400 ppm for soils without good ground cover.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks, it is possible that some of these properties will need to be addressed in the future since the Priority Screening Value of 400 ppm does not represent health protective soil concentrations. Nevertheless, these present a lower concern than Priority 1 and 2 properties (due to lower concentrations). Since this group was based on assumed occupancy with a young child, the tracking of occupancy age is not required. Similar to that described earlier, properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits.

› Priority 3D Properties:

- Older child-occupied sites with Pb concentrations less than 2,800 ppm for soils without good ground cover.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks, it is possible that some of these properties will need to be addressed in the future since the Priority Screening Value of 2,800 ppm does not represent health protective soil concentrations.

Nevertheless, these present a lower concern than Priority 1 and 2 properties (due to lower concentrations). Since this group was based on only older children being present, it is also important that occupancy age is tracked for the prioritization classification to remain valid. Similar to that described earlier, properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits.

Vegetable Gardens

The garden produce pathway is not specifically addressed in this prioritization strategy and requires further consideration. As further described in Section 5.2, there is potential for garden produce consumption to represent significant exposure; however, there are currently insufficient data available to address this pathway. It is recommended that an appropriate methodology for assessing garden produce be developed in the near future. Evaluation of this pathway may form part of a study being developed by provincial agencies; however, as this is not currently defined, in the interim Teck will coordinate with THEP in 2019 to undertake the following:

- › Teck will test garden produce obtained from the community on a voluntary basis to compare to previous data obtained prior to implementation of fugitive dust emissions improvements;
- › Teck will inform residents that an approach is being developed to assess the potential for exposure via the garden produce ingestion pathway and that, in the meantime, there are certain produce gardening and preparation techniques that may reduce Pb in produce consumed by people;
- › Vegetable gardens will be assessed/remediated in conjunction with yard soil assessment/remediation according to the prioritization approach presented herein with the refinement that vegetable gardens will be considered Priority 1 when soil Pb concentration exceeds 400 ppm for properties occupied by younger or older children (i.e., <12 years old);
 - When requested by a property owner, Teck will continue to offer to assess and remediate (if necessary) vegetable gardens at properties that do not fit the Priority 1 classification, provided that doing so will not delay assessment/remediation of Priority 1 properties (yards or vegetable gardens).

Ornamental Gardens

Prioritization of ornamental gardens is completed separately from the other soils within a property. As discussed earlier and in greater detail in Appendix I, the following soil concentrations can be used for prioritization purposes:

- › For soil collected from properties with ornamental gardens and young children present (less than 6 years of age): 1,200 ppm; and
- › For soil collected from properties with ornamental gardens and older children present (6 to less than 12 years of age) and ornamental gardens: 8,400 ppm.

Nevertheless, because there are a range of gardening practices (e.g., mulching), greater likelihood of use restrictions (i.e., ensuring children do not play in these areas, or participate in other activities that result in frequent direct contact with these soils) and as these areas may be of a smaller size (relative to yard space), it was considered that these areas could be prioritized separately from the other areas. It is suggested that discussion with occupants of interim measures could occur for properties that exceed these Priority Screening Concentrations for ornamental gardens. Depending on the outcome of these

discussions, certain ornamental gardens may be considered to be Priority 1, 3A or 3B properties as indicated below:

- › Priority 1 Properties – Ornamental Garden Area:
 - Young child-occupied sites with Pb concentrations greater than 1,200 ppm for soils which occur within an ornamental garden; and
 - Older child-occupied sites with Pb concentrations greater than 8,400 ppm for soils within an ornamental garden.

Key risk management recommendations: These child-occupied properties have areas of bare exposed soils that present the greatest risk that should be addressed as highest priority in 2019.

- › Priority 3A Properties – Ornamental Garden Area:
 - Young child-occupied sites with Pb concentrations less than 1,200 ppm for soils which occur within an ornamental garden.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks provided they remain ornamental gardens that are not used as primary play areas, it is possible that some of these properties will need to be addressed in the future as it could be difficult to ensure that the usage remains consistent over time. Nevertheless, it is recommended that these would be addressed after Priority 1 and 2 properties. While they await decisions regarding further risk management and/or remediation, it is considered important that usage remains the same (children should not garden or conduct other activities that result in frequent contact with soil in these areas). Since this group was based on assumed occupancy with a young child, the tracking of occupancy age is not required. Similar to that described earlier, properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits.

- › Priority 3B Properties – Ornamental Garden Area:
 - Older child-occupied sites with Pb concentrations less than 8,400 ppm for soils with good ground cover or for soils that occur within an ornamental garden.

Key risk management recommendations: Although the US HUD (2012) would not consider these soils to pose appreciable risks provided they remain ornamental gardens that are not used as primary play areas, it is possible that some of these properties will need to be addressed in the future as it could be difficult to ensure that the usage remains consistent over time. Nevertheless, it is recommended that these would be addressed after Priority 1 and 2 properties. While they await decisions regarding further risk management and/or remediation, it is considered important that usage remains the same (children should not garden or conduct other activities that result in frequent contact with soil in these areas). Since this group was based on only older children being present, it is also important that occupancy age is tracked for the prioritization classification to remain valid. Similar to that described earlier, properties can be further prioritized using the Screening Quotient approach that considers magnitude of the concentration and the frequency of visits.

Properties that are not Child-Occupied

As discussed earlier, only child-occupied properties are part of this prioritization strategy. Consistent with US HUD (2012), properties without children are considered to pose much lower risks and were not considered as part of the overall prioritization. This does not mean that acceptable risks exist at

properties without child occupancy (i.e., remediation at such properties may still be required) and, instead, is intended to be interpreted as lower concern and priority than the other properties.

Public Areas

Planning for remediation of public areas (playgrounds, schoolyards, daycare centres and other public spaces) is expected to involve factors that are different than for private properties – considering issues such as prime usage periods, scheduled community activities, alternative park/playground access within a neighbourhood during future remediation, and others. Consequently, additional assessment and consultation with the municipal representatives is planned for 2019 before prioritization of public areas is completed. Overall, the same principles described for prioritization of private properties will apply for public spaces (namely that bare soils where children sit and play offer greater exposure potential than soils with grass or other coverings). More specifically, assuming similar soil Pb concentrations, it is anticipated that sandboxes and other areas with bare soil and young children present/expected, will receive higher prioritization than playing fields with grass or other coverings and/or properties where only older children are expected to be frequently present.

