**Residential Soil Remediation** **Operating Procedures**

1. SCOPE

The Trail Area Health and Environment Program (THEP) offers soil remediation or yard improvement work on properties with soil metal concentrations greater than the Action Levels. The Action Levels are as follows:

* 1. For soil with metals less than Upper Cap Concentrations[[1]](#footnote-1) on residential yards where ground cover is poor and children less than 3 years of age reside; yard improvement work is offered.
  2. For soil with metals greater than 1,000 ppm lead and XX ppm cadmium in vegetable gardens; full remediation of the garden is offered.
  3. For soil with metals greater than Upper Cap Concentrations on residential yards; full remediation of all or part of the yard is offered.

The remediation or yard improvement work is determined case by case, based on the soil assessment results and a review of the yard condition. It is a voluntary program.

1. OBJECTIVES

The goal of the program is to prevent and reduce health risks from exposure to metals that may be present in yard and garden soil. This is done by improving ground cover in areas that are accessible to young children and by removing soil from areas with soil lead concentrations greater than the remediation Action Levels for vegetable gardens and yards.

Each year, the program strives to meet the following performance objectives:

* Provide yard improvement work on all properties where young children are living and where yard improvement work is needed.
* Provide vegetable garden remediation on properties where soil is greater than the Action Level for vegetable gardens and the property owner is interested.
* Provide remediation of all or part of the yard where soil is greater than the Action Level for yards and the property owner is interested.

1. ELIGIBILITY AND PRIORITIES

Yard improvement or remediation work is offered to property owners where soil is greater than the Action Levels. The program is voluntary and work is initiated upon receiving written consent from the property owner(s). Remediation takes place between April and October while the ground is snow free. Work is prioritized as follows:

* Yard improvement work is prioritized as soon as possible to minimize young children’s exposure to metals in bare soil in the yard.
* Vegetable garden remediation is prioritized for the spring and fall prior to and following the growing season.
* Yard remediation where soil concentrations are greater than 5,000 ppm lead are prioritized to be completed within the year.

1. ROLES AND RESPONSIBILITIES
   1. THEP Home and Garden team – offers remediation to property owners, works with the Remediation Contractor and the property owner to develop the Remediation Plan, oversees the Remediation Contractor to ensure the Remediation Plan is carried out, samples backfill materials prior to use, files applicable regulatory documentation, provides soil testing during each stage of the remediation and tracks remediation details in The Database and provides a letter report to the Property Owner and Teck with a summary of the remediation.
   2. Teck – approves the remediation plan for each property and financially supports the Home and Garden team and the Remediation Contractor to complete the remediation and yard improvement work.
   3. Property Owner – provides signed consent to access the property and develops the remediation plan with the Remediation Contractor and the Home and Garden team -
   4. Residents – Allow access to the property during the remediation/ yard improvement work
   5. Remediation Contractor – Carries out the physical work to for the Remediation Plan including providing all materials and equipment.
2. HEALTH AND SAFETY

Health and Safety for the remediation and yard improvement work is carried out by the Remediation Contractor. The Home and Garden team, site visitors and Teck must sign off on the Remediation Contractor’s Health and Safety Program prior to visiting the site.

1. MATERIALS, SUPPLIES AND EQUIPMENT
   1. Forms and Templates
      1. Consent to Access Property for Remediaiton
      2. Remediation Plan
      3. Remediation Drawing
      4. Remediation Soil Log
      5. Remediation Completion Sign-Off
      6. Complaint Form
      7. Remediation Letter (example)
   2. Educational materials
      1. Yard maintenance brochure
   3. Equipment
      1. Video camera and digital camera
      2. Spade or shovel
      3. Clean Poly bags (i.e. Ziploc)
      4. XRF Metals Analyzer
      5. DI water
      6. Paper towels
      7. Nitrile gloves
      8. Sharpie marker
   4. Supporting materials
      1. Garden Kits as part of Healthy Homes program
2. PROCEDURE
   1. **Consent for Remediation**: Remediation and yard improvement work through the Home and Garden Program is voluntary and requires signed consent from the Property Owner prior to starting.
   2. **Pre-remediation Planning:** Begin by recording lead concentrations on the property condition checklist for an overview of yard conditions. Review leachable metals analysis (TCLP or SPLP) for soil disposal, if available and request samples be submitted for additional analysis if required (see Soil Assessment POP). With this information begin to develop the scope of work on the Remediation Plan.
      1. **Backfill Sampling:** Potential backfill sources are sampled and analyzed for metals and soil nutrients to ensure quality soil is replaced in-situ. Discuss the location of the preferred backfill sources with the Remediation Contractor. Submit samples for metals analysis with Caro Labs and for nutrient analysis with Pacific Soil Analysis Inc.
      2. **Preparing Regulatory Documentation:** If the Remediation Plan includes removing soil that exceeds Upper Cap Concentrations outlined in BC Contaminated Site Regulation Protocol 11, independent remediation documents must be filed. Directions for filling out and submitting the appropriate regulatory documentation are included on the Ministry of Environment Contaminated Site Regulation Protocol 12 <http://www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/protocols/pdf/p12_2013.pdf>
   3. **Remediation Planning**: The Remediation Plan is finalized at an onsite meeting with the Property Owner(s) and the Remediation Contractor. The Remediation Plan must ensure the work is risk protective, technically feasible and agreeable to the Property Owner. The Remediation Plan includes;
      1. the scope of the remediation work (i.e. full remediation, partial remediation, yard improvement);
      2. property access issues;
      3. the depth of any excavations (if required);
      4. tasks for the property owner to complete prior to the work (i.e. removing patio furniture, lawn ornaments, play structures, etc.);
      5. details on the replacement of landscape items (i.e. sod, gravel, shrubs, etc.);
      6. a sketch of the property with the proposed remediation.

