TRAIL AREA
Health & Environment Program

"It Starts with the Kids!"

SEPTEMBER 9, 2014

Foreword

September 9, 2014

Chairing the Trail Area Health & Environment Committee (THEC) goes with the job of Mayor. It always has since the Task Force began 25 years ago, created as a community-led initiative comprising the Company, the government Health and Environment agencies, parents and other community representatives, all working together to deal with the issue of lead in our community. It has been a remarkable success. The spirit of cooperation, openness and trust amongst all the participants while dealing effectively with such a sensitive issue has been outstanding. It has been one of the most rewarding experiences of my public life.

I am pleased to present the third edition of our community program, now called the Trail Area Health & Environment Program (THEP). It is certainly the most comprehensive and inclusive version: broader in scope, more encompassing in its application, yet more tightly integrated. It addresses the most recent advances in scientific research on lead, which is ever more stringent. The goal posts keep moving, but so do we. We were ambitious with our goals when we began back in 1989; we met them, and we'll meet our new goals. It's what we do, together. Teck has a major role to play in this; control of fugitive dust from its operations is a key part of this program, an essential contributor to achieving those goals. Teck has done an outstanding job in reducing process emissions; we are counting on them to do the same with fugitive emissions.

This Program also explores the broader opportunities for enhancing childhood development. This is a great new initiative. A child's early development is dependent on many factors. Communities generally should do more to support children and families in these critical years when their capacity to succeed and thrive is being determined. Here's where Trail can show the way. Our new plan describes not only how we will continue to prevent children's lead exposure and further reduce levels of lead in the local environment, but also how we will grow our efforts to work with the community on the broad variety of factors that contribute to children's positive development. We have an enthusiastic core community group, including THEC, keen to champion this vision of a community that cares for its kids and supports the families that nurture them. Through this broader approach, we can make a much stronger contribution to our children's development than through focusing solely on lead. Our business is far more than lead: it's raising the champions of tomorrow!

Finally, I want to express my sincere appreciation and thanks to everyone who has contributed to this Program. We have a great team and it has produced an outstanding Program, incorporating a wealth of knowledge and 25 years of experience. That team includes the community, so important; it's our Program and together we will all make it happen.

Mayor Dieter Bogs
Chair, Trail Area Health & Environment Committee

The Trail Area Health & Environment Program
Collaboration in Action

The Trail Area Health & Environment Program (THEP) represents a unique collaboration of entities combining their knowledge, experience and interests to create and implement a comprehensive Program designed to achieve the objectives and goals agreed to by the stakeholders. The stakeholders comprise the BC Ministry of Environment, Interior Health, Teck Metals Ltd., and the Community itself, represented by the City of Trail and individual community members. All have their own mandates and responsibilities, yet are willing to work cooperatively together towards mutually desired goals.

The success of this collaboration is measured in the progress that has been made, and in the spirit of trust, respect and determination that is reflected in this edition of the THEP. This is a living document that will transcend changes within the stakeholders and will represent an integrated approach to the enhancement of relationships and development of services.

We, the Trail Area Health & Environment Committee, believe the THEP combines the elements necessary to protect and enhance the health and environment of the Trail community, based on 25 years of past experience, extensive research and consultation with community residents, continuing improvements in abatement technology, and the most recent conclusions of Canadian and US health agencies with respect to lead exposure risks.

This is not a legal document. Its strength is that the signatories below publicly acknowledge the cooperative spirit by which this Program has been developed, and the expectation that the various elements of the Program, as they evolve, will be diligently carried out. While the commitments and goals were established in good faith, it is understood that the issues are complex, technologies change and science continues to evolve. As it has in the past, we anticipate this Program will need to adapt in the future as circumstances change. The THEC will work with others to monitor progress, ensure appropriate action is taken when needed, and ensure the Community is fully informed on progress and change.

For the Trail Area Health & Environment Committee:

Date: September 9, 2014

_____	_____	_____
Dieter Bogs, Chair City of Trail	Craig Adams Community Representative	Steve Como USWA Local 480
_____	_____	_____
Bert Crockett Village of Warfield	Gord DeRosa City of Trail	Ali Grieve Director, RDKB, Area A

_____ Ron Joseph Community Representative	_____ Graham Kenyon Community Representative	_____ Brad McCandlish BC Ministry of Environment
_____ Marylynn Rakuson Community Representative	_____ Jeannine Stefani Interior Health Authority	_____ Sonia Tavares Community Representative
_____ Brandi Thirsk Community Representative	_____ Mark Tinholt Teck Trail Operations	_____ Cheryl Whittleton Interior Health Authority

_____
Linda Worley
Director, RDKB, Area B

TRAIL AREA HEALTH & ENVIRONMENT PROGRAM

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EXECUTIVE SUMMARY

Trail, British Columbia has been the site of a major lead and zinc smelting facility for over 100 years. While the goal was to recover as much metal as possible from ore, due to the limits of metallurgical capabilities, lead and other metals from the ore have been emitted to the air. Both stack and fugitive emissions (e.g., dust that escapes from buildings, stockpiles, roadways and other activities on site) have resulted in the deposition of metals in dust in the Trail area. People, plants and animals can become exposed to these metals in the dust, air and soil. If exposures to metals are high enough, there is a risk (or chance) of health or ecological effects.

The Trail Area Health & Environment Program (THEP) is a comprehensive collaborative integrated program that has evolved by continuous effort since 1988 to improve the Trail area environment, and promote and protect the health of the community related to smelter operations. For the first decade, the THEP was known as the Trail Lead Program.

The Trail Area Health & Environment Committee (THEC) is responsible for the THEP. The THEC was established in 2001 with similar structure and purpose to its predecessor, the Trail Community Lead Task Force (Task Force). The Task Force was formed as a community-industry-government partnership to reduce children's blood lead levels.

Mission, Vision and Values

The THEC communicates its purpose through its Vision, Mission and Values.

> **Vision -** A community with healthy children and families, a clean environment and thriving economy.
>
> **Mission -** THEC promotes a healthy environment through a comprehensive integrated program that successfully achieves our goals for air quality and children's blood lead levels, and promotes the health of the community.
>
> **Values -** Health, community-led, partnership, science-based, accountability, trustworthy.

The THEP's activities work together towards achieving the following goal:

> **To reduce exposure to lead and other smelter metals in the community on a continual improvement basis.**

The THEP is a community-led program, and community engagement is fundamental to the functioning of the THEC and the THEP. Community involvement in program governance makes this program unique and contributes to its success. Several diverse approaches are used to communicate with and involve the community; research has found that programs are more successful when program recipients, allied community groups, and their communities are actively engaged. The THEC is accountable to the community, and wants

to continue to earn and build on the trust that has been shown to the Task Force and THEP in the past.

Program Components

The THEP has five components of operation (Figure E-1): Air Quality; Family Health; Home & Garden; Property Development; and, Parks & Wildlands. Together, this Program is intended to meet and go well beyond the requirements of a wide area remediation plan under the BC Contaminated Sites Regulation.

Figure E-1. Trail Area Health & Environment Program

Air Quality - The Air Quality Program addresses stack and fugitive dust emissions from Teck Trail Operations, and dust control in the community. Various actions have been taken to reduce stack emissions of lead and other metals by over 99% since the 1990s. The goal of the Air Quality Program is continuous improvement in air quality, including achievement of the 2018 near-term objectives for lead and arsenic levels in community air. Teck has initiated a specific program to reduce fugitive dust emissions at the Teck Trail Operations site, which is now recognized as the greatest opportunity to further reduce emissions so that the 2018 objectives can be achieved.

Family Health - The Family Health Program reduces health risks from young children's exposure to lead in Trail and Rivervale, and promotes improved early childhood development outcomes in the Lower Columbia region. Approaches include: family and caregiver education, outreach and engagement; Healthy Families in-home visits for families

with children 12 months of age or younger; monitoring of children's blood lead levels; Case Management in-home visits; community and stakeholder collaboration; and, community outreach and communications.

Home & Garden - The Home & Garden Program uses several diverse approaches to prevent and reduce health risks from exposure to lead and smelter metals in the home and yard environment. The Healthy Homes Program was implemented to extend exposure prevention activities to all expectant families and families with children 36 months of age or younger in Trail and Rivervale. In-home visits are offered as support for families to reduce lead exposure. Residential soil assessment is available for Trail and Rivervale residents to prevent and reduce health risks from exposure to metals that may be present in yard and garden soil. Where Action Levels are exceeded, soil remediation is carried out. Yard improvement work is offered to Healthy Homes and Case Management families to reduce bare soil and improve ground cover; decisions are based on soil assessment results and visual inspection of the property. In addition, soil assessment may be done at other locations, such as playgrounds and school yards, where children spend a lot of time and where there may be concerns about metal concentrations or bare soil. A Home Renovation Support Program is available to make it easier for people to carry out "lead-safe" home renovation, construction, demolition or excavation activities.

Parks & Wildlands - The Parks & Wildlands Program decreases human and ecological exposures and risks in urban and wildland areas. The Community Greening Program works to suppress dust through the greening of bare soil sites within the City of Trail. The Lower Columbia Ecosystem Management Program (LCEMP) is a collaborative approach to assess, rehabilitate, conserve and enhance land-based wildland (including wetland and riverbank or creekbank) ecosystems in the LCEMP area.