4 Worked Examples

To facilitate understanding of the overall approach, worked examples of various hypothetical scenarios are provided below:

Worked Example 1

In this scenario, a 95% UCLM soil Pb concentration of 300 ppm was reported for a property; however, 1,000 ppm was reported as the maximum soil Pb concentration at an area with a swing set. In addition, bare areas exceeded 1 m².

In Step 1, it would be determined if the property is child-occupied. In this example, it is determined that 2 children reside at the site (ages 3 and 7 years). Consequently, it would be considered to be occupied by young children.

In Step 2, the ground cover would be determined to be either: 1) bare exposed soils; or 2) grass or other coverings. In this example, the yard has two distinct use areas: 1) swing set area; and 2) other yard area with patchy grass. For the other yard area, grass covers 50% of the yard; however, the grass is not well-maintained and there are many areas of bare soil within the grassed area. In the case of the bare area that is at the swing set, this area would have been considered to lack good ground cover even if less than 1 m² since it is a primary play area. For the other yard area, since the amount that is bare exposed soils is more than 1 m², this area of the property would also be considered to lack good ground cover.

In Step 3, the appropriate Prioritization Screening Concentration is identified. Since young children are present and the property does not have good ground cover at the swing set area regardless of total area, the Prioritization Screening Concentration would be 400 ppm at all areas. In the case of other yard areas, since young children are present and the property does not have good ground cover, the Prioritization Screening Concentration would also be 400 ppm (even though some it was a grassed area, the bare areas were too large to use the good ground cover Priority Screening Concentration).

In Step 4, the soil data for the property is compared to the Prioritization Screening Concentration. Although a 95% UCLM soil Pb concentration of 300 ppm was reported, the presence of a higher concentration at the swing set area indicated that the maximum concentration should be used for this area. Consequently, the maximum concentration of 1,000 ppm was compared to the Prioritization Screening Concentration of 400 ppm for the swing set area. For the other yard areas, the 95% UCLM soil Pb concentration of 300 ppm was considered to be appropriate compared to the Prioritization Screening Concentration of 400 ppm.

In Step 5, the property is considered to be Priority 1 at the swing set area due to it being a young child-occupied site with a maximum soil Pb concentration greater than 400 ppm. In the case of the other yard areas, the 95% UCLM concentration was less than 400 ppm and, consequently, this area was considered to be Priority 3C.

In the case of the calculation of the Screening Quotient for prioritization within the group, the following equation and input parameters can be used for the swing set area:

$$SQ = \frac{SC \times ET}{PSC}$$

where:

SQ = Screening Quotient (unitless)

SC = Soil concentration (1,000 ppm)

ET = Exposure Term (unitless) (1; i.e., assumes full-time residency)

PSC = Prioritization Screening Concentration (400 ppm)

Thus, the Screening Quotient for the swing set area would be 2.5 for this example. Within the Priority 1 group, this Screening Quotient can be used to compare properties in the event that not all Priority 1 sites can be addressed in the same field season.

Worked Example 2

In this scenario, a 95% UCLM soil Pb concentration of 1,000 ppm was reported for the property; however, 2,000 ppm was reported as the maximum soil Pb concentration at some grassed areas. Total bare areas were less than 1 m² and were not at a primary play area (i.e., did not contain a sandbox, play equipment or other indication of frequent play such as toys).

In Step 1, it would be determined if the property is child-occupied. In this example, it is determined that 2 children reside at the site (ages 7 and 11 years); however, interviews with the occupants indicate they are caregivers of young children (ages 3 and 4 years) during the summer at a rate of 2 days per week. Consequently, it would be considered to be occupied by young children.

In Step 2, the ground cover would be determined to be either: 1) bare exposed soils; or 2) grass or other coverings. In this example, grass covers nearly 100% of the yard, the amount that is bare exposed soils is less than 1 m² and consequently the property would be considered to have good ground cover.

In Step 3, the appropriate Prioritization Screening Concentration is identified. Since young children are present and the property has good ground cover, the Prioritization Screening Concentration would be 1,200 ppm.

In Step 4, the soil data for the property is compared to the Prioritization Screening Concentration. Although a maximum concentration of 2,000 ppm was reported, the total bare area was less than 1 m² and not at a primary play area such that the 95% UCLM should be used. Consequently, the 95% UCLM concentration of 1,000 ppm was compared to the Prioritization Screening Concentration of 1,200 ppm.

In Step 5, the property is considered to be Priority 3A due to it being a young child-occupied site with soil Pb concentrations less than 1,200 ppm under good ground cover. For this prioritization to remain valid, it is considered important that the good ground cover remains in place (ground cover should therefore be monitored on a regular basis). Since this prioritization category was based on assumed occupancy by young children, the tracking of occupancy age is not required.

In the case of the calculation of the Screening Quotient for prioritization within the group, the following equation and input parameters can be used:

$$SQ = \frac{SC \times ET}{PSC}$$

where:

SQ = Screening Quotient (unitless)

SC = Soil concentration (1,000 ppm)

ET = Exposure Term (unitless) (0.29 i.e., assumes 2 days per week)

PSC = Prioritization Screening Concentration (1,200 ppm)

Thus, the Screening Quotient would be 0.24 for this example. Within the Priority 3A group, this Screening Quotient can be used to compare properties in the event that not all Priority 3A sites can be addressed in the same field season.

Worked Example 3

In this scenario, a 95% UCLM soil Pb concentration of 3,200 ppm was reported for the grassed areas of the property; however, the maximum soil Pb concentration at bare areas was 250 ppm.

In Step 1, it would be determined if the property is child-occupied. In this example, it is determined that no children reside at the site; however, one of the occupants is pregnant and there was no indication that the current occupants would move prior to the birth of the child. Consequently, it was considered to be occupied by young children.