The Remediation Plan is signed by all parties and submitted to Teck for approval prior to the start of the work. A copy is provided to the Remediation Contractor and the Home and Garden team.

* 1. **Remediation and Yard Improvement Work**: Remediation and yard improvement work is completed by the Remediation Contractor as follows.
     1. **Locating Underground Utilities:** Utility locates are completed by the Remediation Contractor prior to excavation work on a property. A BC 1-Call must be submitted at least 3 days before the start of the work and followed up with a physical locate of underground utilities as well as a discussion with the Property Owner to identify unique property features that may not show up during a locate (i.e. underground sprinkler system, oil storage tanks, unmarked electrical lines, etc.)
     2. **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.
     3. **Excavating Soil:** Soil is removed to a depth of 30 cm for yard remediation, 60 cm for vegetable garden remediation or as specified on the remediation plan. Yard improvement work generally requires an excavation depth of 10 – 15 cm to remove existing organic matter and provide a good base for new sod.
     4. **Disposing of Soil:** 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 further assay and the location of where to drop the soil must be coordinated with Teck.
     5. **Installation of a Demarcation Layer:** 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.
     6. **Replacing Suitable Backfill:** Tested and approved backfill material is placed on the property as specified in the Remediation Plan.
     7. **Restore Landscaping:** Landscape features such as sod, gravel, stone, replacement plants, etc. are installed to complete the work. Care for landscaping is provided by the Remediation Contractor for 2 weeks before passing it over to the Property Owner and/or tenant.
     8. **Job Clean Up:** The property is left clean and in good condition following the remediation work. Pavement areas are washed off, material stockpiles are hauled off-site and equipment and tools are removed from the property.
  2. **Remediation Monitoring and Oversight:** The monitoring and oversight portion of the remediation work is completed by the Home and Garden team to ensure that the work detailed above is carried out as defined in the Remediation Plan. In addition, the Home and Garden team:
     1. **Submits Regulatory Documentation:** Independent remediation documents are sent to the Ministry of Environment Site Advisor within 3 days from the start of the remediation work.
     2. **Video of the Property:** As a record of initial property condition a video is taken from the property prior to the start of the work.
     3. **Excavation Base Sampling**: At the final depth of any excavations, base samples are collected at locations similar to sample locations recorded on the property condition checklist. The purpose is to ensure that soil greater than the UCC has been removed from the property and to record soil metal concentrations below the demarcation layer.
     4. **Post Remediation Sampling**: Following the placement of backfill materials, samples of the replaced soil are collected and submitted for laboratory analysis of SALM.
     5. **Measurement:** Payment to the Remediation Contractor is on a per unit basis. 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 volumes of each property are recorded in THE Database.
     6. **Remediation Completion:** The Property Owner is requested to sign off on the completed remediation work. Deficiencies can be brought up and recorded on the completion sign-off form. Plants are under warranty for 1 year following installation.
  3. **XRF Soil Screening**: Samples collected for metals during the remediation work are screened using an X-Ray Fluorescence Analyzer (XRF). All employees using the XRF must be certified and trained prior to using the analyzer. Procedures for operating the XRF, including safety features, are provided in the *XRF Operating Procedures*. Excavation samples are screened on the property and in the soil lab at the CPO. Post remediation samples are screened in the CPO. Samples are homogenized and screened directly through the Ziploc bag. The screening readings are downloaded to a computer and recorded on the remediation soil log.
  4. **Laboratory analysis**: A composite sample of post remediation samples is submitted for laboratory analysis. In cases where only part of the yard is remediated only samples from that part of the yard are submitted. For full remediation properties, a selection of excavation base samples are submitted to ensure that soil exceeding the Upper Cap Concentrations is not present in the top 1 m of soil on the property. Samples are submitted to the lab in clean glass jar. Samples are named using standard naming:
     1. For excavation base:

**EXYY-PID-SAMPLE NUMBER-YYMMDD**

EX =excavation base sample.

YY=year

PID= property identification

Sample number=01-10 for yards, FG1 for flower gardens, VG1 for vegetable gardens

Date= in format Year Month Day YYMMDD

* + 1. For post remediation:

**PRYY-PID-SAMPLE NUMBER-YYMMDD**

As above except

PR = Post remediation sample

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 Strong Acid Leachable Metals (SALM) method. The metals analysis is received on a Certificate of Analysis (COA) from the lab.

* 1. **Data Management:** Information from the remediation 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.
  2. **Reporting:** 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 the remediation properties and results is provided to Teck by the end of January following the remediation season.
  3. **Quality Assurance/Quality Control (QA/QC):**
     1. Cleaning equipment: between each sample the soil auger or spade must be cleaned using DI water and a clean paper towel or wipe. Nitrile gloves must be changed between each sample
     2. Blind Duplicate sampling: Split one of every 10 samples into two separate samples and submit one under an alias sample ID. Results are compared using relative percent difference (RPD).
     3. Laboratory certificate of analysis (COA) review: Review of laboratory errors to ensure all lab procedures were completed correctly.

1. MONITORING, EVALUATING AND CONTINOUS IMPROVEMENT

A successful remediation program includes:

* Completing yard improvement work on all properties where young children are present and may be exposed to metals in bare soil.
* Completing garden remediation on all properties with soil greater than the Action Levels and the property owner is interested.
* Completing yard remediation on all properties where soil is greater than the Action Levels and the property owner is interested.
* Having no complaints from tenants or property owners during the remediation.
* Having no health and safety incidents.
* Leaving all yards with scheduled work better than before we entered the property.
* Having no to minimal damage to properties where work was performed.

1. REFERENCES

1. Defined by the BC Ministry of Environment Protocol 12. [↑](#footnote-ref-1)