Property Development - The Property Development Program (PDP) works with property owners and developers to address metals in surface soil during the redevelopment or new development of commercial, industrial or residential property within the Program Area. The PDP exists as a separate program from the Home & Garden Program (that addresses existing residential properties) because new developments/redevelopments typically involve significant excavation, movement of soil and potentially new fill, creating a specific opportunity to address soil contamination on the property.

Monitoring, Evaluation and Continuous Improvement

The THEP includes ongoing monitoring, evaluation and continuous improvement to stay on track towards objectives, respond to new information and priorities, uphold the public's trust, and use program resources efficiently and effectively. This includes: Teck's air quality monitoring program; annual children's blood lead testing; monitoring and updates on program components; regular THEC and related meetings; organizational and program management processes; and, professional development. THEC and Program staff also stay abreast of the latest information on lead exposure, health and environmental effects, and children's healthy development. This has included commissioning two literature reviews on lead exposure reduction and children's healthy development in 2013.

Progress Towards Objectives

The THEC's blood lead objectives are to have an average blood lead level of 4 µg/dL for children aged 6 months to 36 months in Trail and Rivervale by 2015 and at least 95% of children's blood lead levels below 10 µg/dL by 2015. The community average has been approximately 5 µg/dL for about a decade. The Fugitive Dust Reduction Program offers the greatest opportunity to further reduce emissions and lead exposure with the anticipated result of reducing blood lead levels.

The THEC's air quality objectives are to have an annual average of lead in community air[1] of 0.20 µg/m^3 or lower by 2018 and an annual average of arsenic in community air of 0.01 µg/m^3 or lower by that same year. In 2013, the annual average for lead in air was 0.34 µg/m^3 and for arsenic was 0.013 µg/m^3. Teck is committed to reducing emissions; the Fugitive Dust Reduction Program offers the greatest opportunity to improve air quality and meet these objectives.

The blood lead clinic participation objective is to have a minimum of 75% of children aged 6 months to 36 months in Trail and Rivervale participate in the fall blood lead testing clinics each year. In 2013, the participation rate was 74%, up slightly from the last few years.

The objective for the Home Renovation Support Program (HRSP) is to have all home renovators in Trail and Rivervale, and renovators of pre-1976 homes throughout Greater Trail use the HRSP. There is no attempt to track all home renovations in Greater Trail. However, since 2010, the numbers of requests for home renovation support have been tracked, in the hope of maintaining a high level of requests and an increasing trend. In the past four years starting with 2010, the numbers of HRSP requests have been 70, 93, 62 and 93.

The ultimate measure of the success of the THEP is to uphold the vision of a community with healthy children and families, a clean environment and thriving economy. This is difficult to measure, with all the factors that influence health, the environment and the economy. As such, the THEP integrates activities that contribute to children's healthy development, ecological rehabilitation, and economic growth.

[1] As measured at Butler Park station as total suspended particulate for lead, and inhalable particulate (PM_{10}) for arsenic.

TRAIL AREA HEALTH & ENVIRONMENT PROGRAM

1.0 INTRODUCTION

Trail, British Columbia has been the site of a major lead and zinc smelting facility for over 100 years. While the goal was to recover as much metal as possible from ore, due to the limits of metallurgical capabilities, lead and other metals from the ore have been emitted to the air. Both stack and fugitive emissions (e.g., dust that escapes from buildings, stockpiles, roadways and other activities on site) have resulted in the deposition of metals in dust in the Trail area. People, plants and animals can become exposed to these metals in the dust, air and soil. If exposures to metals are high enough, there is a risk (or chance) of health or ecological effects.

The Trail Area Health & Environment Program (THEP) is a comprehensive collaborative integrated program that has evolved by continuous effort since 1988 to improve the Trail area environment, and promote and protect the health of the community related to smelter operations. For the first decade, the THEP was known as the Trail Lead Program.

The Trail Area Health & Environment Committee (THEC) is responsible for the THEP. The THEC was established in 2001 with similar structure and purpose to its predecessor, the Trail Community Lead Task Force (Task Force). The Task Force was formed as a community-industry-government partnership to reduce children's blood lead levels.

From the start, the Task Force established community priorities and adopted a community-driven approach. This approach continues with the THEC and is exemplified by the participation of community representatives on the THEC, communication and consultation with local residents, a collaborative style of working with families, and participation in the Family Action Network, a Greater Trail coalition dedicated to family-friendly development in the Lower Columbia region. The THEC's collaborative approach has been recognized internationally as an effective model for protecting health and the environment. The THEC was honoured with a Premier's Award for Partnership in 2011.

The Trail Area Health & Environment Program is currently guided by the following purposes:

- Further reduce children's blood lead levels to meet objectives acceptable to the community;
- Further reduce smelter emissions to achieve air quality objectives acceptable to the community;
- Maintain comprehensive, reliable and timely monitoring systems for blood lead levels and environmental indicators;
- Offer education, counselling, family in-home visits, home and yard assessments and home renovation support to complement emissions reduction;
- Support children's healthy development through partnerships and by emphasizing early childhood development in family in-home visits and communications;

- Support the development of business and industrial property by clarifying responsibilities and instituting procedures in accordance with environmental legislation;
- Support the rehabilitation and conservation of wildlands via the Lower Columbia Ecosystem Management Program (LCEMP);
- Maintain regular open, honest, two-way communication with the community and stakeholders: inform, educate, advise, listen, and uphold trust and confidence; and,
- Meet the requirements of the Contaminated Sites Regulation.

This is the third major review and update of the THEP. Continual improvement means continual change; new information, new technologies and the ongoing evolution of the community will lead to new aspirations and goals in the future. As such, this document is not the final edition of the THEP; it will be reviewed and adapted regularly as new information and technologies become available.

The THEP is intended to meet the requirements of a wide area remediation plan under the Contaminated Sites Regulation (CSR), by addressing concentrations of metals in soil that exceed standards. Therefore, the THEP will serve as the basis for Teck's submission to the BC Ministry of Environment (MoE) for approval under the CSR. However, the THEP goes beyond the CSR's focus on soil contamination to address the main pathway for human health risks in Trail, hand-to-mouth ingestion of fugitive dust by toddlers. In addition, the THEP integrates activities that uphold the vision of a community with healthy children and families, a clean environment and thriving economy.

The THEC supports the Trail Area Health & Environment Program described in this document. The THEC believes the THEP combines all of the elements necessary to protect and enhance the health and environment of the Trail community, based on over 20 years of past experience, extensive research and consultation with community residents, and in light of the most recent conclusions of the Canadian and US health agencies with respect to lead exposure risks.

To facilitate public review of the THEP, this document is written in an accessible style. The detailed and technical documentation required by the BC Ministry of Environment has been compiled into Appendix A. Section 7 lists the reference materials supporting this document.

2.0 BACKGROUND AND HISTORY

This section provides background on the THEP, the Program boundaries, governance, Program delivery as well as a brief history and rationale for the THEP.

2.1 The THEP

The THEP has five components of operation (Figure 2-1): Air Quality; Family Health; Home & Garden; Property Development; and, Parks & Wildlands.

Figure 2-1. Trail Area Health & Environment Program

The THEP's activities use best practices and work in a comprehensive, collaborative and integrated manner toward achieving an overall goal to reduce exposure to lead and other smelter metals in the community on a continual improvement basis. Program components are described in detail in Section 5.

2.2 Program Boundaries

The different THEP components focus on activities that take place within different geographic boundaries. The boundaries are different based on the types of risks (e.g., human health versus ecological), the magnitude of risk (e.g., exposure closer to the smelter vs. farther away), and types of risk management activities (e.g., to address air quality, children's exposure to lead, ecological impacts, etc.).

Community Program Area

The Community Program Area focuses on human health and is divided into three main areas as shown in Figure 2-2, and described as follows:

- Trail and Rivervale[2], the communities closest to the smelter and where potential risks are higher, as identified from previous studies;
- The outlying communities (Warfield, Oasis, Casino and Waneta) where potential risks are low; and,
- The Greater Trail/Lower Columbia area.

The Family Health Program, including monitoring blood lead levels against objectives, focuses on Trail and Rivervale, although blood testing is offered on request to the outlying communities. Similarly, the Home & Garden Program, Parks Program (Community Greening) and Property Development Program also focus on Trail and Rivervale, although services may be offered to the outlying communites (or provided on a case-by-case basis depending on the circumstances). Home Renovation Support is offered to an even broader area, including the communities of Fruitvale, Rossland and Genelle as a means to foster lead paint awareness and lead-safe home renovation in the broader community.

Lower Columbia Ecosystem Management Program Area

The Wildlands Program (LCEMP) focuses on land-based ecosystems and addresses wildland areas where impacts were identified from the ecological risk assessment (ERA). It also includes areas where there are opportunities for offsetting ecological outcomes at a landscape level in the Canadian Lower Columbia Valley. Details are provided in Section 5.4.2.

[2] Historically, the Lead Task Force referred to these communities as Areas 2 and 3, with the outlying communities (Warfield, Oasis, Casino and Waneta) refered to as Area 1.