In Step 2, the ground cover would be determined to be either: 1) bare exposed soils; or 2) grass or other coverings. In this example, the site investigators were satisfied that the 95% UCLM soil concentration of 3,200 ppm for the grassed areas was a distinct and separate population from the bare areas with a maximum concentration of 250 ppm (i.e., there was sufficient rationale provided that indicated the higher concentration in grassed areas would not occur at the bare areas). Consequently, the property was considered as 2 separate subareas: grassed areas and bare areas.

In Step 3, the appropriate Prioritization Screening Concentration is identified. Since younger children are considered present, the Prioritization Screening Concentration would be 1,200 ppm for grassed areas and 400 ppm for the bare areas.

In Step 4, the soil data for the property is compared to the Prioritization Screening Concentration. For the grassed areas, the 95% UCLM concentration of 3,200 ppm was compared to the Prioritization Screening Concentration of 1,200 ppm. For the bare areas, the maximum concentration of 250 ppm was compared to the Prioritization Screening Concentration of 400 ppm.

In Step 5, the property is considered to be Priority 2 due to it being a young child-occupied site with soil Pb concentrations greater than 1,200 ppm under good ground cover (this Prioritization 2 for grassed areas was higher than Priority 3C for the bare areas). For this prioritization to remain valid, it is considered important that the good ground cover remains in place (ground cover should therefore be monitored on a regular basis). Since this prioritization category was based on assumed occupancy by a young child, the tracking of occupancy age is not required.

In the case of the calculation of the Screening Quotient for prioritization within the group, the following equation and input parameters can be used:

$$SQ = \frac{SC \times ET}{PSC}$$

where:

SQ = Screening Quotient (unitless)

SC = Soil concentration (3,200 ppm)

ET = Exposure Term (unitless) (1; i.e., assumes full-time residency)

PSC = Prioritization Screening Concentration (1,200 ppm)

Thus, the Screening Quotient would be 2.7 for this example. Within the Priority 2 group, this Screening Quotient can be used to compare properties in the event that not all Priority 2 sites can be addressed in the same field season.

Worked Example 4

In this scenario, a 95% UCLM soil Pb concentration of 1,800 ppm was reported for the lawn area of the property; however, the maximum soil Pb concentration at an ornamental garden area was 2,250 ppm.

In Step 1, it would be determined if the property is child-occupied. In this example, it is determined that no children reside at the site; however, one of the occupants regularly cares for his 9 year old grandchild (5 days per week during the summer). Consequently, it was considered to be occupied by older children.

In Step 2, the ground cover would be determined to be either: 1) bare exposed soils; or 2) grass or other coverings. In this example, the site investigators were satisfied that the 95% UCLM soil concentration of 1,800 ppm for the lawn area was a distinct and separate population from the ornamental garden area with a maximum concentration of 2,250 ppm. Consequently, the property was considered as 2 separate subareas: lawn area and ornamental garden area. In the case of the lawn area, it was determined although it was largely grassed, there were bare areas greater than 1 m² and, since the data indicated that grass covered and bare areas were a single population it was concluded that these should be considered bare exposed soils.

In Step 3, the appropriate Prioritization Screening Concentration is identified. Since older children are present, the Prioritization Screening Concentration would be 2,800 ppm for the lawn area and 8,400 ppm for the ornamental garden area.

In Step 4, the soil data for the property is compared to the Prioritization Screening Concentration. For the lawn areas (considered exposed soil in this case as outlined above), the 95% UCLM concentration of 1,800 ppm was compared to the Prioritization Screening Concentration of 2,800 ppm. For the ornamental garden, the maximum concentration of 2,250 ppm was compared to the Prioritization Screening Concentration of 8,400 ppm.

In Step 5, the property is considered to be Priority 3D due to it being an older child-occupied site with soil Pb concentrations less than 2,800 ppm without good ground cover at the lawn area and less than 8,400 ppm at the ornamental garden area. Since this group was based on only older children being present, it is important that occupancy age is tracked for the prioritization classification to remain valid.

In the case of the calculation of the Screening Quotient for prioritization within the group, the following equation and input parameters can be used:

$$SQ = \frac{SC \times ET}{PSC}$$

where:

SQ = Screening Quotient (unitless)

SC = Soil concentration (1,800 ppm)

ET = Exposure Term (unitless) (0.71; i.e., assumes 5 days per week)

PSC = Prioritization Screening Concentration (2,800 ppm)

Thus, the Screening Quotient would be 0.46 for this example. Within the Priority 3D group, this Screening Quotient can be used to compare properties in the event that not all Priority 3D sites can be addressed in the same field season.

5 Discussion

5.1 Conservative Nature of the Approach

The modified-US HUD approach is considered by SNC-Lavalin to be more conservative than the US HUD (2012) approach for the following reasons:

- › The modified approach has included the prioritization of properties with good ground cover whereas US HUD (2012) does not.
- › The modified approach considers children up to less than 12 years of age whereas the US HUD (2012) only considers children less than 6 years of age.
- › The modified approach does not consider 400 ppm to represent acceptable risk and instead only uses this value for the prioritization of properties for remediation whereas US HUD (2012) considered it to be an acceptable risk value.
- › The modified approach uses 400 ppm for all bare exposed soils whereas US HUD (2012) used 400 ppm for bare exposed soils at play areas and 1,200 ppm at non-play areas.

It is also stressed that the modified approach is applied in a community that has a unique understanding of the risks associated with Pb exposure. As compared to many places where the US HUD (2012) approach is applied, the community of Trail likely has a higher awareness of the importance of keeping soil out of homes (e.g., use of mud rooms and not wearing outside shoes indoors) and monitoring blood Pb levels in young children.

With the above in mind, it is emphasized that it is not desirable to be overly conservative in such a prioritization process. Applying an overly conservative approach could result in improper ranking with one property of higher risk being prioritized equal to or even below a property of lower risk (e.g., if an area that is not used as a primary play area is “conservatively” assumed to be used, this could result in the property getting an equal or even greater prioritization than a property where bare soil actually exists in the primary play area). While it may seem preferable to use highly conservative assumptions such as that primary play areas with bare soil cover the entire yard or that higher concentrations exist than have been measured, this could result in the identification of more high priority properties than can reasonably be remediated or risk-managed within a field season. Such an approach could result in lower concern properties being remediated prior to higher concern properties. As a result, it is important that reasonable assumptions and the best estimates for the input parameters are used.

Once again, it is stressed that the above Prioritization Screening Concentrations are not considered to represent risk-based cleanup concentrations. Instead, these Prioritization Screening Concentrations are to be used in a prioritization strategy where it is concluded that bare exposed soils should have the highest priority when soil Pb concentrations are above 400 ppm where children < 6 yrs are present or above 2,800 ppm where children 6-<12 yrs are present (i.e., these yards should be prioritized first and are identified as Priority 1). This is consistent with the current HUD and US EPA process and is supported by the current science on Pb toxicity. After Priority 1 properties are addressed, grassed (or similarly covered) areas with soil Pb concentrations above 1,200 ppm where children < 6 yrs are present or above 2,800 conclude that grass is an almost complete barrier to prevent Pb contact with soil; however, we are nevertheless concluding that such soils should still be prioritized. Priority 3 properties have children present and properties that have a combination of either: 1) good ground cover and low concentrations;

or (2) bare soils and even lower concentrations. Finally, properties without children present were the lowest priority (consistent the US HUD [2012] approach, these were not part of the prioritization strategy); however, even these properties (as is the case with Priority 2 and 3 yards) may eventually require some remediation and the key message is that they are only lower priority than properties with children.

Overall, we view the modified-US HUD approach as a reasonable and appropriately conservative approach that offers more protection than adopting the US HUD (2012) approach directly.

5.2 Garden Produce

Soils used to grow garden produce were not evaluated or included in this prioritization; however, as described below, this could be an important route of exposure to Pb. Despite not being part of the current prioritization, it is noted that where soil removal and replacement is triggered in other parts of the yard, property owners with vegetable gardens are offered by Teck the opportunity of having the vegetable garden soils also replaced.

With the above in mind, it is important to stress that garden produce consumption has the potential to pose a greater source of exposure to Pb than direct exposure to soil. As shown in Table 1, the Pb concentrations in the Trail area have been found to vary depending upon the produce type. These garden produce data were compiled from SNC-Lavalin (2014) (produce collected from remediated gardens) and also unpublished data from 2007 (produce collected mostly from unremediated gardens).

Table 1: Garden Produce Concentrations Collected from the Trail Area

Produce Type	Sample Size	Produce Concentration (µg/g, wet weight)		
		Geometric Mean	Arithmetic Mean	95% UCLM
Root-type produce	37	0.23	0.35	0.48
Fruit-type produce	63	0.06	0.10	0.13
Leafy produce (no herbs)	32	1.37	2.09	2.93
Mint	2	23.2	25.8	Not calculated due to small sample size
Sorrel	2	11.8	3.96	Not calculated due to small sample size

The direct analyses of garden produce have not provided useful information for evaluation of risks from soils in Trail. The limited garden produce tissue data collected from the Trail area and reviewed as part of this work indicates that Pb concentrations have been high in past measurements of garden produce; however, it is not clear that current garden produce concentrations are as high as past measurements. It is also not clear that garden soil is the source of the previously elevated garden produce concentrations of Pb and this pathway requires further evaluation. It is also stressed that all of these data were collected during a time of higher smelter emissions (i.e., prior to the fugitive dust reduction improvements being implemented and, thus, smelter emissions depositing onto garden produce could have been a more important source than currently). Although there is some indication that soils with Pb concentrations less than 400 ppm may have little effect on garden produce concentrations, SNC-Lavalin has not been able to develop a reliable mathematical approach to address this pathway. Thus, it is not possible to be conclusive regarding the soil concentrations that would be adequately protective of garden produce.

Despite the lack of clear relationships between soil and garden produce concentrations of Pb, it is apparent that the Pb concentrations in garden produce previously collected from the Trail area are high and have the potential to represent an appreciably more important source of intake than from direct contact pathways of Pb in soil. Nevertheless, it would be premature to inform people that they should not consume garden produce. There could be many benefits from consuming garden produce and as noted above there is a high degree of uncertainty with the data. Instead, this information could be shared with the community. In addition, it is noted that some literature has indicated that certain gardening techniques may reduce Pb uptake by plants and this can be communicated to potentially reduce Pb intake. For example, there is indication that certain types of produce may uptake less Pb than other plants/produce and that iron amendments to soil may also reduce Pb uptake by plants (Paltseva et al., 2018). Finally, it should be communicated that although washing and/or peeling can reduce Pb concentrations and such activities are to be encouraged, it is also important to be aware that these are not totally effective in reducing concentrations (i.e., garden produce concentrations in Table 1 are for washed produce).

Overall, it was not possible at this time to include consumption of garden produce in the soil prioritization approach. Consequently, the soil to garden produce pathway requires further evaluation (i.e., it would seem possible that smelter air emissions depositing on garden produce could also be an important source). Evaluation of this pathway may form part of a study being developed by provincial agencies; however, as this is not currently defined, in the interim Teck will coordinate with THEP in 2019 to undertake assessment/remediation of vegetable gardens and testing of garden produce obtained from the community as outlined in Section 3.3.

Nevertheless, residents should be informed of the potential for exposure via this pathway, and it is recommended that information available from the literature on gardening techniques that may reduce Pb uptake by plants be communicated.

6 Conclusions

Overall, it would seem the modified-US HUD approach is a reasonable and appropriately conservative approach that offers more protection than directly adopting the US HUD (2012) approach. Using the modified-US HUD approach, the prioritization of the sites for remediation can be completed in a scientifically defensible manner according to the following rationale:

- › Significance of Priority 1 Properties: A property is a Priority 1 if:
 - 1: it does not have good ground cover (i.e., soils are bare and not covered with grass or other materials); and
 - 2: the soil Pb concentration exceeds 400 ppm where children less than 6 years of age (i.e., young children) are present or 2,800 ppm where children 6 to less than 12 years of age (i.e., older children) are present.

These properties represent the greatest risk and, thus, should receive the most immediate attention.