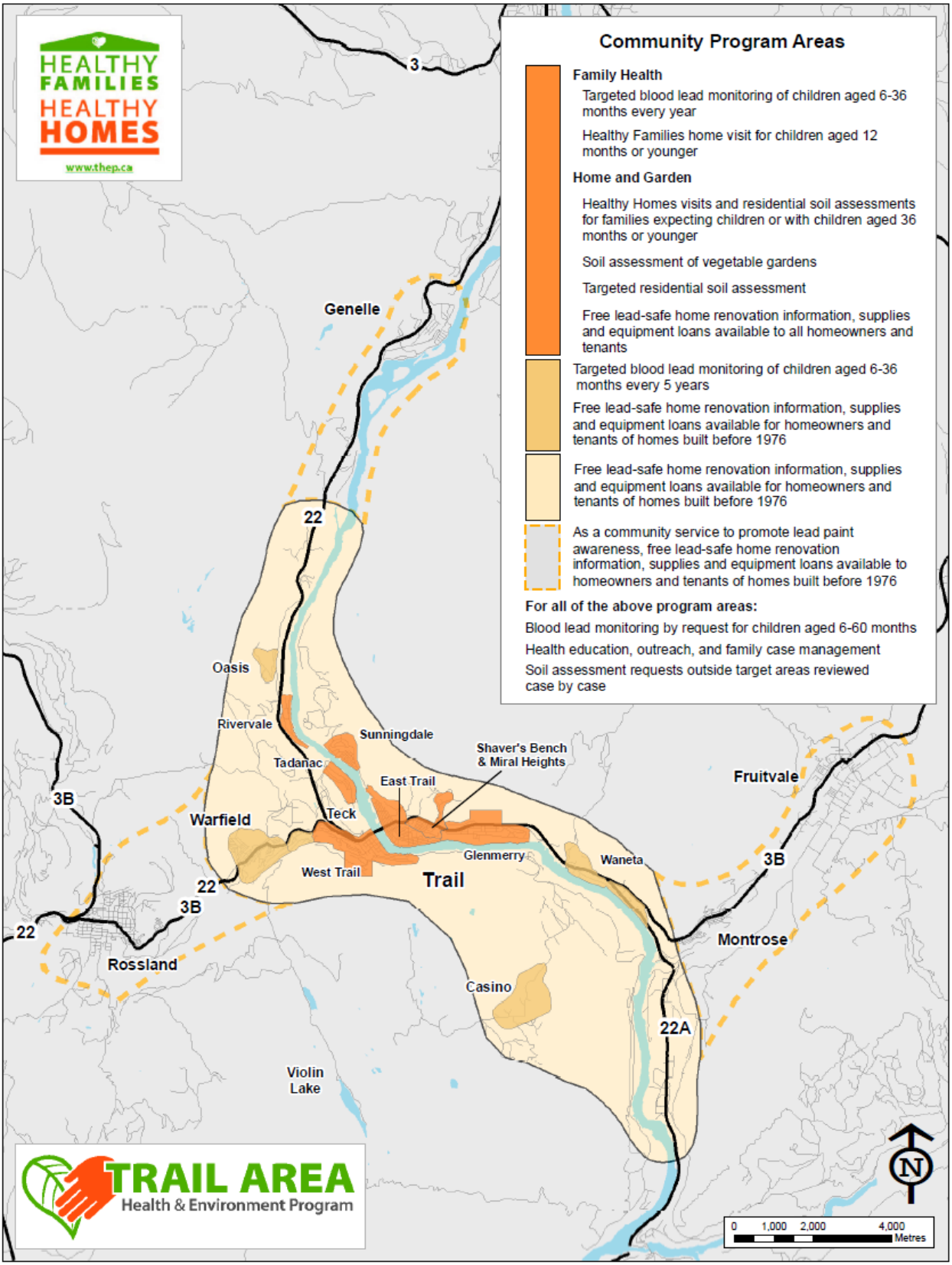

Figure 2-2. Community Program Area

2.3 Governance

The Trail Area Health & Environment Committee provides governance for the THEP. The THEC is a partnership between the local community, Teck, Interior Health and the BC Ministry of Environment, Environmental Protection Division. The THEC is formally established as a Sub-Committee of the City of Trail with Terms of Reference approved by Trail City Council.

The mandate of the THEC (as described in its Terms of Reference; see Appendix B) is to reduce exposure to lead and other smelter metals in the community on a continual improvement basis. The functions of THEC, within the mandate, are to:

- Monitor, coordinate and advise (Trail City) Council on the implementation of the Trail Area Health & Environment Program;
- Facilitate public communication and oversight with respect to delivery of services and progress toward the Committee's mandate;
- Provide for public financial accountability, especially in terms of public input on priority setting; and,
- Participate directly in the development of the final remedial plan for the area.

To support effective governance, the THEC has an Executive Committee comprised of one representative each from the City of Trail, Ministry of Environment, Interior Health, and Teck.

The THEC also establishes working groups and advisory groups from time to time to support its work and to oversee specific initiatives. This includes technical working groups that investigate and make recommendations on specific issues. One group that commenced in 2013 is:

- Air Quality Technical Working Group. This group is comprised of THEC members and technical specialists from Teck Trail Operations. The purpose is to gain a better understanding of and prioritize air quality issues that impact the community, including health and aesthetic concerns.

In addition to the THEC, there is a Wide Area Remediation Plan (WARP) Steering Committee, comprised of representatives of Teck and the Ministry of Environment (both the Land Remediation Section and Environment Protection Division). The purpose of the WARP Steering Committee is to oversee and approve the aspects of the Program that are under the jurisdiction of the CSR.

2.4 Program Delivery

Program delivery is provided in a collaborative manner that reflects the expertise and mandates of the organizations involved.

2.4.1 *Program Delivery Partners*

Program activities and services are delivered by different THEC partners:

- Interior Health provides the Family Health Program.
- Teck Trail Operations provides the Air Quality, Parks & Wildlands, Home & Garden, and Property Development Programs; the latter two Program components are provided via a contractor, SNC-Lavalin Inc., Environment & Water (SNC-Lavalin).
- BC Ministry of Environment oversees Teck's emissions levels and environmental monitoring.
- City of Trail conducts street sweeping and contracts Program Management services.

2.4.2 *Program Team*

Collaboration between the Family Health, Home & Garden and Property Development Programs is facilitated through a collaborative Program Team comprised of the Program Manager, the Home & Garden Team (the Trail office manager and staff from SNC-Lavalin), an Interior Health Public Health Registered Nurse (RN) who supports the Family Health Program, and, the Superintendent of Environmental Remediation for Teck Trail Operations.

2.5 History

It is almost 25 years since the Trail Community Lead Task Force (Task Force) began the journey that has led the THEP to where it is today. The establishment in 1990 of the joint Task Force, comprising the provincial government environment and health agencies, the company and the community, represented by Trail parents and the Mayor of Trail as Chair, was a bold new approach to collaborative problem-solving. It was unprecedented in its devolution of power, acknowledging the role of the community and its citizens in participating directly in the critical choices and decisions that would influence their future.

The Task Force launched initiatives to reduce and measure environmental exposures, and provide family case management. Installation of the KIVCET smelter in 1997 brought about substantial decreases in emissions. Meanwhile, the Task Force also 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). In 2001, the Task Force made the following recommendations:

- Interior Health Authority (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;
- Company (Teck, formerly Cominco): 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;
- 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 to monitor, coordinate, and advise on the implementation of the Task Force's recommendations.

The activities undertaken since 1990 are shown on the timeline in Figure 2-3. This figure illustrates the THEC's commitment from the beginning to understand the influence of the smelter on the community and the environment. It was recognized that these studies would take time, and so the decision was made to move forward with actions to help address metal exposures, and also educate and involve the community. There was no need to wait for the final answers before implementing these programs and activities that would be evaluated based on their feasibility in Trail (Hilts, 1993).

British Columbia environmental regulations were being developed over the early years of the Program as well (Figure 2-3). The CSR came into force in 1997, and included the requirement to not only consider human health effects but also ecological effects. Therefore, in 2000, studies were begun to evaluate the effects of historical smelter emissions on the environments around Trail. The conclusion of the ecological risk assessment was that priority actions should be undertaken to restore the plant communities in the area, and that restoring plant communities would enhance the habitat for wildlife; further details are provided in Section 5.4.2 and Appendix A. A Steering Committee was formed in 2010 to oversee the development and implementation of restoration activities via the Lower Columbia Ecosystem Management Program (LCEMP), which comprises the Wildlands component of the THEP Parks & Wildlands Program.