- › Significance of Priority 2 Properties: A property is a Priority 2 if:
 - 1: it has good ground cover (i.e., soils are covered with grass or other materials); and
 - 2: the soil Pb concentration exceeds 1,200 ppm if young child-occupied or 8,400 ppm if older child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover creates a situation where the risk is not considered to be as the highest priority (indeed, under the US HUD [2012] approach, these sites would be ranked as not posing risk provided the ground cover exists).

- › Significance of Priority 3A Properties: A property is a Priority 3A if:
 - 1: it has good ground cover; and
 - 2: the soil Pb concentration is less than 1,200 ppm if young child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover and lower concentrations than Priority 2 creates a situation where the risk is not considered to be as high priority.

- › Significance of Priority 3B Properties: A property is a Priority 3B if:
 - 1: it has good ground cover; and
 - 2: the soil Pb concentration is less than 8,400 ppm if older child-occupied.

Although the soil at these properties present potential concerns, the presence of ground cover and lower concentrations than Priority 2 creates a situation where the risk is not considered to be as high priority.

- › Significance of Priority 3C Properties: A property is a Priority 3C if:
 - 1: the soil Pb concentration less than 400 ppm if young child-occupied regardless of ground cover.

These properties may still require remediation in the future; however, they represent lower risk sites due to their lower concentrations and age-group considerations.

- › Significance of Priority 3D Properties: A property is a Priority 3D if:
 - 1: it has soil Pb concentration less than 2,800 ppm if older child-occupied regardless of ground cover.

These properties may still require remediation in the future; however, they represent lower risk due to their lower concentrations and age-group considerations.

Ornamental garden areas (i.e., areas that contain flower or other decorative plants and where it is reasonable to assume that children would be discouraged from regular play), should be identified at child-occupied properties. Since there are a range of possibilities available for consideration, it is suggested that discussion of interim measures should occur with the occupants when soil concentrations exceed the Priority Screening Concentrations for ornamental gardens (i.e., 1,200 ppm if young child-occupied or 8,400 ppm if older child-occupied). These measures include that children should not garden or conduct other activities that result in frequent contact with soil in these areas. Depending on the outcome of these discussions, certain ornamental gardens may be considered to be Priority 1, 3A or 3B properties.

The garden produce pathway is not specifically addressed in this prioritization strategy and requires further consideration. There is the potential for garden produce consumption to represent significant exposure; however, there are currently insufficient data available to address this pathway. It is recommended that an appropriate methodology for assessing garden produce be developed in the near future. Evaluation of this pathway may form part of a study being developed by provincial agencies; however, as this is not currently defined, in the interim Teck will coordinate with THEP in 2019 to undertake the following:

- › Teck will test garden produce obtained from the community on a voluntary basis to compare to previous data obtained prior to implementation of fugitive dust emissions improvements;
- › Teck will inform residents that an approach is being developed to assess the potential for exposure via the garden produce ingestion pathway and that, in the meantime, there are certain produce gardening and preparation techniques that may reduce Pb exposure;
- › Vegetable gardens will be assessed/remediated in conjunction with yard soil assessment/remediation according to the prioritization approach presented herein with the refinement that vegetable gardens will be considered Priority 1 when soil Pb concentration exceeds 400 ppm for properties occupied by younger or older children (i.e., <12 years old); and
- › When requested by a property owner, Teck will continue to offer to assess and remediate (if necessary) vegetable gardens at properties that do not fit the Priority 1 classification, provided that doing so will not delay assessment/remediation of Priority 1 properties (yards or gardens).

It is recommended that occupancy (i.e., age groups) should be tracked for Priority 1, 2, 3B and 3D properties. Where grass or ground cover is a key determinant in the ranking results (i.e., Priority 2, 3A and 3B properties), it is recommended that such cover should also be monitored. Finally, it is recommended that communication with the community occurs that continues to encourage the maintenance of lawns and other ground covering and that updates people on the status of garden produce monitoring.

Finally, in the case of public areas such as parks, playgrounds, schoolyards, daycare centres and other public spaces that may contain elevated soil Pb concentrations, the same principles described for prioritization of private properties will apply for these public spaces (namely that bare soils where children

sit and play offer greater exposure potential than soils with grass or other coverings). Nevertheless, receiving permission to assess and manage/remediate public spaces may involve a different approval process. Consequently, additional assessment and consultation with the municipal representatives is planned for 2019 before prioritization of public areas is completed.

7 Professional Statement

As required under Part 16, Section 63 of the *Contaminated Sites Regulation* (CSR), B.C. Reg. 375/96, includes amendments up to B.C. Reg. 13/2019, January 24, 2019, SNC-Lavalin acknowledges that the person signing this report has demonstrable experience and is familiar in completing the work, as described, for the type of COCs at this site. The documentation provided has been prepared in accordance with the applicable regulations in the *Environmental Management Act* (EMA), B.C. Reg. 13/2019 / effective January 24, 2019.

Furthermore, as per ENV (2017), a signed statement from the authors of this report is included below.

In accordance with Section 63 of the Contaminated Sites Regulation, I confirm that I have demonstrable experience in conducting human health and/or ecological risk assessment pertinent to the purposes of the Contaminated Sites Regulation.

I also confirm that:

- (a) the risk assessment performed by me, and reported herein, has been performed to the best of my ability in accordance with ministry approved protocols, guidance, procedures, policies, methods and standards of professional practice, and
- (b) the information used in the performance of the risk assessment and the conclusions of the risk assessment reported herein are true and accurate based on my current knowledge as of the date completed.



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8 Notice to Reader

This report has been prepared and the work referred to in this report have been undertaken by SNC-Lavalin Inc. (SNC-Lavalin) for the exclusive use of Teck Metals Ltd., who has been party to the development of the scope of work and understands its limitations. The methodology, findings, conclusions and recommendations in this report are based solely upon the scope of work and subject to the time and budgetary considerations described in the proposal and/or contract pursuant to which this report was issued. Any use, reliance on, or decision made by a third party based on this report is the sole responsibility of such third party. SNC-Lavalin accepts no liability or responsibility for any damages that may be suffered or incurred by any third party as a result of the use of, reliance on, or any decision made based on this report. Should this report be submitted to the BC Ministry of Environment & Climate Change Strategy (ENV) by Teck Metals Ltd., ENV is authorized to rely on the results in the report, subject to the limitations set out herein, for the sole purpose of determining whether Teck Metals Ltd. has fulfilled its obligations with respect to meeting the regulatory requirements of ENV.

The findings, conclusions and recommendations in this report (i) have been developed in a manner consistent with the level of skill normally exercised by professionals currently practicing under similar conditions in the area, and (ii) reflect SNC-Lavalin's best judgment based on information available at the time of preparation of this report. No other warranties, either expressed or implied, are made as to the professional services provided under the terms of our original contract and included in this report. The findings and conclusions contained in this report are valid only as of the date of this report and may be based, in part, upon information provided by others. If any of the information is inaccurate, new information is discovered, site conditions change or standards are amended, modifications to this report may be necessary. The results of this assessment should in no way be construed as a warranty that the subject site is free from any and all environmental impact.

Any soil and rock descriptions in this report and associated logs have been made with the intent of providing general information on the subsurface conditions of the site. This information should not be used as geotechnical data for any purpose unless specifically addressed in the text of this report. Groundwater conditions described in this report refer only to those observed at the location and time of observation noted in the report.

This report must be read as a whole, as sections taken out of context may be misleading. If discrepancies occur between the preliminary (draft) and final version of this report, it is the final version that takes precedence. Nothing in this report is intended to constitute or provide a legal opinion.

The contents of this report are confidential and proprietary. Other than by Teck Metals Ltd., copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted without the express written permission of Teck Metals Ltd. and SNC-Lavalin.

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Appendix I

Technical Details Related to the Development of Prioritization
Screening Concentrations

Technical Details Related to the Development of Prioritization Screening Concentrations

This appendix provides technical details related to the development of the Prioritization Screening Concentrations. As noted in the main report, a modified-US HUD approach was used to develop the following Prioritization Screening Concentrations:

- › For soil collected from properties with young children and not good ground cover: 400 ppm;
- › For soil collected from properties with young children and good ground cover: 1,200 ppm;
- › For soil collected from properties with older children and not good ground cover: 2,800 ppm; and
- › For soil collected from properties with older children and good ground cover: 8,400 ppm.

These concentrations do not represent acceptable soil concentrations and, instead, the objective of these concentrations is to be used in a risk-based remedial strategy to provide a scientifically-defensible approach that will identify and prioritize those properties for which remediation in 2019 is most important.

The technical rationale for the development of each of these concentrations is discussed in the sections below.

Properties with Young Children (Less than 6 years of age) and Not Good Ground Cover

For this type of property, the US HUD (2012) soil concentration of 400 ppm for bare play area soils was adopted. For this soil concentration, US HUD (2012) cites the US EPA (2001) regulation. The US EPA (2001) rule is:

- › Soil-lead hazard. A soil-lead hazard is bare soil on residential real property or on the property of a child-occupied facility that contains total lead equal to or exceeding 400 parts per million ($\mu\text{g/g}$) in a play area or average of 1,200 parts per million of bare soil in the rest of the yard based on soil samples.

Although it is recognized that the US EPA Regulation (2001) may need revision to include more recent toxicological information on Pb, the Prioritization Screening Concentration emphasizes that this is not used as the acceptable soil concentration. Overall, the SNC-Lavalin approach is considered to be more conservative in that this concentration is used for all yard soils that are bare and not just the US HUD (2012)/US EPA (2001) play area soil.

Properties with Young Children (Less than 6 years of age) and Good Ground Cover

For this type of property, the US HUD (2012) soil concentration of 1,200 ppm for bare soil in the rest of the yard was adopted. Although US HUD (2012) concludes that soils with good ground cover do not pose any appreciable risk, this approach was not adopted and instead the value developed for non-play area bare soils was used in the SNC-Lavalin-modified approach for soils with good ground cover.

For soils covered by well-established lawns or other cover materials, it is anticipated that there will be substantially less soil ingestion for kids spending time outside. For a child contacting soil covered by grass versus bare soil, much less soil would be expected to adhere to the hands. Since hand-to-mouth activity is believed to be the predominant manner that soil is ingested by children, soil adherence to hands is considered to be a key predictor of soil ingestion rates (Özkaynak et al., 2011; Wilson et al., 2013; US EPA, 2017). Consequently, there would be lower soil ingestion rates from yards with well-established lawns for children spending time outside. Thus, this is considered to be consistent with the US EPA (2001) and US HUD (2012) approaches/rules.

In addition to lower outside soil ingestion rates, it would be expected that yards with well-established lawns (or soils covered with other cover materials) would be expected to have less outdoor soil tracked into homes. Similar to that described above for hands, there would be less soil expected to adhere to footwear contacting well-established lawns/soils covered with other materials. Since soil adhering to footwear can be an important source of indoor dust, it would be expected that properties with well-established lawns/other cover materials would have lower potential contributions to indoor dust than properties with bare soils (assuming all other aspects being equal). Consequently, there would potentially be lower levels of outdoor soil incorporated into indoor dust from yards with well-established lawns/covered soils versus those with bare soils.

Besides grass, US HUD (2012) considers other coverings to be protective barriers including moss (or other live coverings), wood chips, gravel and artificial turf. Provided that there is assurance that these coverings are sufficiently thick and will remain in place for the foreseeable future (until remediation decisions are made), these coverings are considered suitable.

With respect to the specific selected value of 1,200 ppm, this value was based on professional judgment. Although we do not have a literature citation for soil adherence to hands and footwear being 3-fold less when good ground cover exists, it seems like a reasonable value. In addition, it is more conservative than US HUD (2012) and US EPA (2001) which both seem to suggest that there is no appreciable exposures that arise when such covering exists. Consequently, a value of 1,200 ppm was considered to be reasonably conservative for prioritization purposes and adopted for properties with young children and good ground cover.

Properties with Older Children (6 to less than 12 years of age) and Not Good Ground Cover

US HUD (2012) does not address older children and instead seems to imply that they could not be at appreciable risk. However, in the more recent US EPA (2017) guidance on exposure assessment, it seems clear that children in the 6 to less than 12 years age group are assumed to ingest soil at a similar rate as young children (at least for upper end children where 90 mg/day is assumed for both age categories). Consequently, it was considered to be appropriate to consider this older child age group in the modified approach.