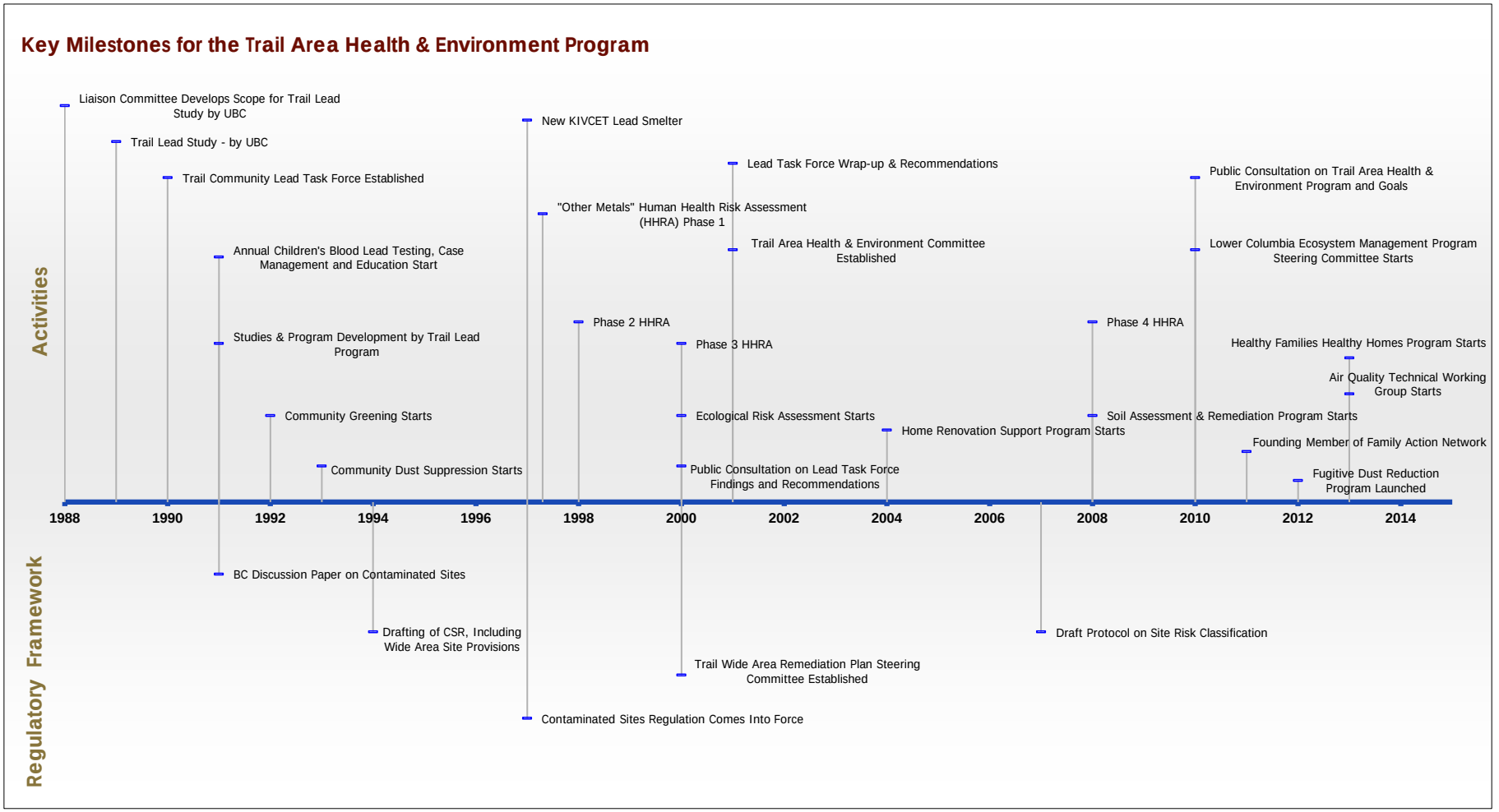

Figure 2-3. Key Milestones for the Trail Area Health & Environment Program

2.6 Rationale for the THEP: Issues and Strategies

Lead has been, and continues to be, the primary human health issue in the Trail community related to smelter emissions. There is considerable research that shows a link between blood lead levels and health effects. Children are known to be particularly vulnerable to the effects of lead. The goal for children's blood lead levels was to reduce the community average for pre-school aged children to 5 µg/dL from 13.5 µg/dL, the average measured during the 1989 University of British Columbia study (Hertzman et al., 1991) that preceded the formation of the Task Force. This goal was achieved in 2005 and new goals have been set since then. At the blood lead levels currently seen in Trail area children, effects would be subtle and not likely be measurable or noticeable in individual children.

It made sense for the Task Force to focus on lead while investigating the health risks from other smelter metals. A scientific evaluation of potential health concerns resulting from exposure to metals other than lead, referred to as a "human health risk assessment", was conducted in four phases from 1997 through 2008 (Exponent, 1997, 1998, 2000; Integral, 2008). This assessment used standard methods to model potential health risks of eight metals: antimony, arsenic, cadmium, mercury, selenium, thallium, tin and zinc. The human health risk assessments concluded that there were no imminent health risks posed by these other metals, and that the health program should continue its focus on lead. The reasoning was that reductions in lead emissions and, in the long term, remediation of lead in soil would address other metals, because there was an association between lead and the other metals in soil.

During the 2010 public consultation, discussions took place about how the THEP could incorporate more public health best practices related to early childhood development (ECD) and community engagement. ECD research shows that the early years of life are crucial to a person's life-long health and well-being. At the blood lead levels seen in Trail at that time, the THEC noted that there could be more important factors than lead exposure impacting young children's health, and the THEP might benefit from taking a broader ECD approach. The THEC also received public input suggesting that its communications take a more positive approach, noting that THEP is "one of the many great services for families that makes Trail a great place to raise children". This broader focus on children and family health became a defining feature of the THEC's vision to achieve the new blood lead goal of 4 µg/dL, and it spurred the THEC to become a founding member of the Family Action Network, a Greater Trail coalition dedicated to family-friendly development in the Lower Columbia region.

This new direction was reinforced when in 2012, an Advisory Committee of the US Centers for Disease Control and Prevention (US CDC) issued a paper recommending a fundamental change in policy with respect to young children's exposure to lead (ACCLPP, 2012). Also, Health Canada issued a report summarizing health effects associated with different blood lead levels, and an associated Risk Management Strategy (HC, 2013 a, b). These papers noted that adverse health effects are evident at lower blood lead levels than previously acknowledged, indicating that the previous 'level of concern' for community action of 10 µg/dL was no longer appropriate. The US CDC recommended a new approach, focusing

on exposure prevention, and set a 'reference level'[3], currently 5 µg/dL to identify children with lead exposure outside the typical range. Health Canada also focused on exposure prevention or reduction, but did not set a numerical objective; rather, the Government of Canada set a risk management objective for lead of "reducing exposure to the extent practicable". Following this guidance, the THEC saw this as an opportunity to reach out pro-actively to all young families in the target area, offering two family in-home visits (described in Sections 5.2.2 and 5.3.2).

The THEC now recognizes that reduction of fugitive emissions, emissions such as dust that escapes from buildings, stockpiles, roadways and other activities on site, is the main opportunity to further decrease exposures, and Teck Trail Operations has initiated a Fugitive Dust Reduction Program with the objective of achieving the 2018 air quality objectives.

Ongoing evaluation of air, dust and soil data and analysis of lead pathways indicate that, within the Community Program Area, educating and supporting families to reduce indoor dust may present a greater opportunity than soil remediation to reduce metals exposure for young children. Based on experiences at other smelter sites, soil remediation is one of the factors that can influence blood lead levels, but it will likely have only a modest effect on reducing blood lead levels, particularly while the smelter continues to operate and fugitive dust is the primary pathway (Aschengrau et al., 1994; Hilts, 2003; Taylor et al., 2013; US EPA, 1998; Weitzman et al., 1993; Yeoh et al., 2009). A better opportunity is to ensure good ground cover (such as sod, gravel, mulch, concrete) which helps reduce dust tracked into the home and reduces indoor dust, perhaps the primary way that children less than 3 years of age are exposed to lead.

In 2013, the THEC undertook literature reviews to update the THEC's knowledge of what other researchers and communities have learned about lead exposure reduction, and ways to improve children and family well-being in the community. These literature reviews examined:

1. The effectiveness of programs used at other mining and smelting sites to address elevated blood lead levels in children, and evaluate the effectiveness of specific intervention techniques (e.g., source reduction strategies, soil removal, dust mitigation, household cleaning, hand-washing, education programs, etc.) at reducing children's blood lead levels;
2. The factors other than blood lead that influence early childhood development, the effectiveness and benefits of different ECD interventions including in-home visits and community collaborative initiatives, and the features of those interventions that promote equity in health outcomes.

The review of programs at other mining and smelting sites examined the lead intervention programs at: Broken Hill, Australia; Port Pirie Australia; Torreón, Mexico; La Oroya, Peru;

[3] The 97.5 percentile of the blood lead level distribution for US children aged 1 to 5 years.

and, Herculaneum in the United States. The review highlighted several exposure reduction strategies that typically were implemented as a combined program (e.g., emissions reduction, soil replacement, in-home dust cleaning, smelter materials handling modifications, re-location of families with high lead exposure, education, etc.), so it was not possible to determine which interventions were responsible for the observed decrease in blood lead levels. There is evidence that emissions reduction has the greatest impact on reducing blood lead levels and that it needs to be part of any exposure reduction program. The evaluation of specific intervention techniques indicated that educational and home and yard lead exposure reduction programs may play a supporting role within an overall strategy of exposure reduction that included emissions reductions.

Lead is known to have toxic effects on the human nervous system, especially in children, as they are much more sensitive than adults to the effects of lead. Health Canada (2013a) has defined a range of 1 to 2 µg/dL of lead in blood that may be associated with a 1 point reduction in children's IQ. Effects have not been clinically diagnosed in individual children but rather were identified through studies of populations (large groups) of children (Wilson and Richardson, 2013). Many other factors, beyond lead exposure, contribute to IQ differences[4] including: socioeconomic status (+/- 12 IQ points), parent education (+/- 15 IQ points), attendance at an enriched pre-school (+/- 15 IQ points), breastfeeding (+/- 3 to 5 IQ points), and that the approximate error rate in children's IQ tests is +/- 3 IQ points (Wilson and Richardson, 2013). These other contributing factors could potentially be influenced in a positive way through improvements in early childhood education supports. This view is supported by the Port Pirie Cohort study, one of the few studies to follow participants into adulthood (three decades of data), that concluded "minimizing lead exposure in combination with improving other important early childhood factors such as parent-child interactions may be the best way to improve developmental outcomes" (Searle et al., 2014). The broad nature of the THEP includes consideration of how well the existing program components might contribute, at a family or community level, to improved ECD and children's health outcomes in the population (as well as what more could be done to further improve outcomes). Therefore, the supports for ECD that are within the THEP may create resilience or protection, or offset in some way the potential negative impacts from children's exposure to low levels of lead.