Although assumed to ingest soil at a similar rate as young children, older children have an appreciably higher average body weight and this warrants consideration. US EPA (2017) provides a body weight of 11.4 kg for the most sensitive age group between 1 to 5 years (i.e., 1 to 2 years of age) whereas they provide a body weight of 31.8 kg for the 6 to <11 years old age group (i.e., US EPA do not provide a body weight for 6 to less than 12 years and instead provide it for 6 to 10 years of age and they do not provide body weight for narrower within group age ranges [e.g., 6 to 7 years; 7 to 8 years, etc.] similar to that provided for the less than 6 years age group). Nevertheless, it is considered to be reasonable that the US HUD (2012) soil concentration for young children can be multiplied by a factor of 2.8 (i.e., 31.8 kg/11.4 kg) to account for body weight differences.

In addition, there is some reasonable evidence that suggests older children will have appreciably lower oral absorption than young children. Citing a variety of sources, Mushak (2011) has concluded that once a child enters the 5 to 6 years age range, their oral absorption of Pb is more similar to adults. US EPA (2003) indicated that the adult absorption factor is 20% versus 50% for young children in their models. As a result, difference between young children and adults is 2.5-fold in the US EPA approach. Although the Mushak (2011) conclusion of older children having absorption rates similar to adults may not be conclusive enough for an eventual risk assessment (i.e., it would essentially assume that if this was valid, the WHO and EFSA potency factors for children only apply to young children), it seemed reasonable for prioritization (which is the goal of the current exercise). Consequently, this factor of 2.5 was used to account for absorption rate differences between young and older children.

As a result of applying the body weight factor of 2.8 and the absorption factor of 2.5 to the US HUD (2012) soil concentration of 400 ppm for young children, a Prioritization Screening Concentration of 2,800 ppm was calculated for older children (i.e., $400 \text{ ppm} \times 2.8 \times 2.5 = 2,800 \text{ ppm}$).

Properties with Older Children (6 to less than 12 years of age) and Good Ground Cover

For similar reasons as described above for older children at properties without good ground cover, it was considered to be reasonable to apply body weight and absorption rate factors to the young child screening concentration. As a result of applying the body weight factor of 2.8 and the absorption factor of 2.5 to the US HUD (2012) soil concentration of 1,200 ppm for young children, a Prioritization Screening Concentration of 8,400 ppm was calculated for older children (i.e., $1,200 \text{ ppm} \times 2.8 \times 2.5 = 8,400 \text{ ppm}$).

Child-Occupied Properties with Ornamental Gardens

For properties with ornamental gardens, it is proposed that the Prioritization Screening Concentration for properties with good ground cover can be used. Although ornamental gardens are likely to be bare soil, it would seem reasonable that caregivers would discourage children from playing in these soils. Thus, soils from ornamental gardens would offer appreciably lower exposure potential than bare soils at play areas. In the case of US HUD (2012), a soil Pb concentration of 1,200 ppm was recommended for young children at non-play areas with bare soils. This US HUD approach seems most consistent with ornamental gardens and, consequently, it would seem that ornamental gardens could be considered to present the same range of exposure as areas with good ground cover. As a result, a value of 1,200 ppm was adopted for properties with young children and ornamental gardens and 8,400 ppm was adopted for properties with older children and ornamental gardens.



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Appendix VI

Teck Trail Operations 2019 Workplan – Communications Plan,
January 31, 2019

Appendix VI

Trail Area Soil Assessment and Remediation – 2019 Workplan Communications Plan

This communications plan has been developed for review by the Ministry of Environment and Climate Change Strategy.

1. Purpose

This communications plan outlines proposed activities to satisfy the Ministry of Environment and Climate Change Strategy's request in a letter December 7, 2018 outlining the 2019 workplan for soil remediation, specifically:

- 1. C) A communication plan for informing and seeking the approval of land owners for investigating &/or remediating their sites and for providing investigation or confirmation of remediation reports at the completion of work. The communication plan must also include a strategy for informing the broader community of the work being carried out under the 2019 workplan and more generally to address highest risk sites in the Environmental Management Area.*

In addition, this plan proposes how Teck will satisfy reporting requirements also outlined in the December 7 letter, namely:

- 2. C) To be submitted to the director no later than June 30, 2019: The results of communication completed with owners of selected sites and other members or groups in the community.*
- 3. D) To be submitted to the director no later than March 31, 2020: A summary of communication records with land owners or other community members/groups related to the investigation or remediation work completed in 2019 or planned for later years.*

2. Communications Plan Objectives

- Continue to promote people's health and a healthy environment, with a focus on preventing children's exposure to lead,
- Provide clear and concise information about the 2019 workplan to land owners and the broader community through existing communications processes, methods and channels used by the Trail Health & Environment Program, and,
- Meet or exceed the Ministry's requirements for communications and reporting.

3. Overview of Proposed Communications Approach

Communications with landowners and residents regarding assessment and remediation of sites within the Trail area currently occurs through the Trail Health & Environment Program (THEP). As noted in the objectives, this plan proposes that the existing and proven communication processes, methods, channels and tracking currently used by THEP continue to be used to meet the Ministry's request, albeit modified to include communications relating to the 2019 workplan.

In brief, the approach to communications in 2019 is as follows:

- a) THEP to continue to lead direct communications with land owners and residents regarding assessment and remediation of sites (*see process described in section 4*),
- b) THEP to continue to track communications with landowners and residents and provide information to Teck for reporting purposes,
- c) Teck to work with THEP to develop content describing the 2019 workplan to be incorporated in existing communications materials and channels to reach the broader community of Trail: (*see section 5*)
 - o Newsletter mailed to all homes within the THEP area,
 - o Website update (www.thep.ca) to incorporate soil remediation focus and objectives,
 - o Standing agenda item for Trail Health & Environment Committee meetings to allow for feedback and direction,
 - o Presentations to community and stakeholder groups.
- d) Teck to provide Ministry with progress report and annual report based on information from THEP (*see section 6*).