The literature identifies numerous factors that can have an influence on ECD, many of which are modifiable or can be mitigated, offering the potential for constructive intervention. These factors can be grouped into themes: health & safety; education; material well-being; family and peer relationships; participation; subjective well-being; behaviours and risks; and, environment. Areas of potential intervention include policy, programs, community development and "environmental" change (e.g., smoke free spaces, affordable housing).

The literature suggests that home-visiting programs aimed at addressing these factors can be effective, especially where part of a comprehensive, high-quality system of support for

[4] The magnitude of the potential effect reflects the values reported in the literature. They should not be interpreted as definitive, but rather as an approximate indication of the relative importance of these factors.

early childhood and family health and well-being (such as exists in the Trail area). The success of home visits is enhanced by engaging parents and collaborating with other ECD service providers and related organizations (i.e., inter-agency and cross-sector partnerships). A more in-depth review of the literature on home visiting confirmed these basic findings and highlighted potential opportunities for the THEC to hone its Program for families.

All of these recent reports, reviews and recommendations support the THEC's programming choices and emphasis, which also incorporate the public input provided by the community consultation. This research suggests that the THEP will be most successful if it remains a program that can adapt based on: advances in our understanding of the health risks from children's exposure to lead; effectiveness of strategies to reduce smelter emissions and blood lead levels as well as enhance early childhood development; and, working with parents, and public and community partners to provide health education and services.

2.7 Moving Forward

As can be seen in the timeline (Figure 2-3), the THEC continues to identify ways to support the community and the environment. The THEC has been able to address priorities and develop a THEP that works: a combination of source control, education, case management and localized exposure reduction, linked with a sophisticated monitoring system measuring environmental indicators, and blood lead sampling of young children who are most vulnerable to lead absorption.

The THEC has a track record of setting and achieving objectives for air quality and children's blood lead levels, and setting new goals when needed to ensure continuous improvement. It is acknowledged that Teck's emissions reduction makes the largest contribution to improved air quality and blood lead levels. Since the start of the Program, and primarily due to the KIVCET smelter, the air quality and environment of Trail have improved dramatically and stack emissions have been reduced by 99.5%. The THEC now recognizes that reduction of fugitive emissions, emissions such as dust that escapes from buildings, stockpiles, roadways and other activities on site, is the main opportunity to further decrease exposures, and there is a clear understanding of the issues of living with a major industrial operation in the community.

Also, the THEC now sees its mission more broadly. While the main focus is preventing exposure to smelter metals in the community, the Committee is actively involved in partnerships and projects that promote children's healthy development, including the Family Action Network.

3.0 PURPOSE AND GOALS

The THEC communicates its purpose through its Vision, Mission and Values.

Vision

A community with healthy children and families, a clean environment and thriving economy.

Mission

THEC promotes a healthy environment through a comprehensive integrated program that successfully achieves our goals for air quality and children's blood lead levels, and promotes the health of the community.

Values

Health – The bottom line is the health of people and the ecosystem: program resources are targeted to preventing health risks, promoting children and family health, and sustaining a healthy environment.

Community Led – The community drives decision-making about the THEP. Community members participate in the THEC; program goals and activities are reviewed by the community through regular public consultation.

Partnership – THEC uses a partnership approach to decision-making and has been recognized for the effectiveness of its collaborative multi-stakeholder model.

Science-based – The THEP is developed based on scientific research, evidence of effectiveness and a systematic approach to innovation of new best practices.

Accountability – THEC is accountable to the community, its partners and stakeholders through transparent decision-making, responsive and timely programming, and pro-active public communication and consultation.

Trustworthy – THEC is open, honest and transparent in its actions and communication with the public and with each other as partners on the Committee.

Goal and Objectives

The THEP's activities work together synergistically towards achieving the following goal:

To reduce exposure to lead and other smelter metals in the community on a continual improvement basis.

In 2011, to achieve this goal, the Program set new near-term objectives that had been proposed, reviewed and approved through public consultation in 2010:

1. To have an average[5] blood lead level of 4 µg/dL for children aged 6 months to 36 months in Trail and Rivervale by 2015;
2. To have at least 95% of children aged 6 months to 36 months in Trail and Rivervale with blood lead levels below 10 µg/dL by 2015[6];
3. To have an annual average of lead in community air[7] of 0.20 µg/m^3 or lower[8] by 2018;
4. To have an annual average of arsenic in community air[9] of 0.01 µg/m^3 or lower[10] by 2018;
5. To have a minimum of 75% of children aged 6 months to 36 months in Trail and Rivervale participate in blood lead testing clinics each year;
6. To have all home renovators in Trail and Rivervale, and renovators of pre-1976 homes throughout Greater Trail use the Home Renovation Support Program;
7. To have at least 75% participation[11] in the Healthy Families Healthy Homes Program each year.

[5] We use the term "average" to refer to the geometric mean (geomean) of the children's blood lead levels because it is a more widely understood concept. The geomean is the most widely used representation of "central tendency" (i.e., one's notion of "middle") for blood lead distributions.

[6] Although 10 µg/dL is no longer the international "level of concern", this objective was established in 2010 and was approved by the community through public consultation.

[7] As measured in total suspended particulate at Butler Park station.

[8] The objective for lead was based on the 30-day Ontario Ambient Air Quality Criterion (OMOE, 2007) of 0.2 µg/m^3 for lead and its compounds. This value was the most current and stringent guideline in Canada when the objective was set, and remains the criterion in Ontario (OMOE, 2012).

[9] As measured in inhalable (PM_{10}) particulate at Butler Park station.

[10] The objective for arsenic was based on the annual average Alberta Ambient Air Quality Objective (Alberta, 2005) of 0.01 µg/m^3 (0.0033 ppb). This value was the most current and stringent guideline in Canada when the objective was set. This Objective was reviewed in 2013 and remains unchanged.

[11] As measured by the number of families visited out of the total list of families (in a given year) with children in the target age range living in Trail and Rivervale: children 12 months and younger for Healthy Families; children 36 months and younger and expectant families for Healthy Homes.

4.0 COMMUNITY ENGAGEMENT AND PUBLIC OUTREACH

Community engagement is fundamental to the functioning of the THEC and the THEP. Community engagement is an end in itself; it is a community development and health promotion best practice - strong relationships support a healthy community.

Community engagement is a lens through which one can understand the essence of the THEP and what makes it unique. In the words of one THEC member:

> "The Trail Area Health & Environment Program combines all of the elements necessary to protect and enhance the health and environment of the Trail community. It is unique in that, from the initial program developed over 20 years ago, it has been led and overseen by the community itself."

The objectives of community engagement are to:

- Be accountable to the community;
- Build trust and continue to earn public trust;
- Encourage community participation in governance;
- Encourage public "buy in" and commitment to the THEP;
- Achieve public health objectives including informing the public about health risks, programs and opportunities to address risks;
- Receive public guidance about acceptable community risks and THEP programming;
- Build relationships to support collaborative action to achieve goals; and,
- Fulfill government requirements.

These objectives are met by:

- Community engagement in governance;
- Public consultation;
- Parent/caregiver engagement;
- Community collaboration; and,
- Public outreach and accountability.

An overview of community engagement and public outreach activities is provided below. Details on public consultation and communication are given in Appendix A, Section A-4.7.

4.1 Community Engagement in Governance

Community leadership and participation is essential to the THEC. It is enshrined in the organizational structure of the THEC and reinforced through continuous ongoing outreach and engagement activities. Community engagement is enshrined in governance through the following means:

- The THEC is formally established as a sub-committee of the Trail City Council.
- The THEC is chaired by the Mayor of Trail.

- A majority (11 of 16) of seats on the THEC are held by the community, either elected representatives or members from the community at large. There is one seat for the Chair, an additional seat for Trail City Council, one seat each for elected representatives from Warfield and Regional District of Kootenay Boundary Areas A and B, and up to 6 seats for members of the community at large.
- Meetings are open to the public and the media. Agenda notices are sent to the local media in advance of each THEC meeting. Minutes are posted on the website, www.thep.ca.
- THEC regularly seeks new community members from its main client population – parents and caregivers of young children.

4.2 Public Consultation

The THEC has held two major public consultations since the inception of the THEP, in 2000/2001 and again in 2009/2010. These are the formal consultation activities that have been held in addition to all the regular outreach and communication activities described below and in detail in Appendix A, Section A-4.7.

2000/2001

The first public consultation was held in 2000 and led to the Task Force Report and recommendations to the BC Minister of Environment in 2001. The purpose of the consultation was to incorporate the public's long-term expectations for remedial activities. In addition, international experts were consulted so that the Task Force could benefit from their combined experience and knowledge of remedial efforts. The consultation methods, results and evaluation were summarized in Ferraro et al. (2000).

2009/2010

A second public consultation took place in 2009 and 2010. The purposes of the consultation were to update the public on health risks from smelter metals, assess public acceptability of new blood lead and air quality objectives and program activities to meet those objectives, and obtain input into a long-term plan to be submitted for approval to the BC Ministry of Environment under the CSR. The consultation methods, results and evaluations were compiled in Circle B Services (2011).

4.3 Parent/Caregiver Engagement

The THEC and the THEP Program Team use every opportunity to engage parents and caregivers of young children in governance as well as in providing advice and evaluative feedback on programs.

4.4 Community Collaboration

The THEP collaborates with many groups and organizations in the Trail area to extend outreach to families and build cross-sectoral networks to support children's healthy

development, promote lead-safe home renovations, enhance community greening, and support other objectives. Collaborations include:

- Participation in collaborative strategies with early learning service providers and community stakeholders to improve children's healthy development (this includes Greater Trail Success by 6 and the Family Action Network); and,
- Collaboration with the Trail Communities in Bloom Committee, from time to time, as part of an ongoing commitment to support their volunteer efforts toward community greening and environmental enhancement in the City of Trail.

4.5 Public Outreach and Accountability

Public outreach and accountability are achieved via several different approaches and media:

- Community Program Office, located at 1319 Bay Avenue in downtown Trail, where THEP clients and members of the public can get information or sign up for programs;
- Branding, including the use of identifiable logos;
- The website www.thep.ca;
- News releases to announce the results of annual children's lead testing each November, as well as from time to time to announce program changes, updates about health risks from lead exposure, lead exposure prevention tips, and special events;
- Brochures, posters, fridge magnets and rack cards for educational purposes and to promote programs;
- Information tables at family-friendly community events;
- Community newsletters; and,
- Radio ads.

4.6 Summary of the Community Engagement and Public Outreach Activities

Community engagement is fundamental to the functioning of the THEC and the THEP. Several diverse approaches are used to communicate with and involve the community; research has found that programs are more successful when program recipients, allied community groups, and their communities are actively engaged. The THEC also is accountable to the community, and wants to continue to earn and build on the trust that has been shown to the Task Force and the THEP in the past.

5.0 PROGRAM COMPONENTS

The Trail Area Health & Environment Program includes five components:

1. Air Quality
2. Family Health
3. Home & Garden
4. Parks & Wildlands
5. Property Development.

These program components operate as an integrated program to provide a comprehensive, collaborative approach to achieving the goal **to reduce exposure to lead and other smelter metals in the community on a continual improvement basis**.

5.1 Air Quality

Emission reductions are the single most effective way to further reduce children's blood lead levels. The goal of the Air Quality Program is continuous improvement in air quality, including achievement of the 2018 near-term objectives for lead and arsenic levels in community air.

The Air Quality Program includes four main approaches:

1. Implementing technology to reduce emissions;
2. Finding and reducing fugitive emissions of dust from sources other than the stacks;
3. Optimizing performance of emissions control equipment; and,
4. Suppressing dust in the community.

Each of these approaches is described in detail below. Air Quality monitoring is described in Section 5.1.5.

5.1.1 *Technology to Reduce Emissions*

Teck Trail Operations has long been in the forefront of industrial environmental protection technology, going back to the first acid plant in 1915 and the implementation of fertilizer production in 1930 to utilize captured sulphur. In the decades that followed, many environmental improvements were made at the operation.

In 1977, the Trail Modernization Program was announced, and over $1.5 billion has been invested in Trail Operations since that time. Many projects were done for specific environmental reasons, while others, targeting improved production efficiency, also provided significant environmental benefits. Advances included:

- 1980, the Smelter Feed Plant was constructed for the storage and mixing of feed materials for the lead smelter, significantly reducing fugitive dust and lead emissions.

- 1981, the first Zinc Pressure Leach Plant was started up, allowing zinc production to be increased without increasing the release of sulphur dioxide.
- 1983, the Zinc Electrolytic and Melting Plant was started up, reducing fugitive zinc and acid emissions.
- 1985, upgrades were made to the Sulphur Gas Treatment allowing for improved control of sulphur dioxide emissions. A Brinks plume eliminator was also installed reducing the emission of ammonium bisulphite particulate from the main zinc stack.
- 1989, a new lead smelter using the QSL oxygen smelting process was completed. The old smelter was returned to service in 1990 when the QSL process proved unworkable for the complex feed materials handled in Trail.
- Beginning in 1990, improvements were made to materials storage and handling practices. These measures included: consolidating and covering key material stockpiles; construction of paved haul roads separated from other plant traffic; increased road washing and sweeping; and, construction of a vehicle wash facility to reduce transport of contaminants off-site.
- 1996, new baghouses were constructed at the silver refinery reducing arsenic emissions by 85 percent.
- 1997, the KIVCET smelter replaced the sintering and blast furnace operation. Compared to the old operation, the KIVCET smelter significantly reduced the stack emissions:
    - Total particulates (smoke) were reduced by 90 percent;
    - Lead emission by 70 percent; and
    - Arsenic emission by almost 90 percent.
- 1998, a new state-of-the-art baghouse was started up in conjunction with the new slag fuming furnace associated with the KIVCET furnace. Emissions from the baghouse were significantly reduced compared to the old baghouse system.

During the years following the startup of the KIVCET and new slag fuming furnaces, emphasis was placed on optimizing installed abatement equipment prior to installing additional new equipment. However, even during this period, improvements and innovation continued:

- 2001, improvements were made to the Smelter Feed Plant dryer baghouse.
- 2005, improvements were made on the launder ventilation between the KIVCET and continuous drossing furnaces.
- 2007, a new sorbent injection system was commissioned for dry gas scrubbing of sulphur dioxide from #2 slag fuming furnace flue gas.
- 2008, the Silver Refinery ventilation system was improved to improve capture of fugitive furnace arsenic emissions.
- 2012, a new vacuum system was installed at the Silver Refinery to pick up arsenic laden dusts.

Improvements were also made to non-process areas of the operation:

- In 2000, a new vacuum sweeper was purchased for cleaning roadways. In 2012, a new year-round useable street sweeper was put into operation.
- In 2009, a tent enclosure was installed around the Red Dog zinc concentrates unloading area at the Roasters. In 2010, a second tent enclosure was installed for storage of stockpiled cleanings from the Roasters.
- In 2011, a new tent cover was installed at the indium kiln building, an area used to store crushed cathode ray tube glass (old television screens) and Red Dog lead concentrates.
- 2012, a truck wheel wash system at the Tadanac Beach area.
- 2013, a second truck wheel wash for the zinc concentrate unloading area.

Efforts to reduce stack emissions continued through the decade. Between 2000 and 2010, Trail Operations reduced stack lead emissions from 6.8 to less than 1 tonne per year (Figure 5-1). In 2012, lead emissions were less than 0.5 tonnes/year. Teck meets the permitted stack emission limits. With stack emissions this low, the focus has shifted to reducing fugitive emissions.

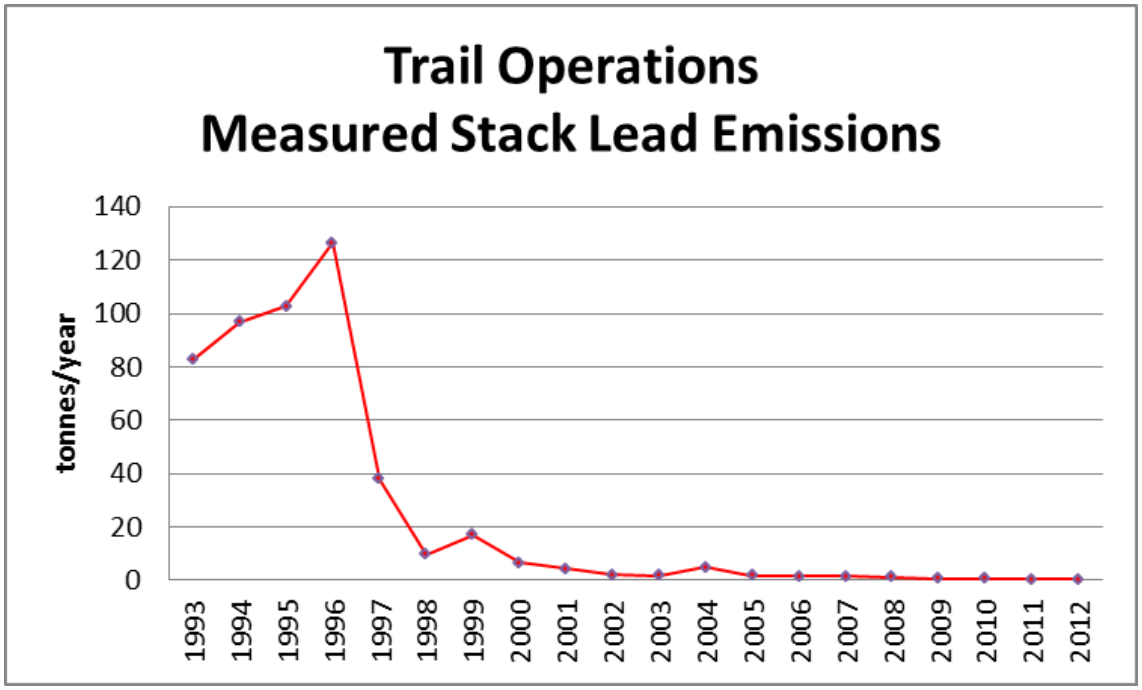

Figure 5-1. Reduction in Trail Operations Stack Emissions of Lead from 1993 to 2012

5.1.2 *Reducing Fugitive Emissions On-site*

Teck Trail Operations recognizes that fugitive emissions are a major source of lead and arsenic emissions. This source of emissions represents the best opportunity for emissions reductions towards achieving the 2018 air quality objectives. To achieve the new objectives, Trail must reduce lead emissions by about 50 percent and arsenic by about 40 percent from the 2012 levels, as shown in Figure 5-2. In 2013, the annual average for lead in air was 0.34 µg/m^3 and for arsenic was 0.013 µg/m^3. The spike in arsenic concentrations in 2008 was due to problems at the Continuous Drossing Furnace and Refinery and Scrubber Stack that have since been corrected.