About the Trail Health & Environment Program

The Trail Area Health & Environment Program (THEP) is a comprehensive, community-led program with five main areas of activity: Family Health, Home & Garden, Air Quality, Parks and Wildlands, and Property Development. Its mission is to promote people's health and a healthy environment, with a focus on preventing children's exposure to lead.

The Trail Area Health & Environment Committee (THEC) oversees the program. THEC is a partnership between the local community, Teck, the Ministry of Environment and Climate Change Strategy, and Interior Health. Over the past 30 years of successful collaboration, children's blood levels in Trail have reduced significantly and air quality has greatly improved.

Of particular relevance to this communications plan is the Home & Garden program, which includes garden and yard soil testing and remediation. The Home & Garden program is delivered by SNC-Lavalin on behalf of THEC, funded by Teck.

4. Communications with Individual Land Owners

As outlined in Section 5 of the workplan, work in 2019 will include targeted soil assessment and risk-management activities at properties within the City of Trail where occupancy, ground cover and soil lead information indicate they are the highest priority.

The following outlines how the THEP Home & Garden program currently communicates with individual landowners regarding assessment and remediation of sites. This process is proposed to remain the same for the 2019 workplan although on a larger scale.

- THEP sends a letter offering a soil assessment to priority properties,
- If landowner consents to assessment, THEP schedules and carries out the assessment,
- When the assessment is complete, THEP presents a results letter to the landowner,
- Based on the results, potentially no further action is required (which is noted in the letter),
- Should the results recommend remediation, THEP sends a letter offering remediation and follows up with a phone call to confirm receipt of the offer letter and/or clarification of understanding regarding remediation,

- If landowner consents to remediation, THEP works with landowner to develop a property remediation plan, schedules the remediation and provides the landowner with a Residential Health and Safety document,
- THEP then notifies Teck of the start of remediation and completes remediation on the property,
- Following remediation, THEP provides information to the landowner, including a remediation summary letter with a drawing visually outlining the remediation activities and information and advice on how to maintain the remediation work,
- In some cases, as a bare soil mitigation measure when soil removal is not planned, THEP also provides lawn care services through the lawn care agreement and provides lawn maintenance info.

All of these steps in the process are tracked by THEP in a database. These records will form the basis of Teck's progress and annual reports to BC ENV.

5. Communications with the Broader Community

The following outlines some of THEP's regular communications activities, supported by Teck, which are proposed to be used to inform the broader community of work being carried out in 2019 (see timeline checklist of activities in section 7):

- **Newsletter mailed to homes within the THEP area:** THEP produces a newsletter twice a year, typically in spring and fall. The newsletter is mailed to approximately 4,500 residential addresses in Trail, Rivervale, Warfield, Oasis, Casino and Waneta, and is also available on the THEP website. Information about the 2019 workplan would be included in both the spring and fall issues.
- **THEP website:** The THEP website (www.thep.ca) would be updated to include information about the 2019 workplan.
- **Presentations and outreach to community and stakeholder groups:** The THEC Chair, Facilitator, Committee members and Program team have generally made presentations and/or conducted outreach to community and stakeholder groups on an annual basis. As part of this plan, THEP and/or Teck representatives will offer to present an update or provide information on the 2019 workplan to local agencies, organizations, and community based groups. The following is an initial list stakeholders who could be approached:
 - Local Municipalities: Trail, Warfield, RDKB Area A and B, Rossland, Castlegar, and Montrose,
 - Children and families: BC Ministry for Children and Family Development, Trail Family and Individual Resources Society (FAIR) Family Action Network, local childcare centres, Columbia Basin Alliance for Literacy, libraries, etc.
 - Health and social: Lower Columbia Poverty Reduction Task Force, senior centres; garden clubs, etc.
 - Economic: Trail and District Chamber of Commerce, Lower Columbia Initiatives Corporation, realtors, etc.
- **Trail Health & Environment Committee meetings:** The THEC is a Select Committee of Council for the City of Trail, is chaired by the Mayor of Trail, and includes representatives from local/regional government, the community, Teck, Interior Health, and the Ministry of Environment and Climate Change Strategy. There are typically five meetings of the THEC each year, which are open to the public. As part of this plan, it is proposed that an update regarding the 2019 workplan be added as an agenda item for each meeting.

The THEP also maintains many other communications methods to engage with the community regarding program components, including local radio, print or online advertising, news releases, and posters and brochures in targeted, high traffic locations (e.g., the waiting room of the Family Obstetrics Clinic at the local hospital). The THEC also maintains a storefront office in the downtown core that is welcoming to the public and has staff on hand to meet and consult with them on issues related to THEP, including any topics that relate to 2019 workplan.

6. Progress and annual reporting

Teck will provide the Ministry with a progress report by June 30, 2019 (and subsequent years) and March 31, 2020 (and subsequent years).

These reports will include:

- A summary of communications with landowners and residents regarding assessment and remediation:
 - Appended to each report will be a detailed log of communications.
- A summary of communications activities carried out to reach the broader community:
 - Appended will be copies of materials used to communicate with the community.

An example of the detailed communications log can be found in Table VI-1.

7. 2019/2020 Communications Milestones

The following table provides key dates related to communications with land owners and residents in 2019 and reporting to the Ministry:

Activity	Who	When
Update THEP website with information about 2019 workplan (once workplan is accepted by Director)	THEP/ Teck	Spring 2019
Assessment letters sent to Trail area properties after filling data gaps	THEP	Spring-Summer 2019
THEC Meeting #2	THEC	April 2019
Presentations and outreach to local municipalities	THEP	Spring 2019
Presentations and outreach to community and family organizations	THEP	Ongoing through 2019
THEP spring newsletter	THEP	May 2019
Progress report to Ministry of Environment and Climate Change Strategy	Teck	June 30, 2019
THEC Meeting #3	THEC	June 2019
THEC Meeting #4	THEC	September 2019
THEP fall newsletter	THEP	September 2019
THEC Meeting #5	THEC	November 2019
Annual report to Ministry of Environment and Climate Change Strategy	Teck	March 31, 2020



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