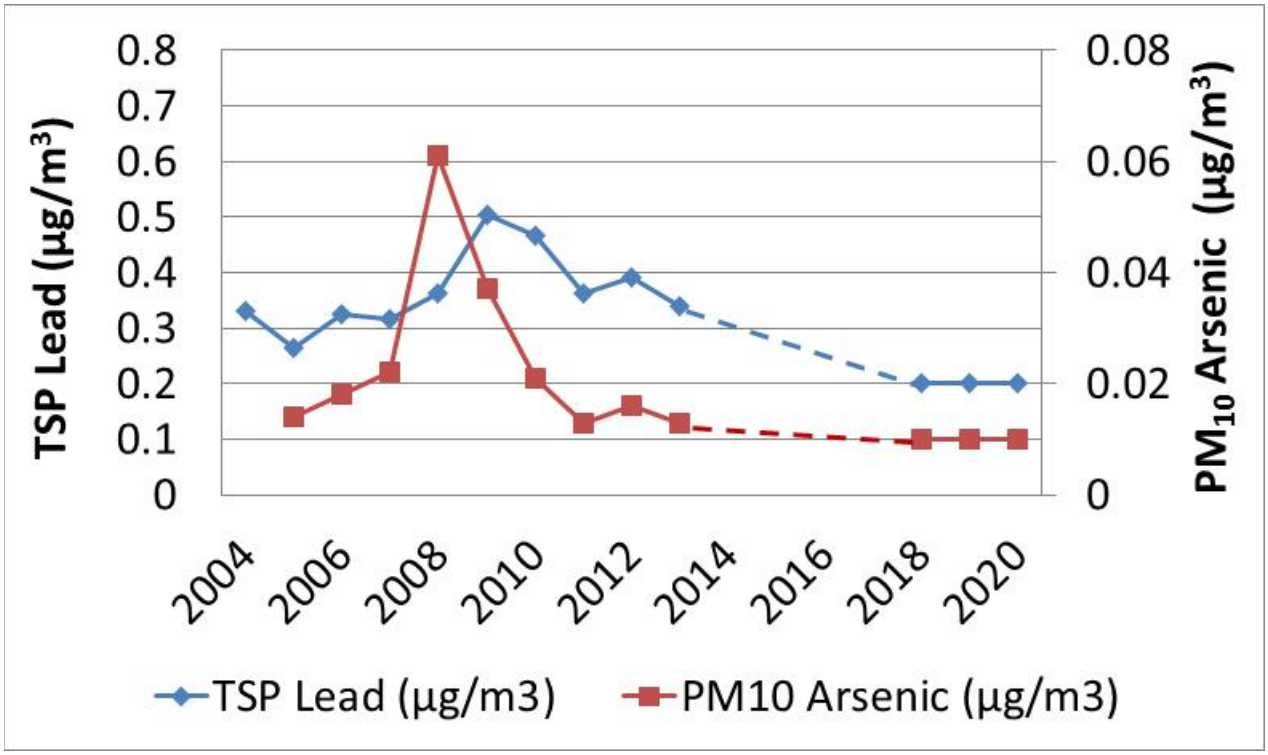

Figure 5-2. Levels of Metals in Community Air Measured at Butler Park, with 2018 Objectives

Fugitive emissions are non-stack emissions that are released directly from processing equipment or buildings, or during transfer of materials at Trail Operations. The key sources of fugitive emissions are:

- Roadways: dusts generated by vehicle traffic and wind;
- Stockpile storage and mixing: dusts generated during loading and unloading of materials from vehicles and transfer bins, as well as by wind;
- Process equipment: dusts and fumes escaping from process equipment and operations such as screening;
- Buildings housing process equipment: dusts and fumes escaping from buildings as well as windblown dust from building roofs; and,
- Open mixing of materials: dusts generated by mixing materials outside of buildings.

Unlike stack emissions which can be accurately sampled and flows measured, fugitive emissions must be estimated or modeled by various techniques and then compared to produce a best estimate:

- Road and mix area emissions are estimated using EPA methodology AP-42[12].
- Fugitive emissions from buildings are estimated by measuring metal concentrations in outdoor air near openings and exhaust fans. Airflow through the openings and fans is measured and the total emission calculated.

Employing these methods, Trail Operation's fugitive emissions of lead were estimated in 2013[13] to be:

Area	Estimated Lead Emission (tonnes/year)
Materials Handling • Roadways • Mix areas	 10 25
Buildings	10
Total	45

Emissions are also estimated using a dispersion model to back-calculate total lead emissions based on measurements taken at community sample stations (dustfall collectors and TSP from sampling stations). The result of this analysis was that total lead emissions were estimated between 26 and 66 tonnes/year (the range is due to the sample data set and assumptions used in the model). The average total lead emission calculated was 46 tonnes/year. Since the measured stack emissions are less than 0.5 tonnes/year, then the fugitive emissions are responsible for almost all of the 46 tonnes/year.

Studies by the Geological Survey of Canada[14] indicate that fugitive emissions deposition at Trail decreases significantly outside the boundary of the smelter, and the contribution of fugitive emissions to the level of metals in dustfall becomes less significant after a distance of 1.5 km from the smelter.

The estimates of current fugitive emissions demonstrate that these emissions are more significant than stack emissions and represent the top opportunity for emission reductions from Trail Operations. Based on this information, Teck proceeded to develop a five-year

[12] US EPA (United States Environmental Protection Agency). 1995. AP 42, Fifth Edition. Compilation of Air Pollutant Emission Factors. Volume I: Stationary Point and Area Sources. Introduction. January 1995. Office of Air Quality Planning and Standards. Office of Air and Radiation. Available at: http://www.epa.gov/ttn/chief/ap42/c00s00.pdf

[13] Prior to the additional sampling and studies in 2013, fugitive dust emissions reported in Canada's National Pollutant Release Inventory were based on engineering calculations listed in Environment Canada's NPRI reporting Toolbox.

[14] Goodarzi F, Sanei H and Duncan WF. 2003. Deposition of Trace Elements in the Trail Region, British Columbia; An Assessment of the Environmental Effect of a Base Metal Smelter on Land. Geological Survey of Canada Bulletin, 573.

plan with a goal to reduce fugitive emissions by at least 50% in order to achieve the 2018 air quality objectives.

As part of the five-year plan, projects are currently being developed to reduce or eliminate the most significant fugitive emissions through a combination of new enclosures, roadways management, and reducing or eliminating emissions from existing buildings, as outlined later in this section. Successful implementation of all of the currently identified opportunities has the estimated potential of reducing Trail's fugitive emissions of lead by as much as 80% and arsenic by as much as 75%. However the projects will be evaluated and prioritized based on where the best return on investment can be realized, and subject to the project engineering and stage gating processes.

Project Engineering and Appropriation Stage Gating Process

Implementation of each and any project to reduce emissions is dependent on the project successfully passing Teck's Project Stage Gating process – which is based on engineering best practice – due to the anticipated required expenditures and to ensure the most effective engineering solutions are implemented at the best return on investment. This five-step process ensures that the project is fully vetted by all Teck stakeholders from initial definition through to execution; the steps are detailed in Appendix C.

Fugitive Dust Reduction Five-Year Plan

The plan has four key components, the first two of which are engineering controls:

1. Reducing emissions from the materials handling areas by constructing enclosures for stockpiles and concentrates. Three structures have been identified and prioritized for implementation at this time:

    a) Tadanac North: This enclosure was completed in December 2013 and is used to house intermediate materials containing arsenic, lead and copper. It is located at the north end of the property near the Tadanac Water Treatment Plant. This project is expected to reduce approximately 0.5 tonnes of lead in fugitive dust per year.
    b) Smelter Recycle Building: This enclosure project is at the feasibility study stage. The structure is to be located on the east side of the property just north of the Effluent Treatment Plant and adjacent to the Tadanac residential area, and will be used to enclose the materials and activities that currently take place daily in this area. This project would be expected to reduce approximately 9.5 tonnes of lead in fugitive dust per year.
    c) Roaster Concentrate Storage: This enclosure is at an early engineering study stage with potential implementation to follow completion of the Smelter Recycle Building. This project will eliminate the unloading, storage and mixing of zinc concentrates from taking place in the open air. This project would be expected to reduce approximately 16 tonnes of lead in fugitive dust per year.

2. Reducing emissions from roadways and buildings:

a) Roadways: The roadways accessing the Smelter Recycle Building and the zinc Roaster Concentrate unloading area have collectively been identified as the greatest opportunity to reduce roadway emissions, on the order of 3 to 6 tonnes of lead in fugitive dust per year. The plan is to incorporate year-round wheel washes for all vehicles leaving these two structures. Until these projects are implemented, an interim plan is in place:

- Truck wheel wash units (similar to those planned for the structures) have been installed close to the two key areas. These units are only useable when temperatures remain above freezing.
- Increased emphasis on cleaning roadways with vacuum/sweeper trucks and flushing with water. In 2013, the targeted hours for these activities were double the 2012 targets.

b) Buildings: In early 2013, fugitive emissions were estimated for all major process buildings at Trail Operations. The results (Figure 5-3) showed that although these emissions were dominated by the KIVCET building (i.e., 6 tonnes of lead per year), there were also significant emissions from the Lead Refineries and Roasters building (on the order of 0.5 to 1 tonnes/year), and to a lesser extent the Komatsu building (lead concentrate unloading) and the Smelter Feed Plant. Note that Figure 5-3 has two scales for estimates of Potential Lead Emissions: the KIVCET emissions use the left-hand (purple) scale and all the others use the right-hand (turquoise) scale.

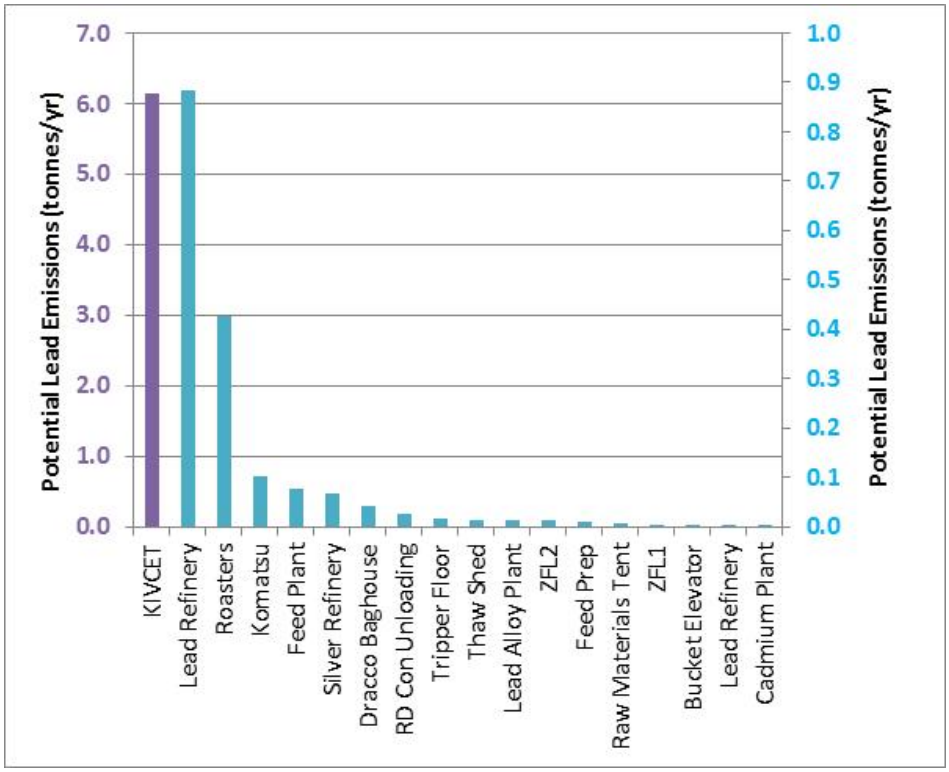

Figure 5-3. Lead Emissions from Various Buildings at Trail Operations

As part of the Five-Year Plan, potential projects are currently being developed to reduce or eliminate the most significant fugitive emissions from various buildings onsite based on where the best return on investment can be realized. These projects will use proven technology. The priority opportunities identified by the scoping studies include:

- KIVCET waste head boiler clinker crusher enclosure/ventilation;
- KIVCET burner ventilation;
- Additional building ventilation in:
    - KIVCET (if still required);
    - Lead and Silver Refineries;
    - Alloy Plant[15]; and
    - Roasters.

3. Employee Awareness and Training

Employees are an important component of the Five-Year Plan, as it has been shown at other operations that it is important that the "culture" across operations is oriented towards fugitive emission reduction. Consequently, it is important that all employees:

- Are aware of Trail's reduction goals;
- Are involved in identifying and reducing emissions sources; and,
- Understand how they contribute to the successful reduction of fugitive emissions.

All current employees (operation and maintenance personnel) have participated in a crew talk (i.e., a focused presentation that details the rationale and requirements) regarding Trail's Five-Year Plan to reduce emissions by 2018 including how they play a role in reducing fugitive emissions by:

- Responding quickly to XACT alarms to identify emission sources impacting the community and to take corrective actions to prevent re-occurrence;
- Maintaining housekeeping practices and not allowing dusty materials to accumulate;
- Ensuring dust abatement equipment is operating correctly and, if not, taking the necessary steps to have it repaired;
- Planning and executing work to limit fugitive emissions; and,
- Including in Trail's Integrated Process Management (IPM)[16] system the monitoring and control of key variables identified as impacting fugitive emissions.

[15] While the Alloy building is not as significant a contributor for lead, it is a source of arsenic which increases the return on investment.

The topics in this crew talk are also being incorporated into the orientation for new employees.

4. Continuous Improvement

Continuous improvement is based on the 'Plan Do Check' model. As each project is approved for implementation, a model predicts the amount (or percentage) of emissions reduction that the project is designed to achieve. Once the project is completed, air data from the Butler Park station are compared with pre-project levels. If results show that the project achieved the predicted reductions, then the project is completed. If it falls short, the implementation is reviewed to determine why the shortfall occurred and corrective measures are taken to address the shortfall. Regardless, the plan proceeds and either the next project is assessed based on the gating process described in Appendix C or the current project is modified to address the shortfall.

The Five-Year Plan to reduce fugitive emissions will be reviewed annually (at a minimum) to assess the progress Trail Operations is making towards the 2018 air quality objectives.

5.1.3 *Optimization of Air Emissions Control Equipment*

As detailed in Section 5.1.1, Trail Operations has installed numerous types of air emission control equipment. The most important of these from an ongoing maintenance and optimization perspective are the baghouses (large volume air filters), the best available technology for air pollution control. Trail Operations has identified baghouse efficiency as a high environmental priority.

Baghouses require ongoing monitoring and maintenance to ensure efficient operation since, for example, the filters can become clogged over time. Teck uses Integrated Process Management (IPM)[15] to monitor and control key variables that have been identified to impact emissions. A key monitoring variable for baghouses is the pressure drop across the bag filter which is an indicator for the degree of clogging.

Each baghouse on the property has a unique "Control Plan" developed to ensure good performance. The Control Plan is a roadmap to the many different tasks, checks and responsibilities required, including:

- Clear Roles and Responsibilities
    - Individual plant areas are responsible for managing their Control Plan and all requirements listed in the plan.
    - The Trail Baghouse Steering Committee is responsible for improving the management structure of Baghouses property-wide and sharing best-

[16] Integrated Process Management is a standardized six-step methodology using software support that creates the elements of a sound management system. Companies identify customer needs (e.g., objective levels of metals in the community air), the variables which impact the specifications, and then decide on control strategies and means to assess and improve the system.

practices across business areas, as well as providing technical support where required. It continues to audit Baghouse management, maintenance and operation according to the Control Plans to ensure good performance.

- Technical – Understanding of Baghouse operation, equipment, design and troubleshooting. Including training courses and technical support by experts where required.
- Monitoring – appropriate ongoing monitoring and control of key variables for proper operation including physical checks of filter media condition, pressure and pressure drop, temperature, moisture, air volume, self-cleaning effectiveness, dust removal and dust loss. The Control Plans trigger shut-down, troubleshooting and filter bag replacement based on these variables.
- Maintenance – filter bag replacement and other maintenance is scheduled on a regular basis, or when triggered by monitoring.

Similar Control Plans have been established for proper operation of other pollution abatement equipment including Scrubbers, Cyclones, and Electrostatic Precipitators (ESPs).

5.1.4 *Dust Suppression in the Community*

In collaboration with Teck, the City of Trail performs additional dust control measures on an ongoing basis as part of the Lead Task Force recommendations. These include:

- While most towns only clean their streets in the spring and fall, the City of Trail performs at least two extra street sweepings over the summer in order to control dust. The downtown core is swept and flushed weekly. The City pre-wets the roads prior to sweeping so that dust is not stirred up in the process. During the spring sweepings, it is difficult not to stir up dust but the sand applied in the winter does not contain lead, so lead levels on the street are relatively low.
- Dust suppressant is applied to unpaved alleys each June in Trail.

In addition, there is collaboration between Teck and the City of Trail to provide grass cover on bare ground areas (refer to Community Greening Program within Section 5.4 Parks & Wildlands).

Beginning in August 2014, a new dust suppression service was established in Rivervale, funded by Teck Trail Operations. Each summer, the highways contractor for Regional District of Kootenay Boundary (RDKB) Area B will conduct one street washing of Rivervale streets to keep dust down.

5.1.5 *Air Quality Monitoring*

Teck monitors emissions from the site in several ways:

- Major point sources (stacks) are directly sampled regularly for many elements including particulate metals and gases.

- Primary furnace stacks (stacks containing sulphur dioxide, SO_2) are continuously monitored for SO_2 concentration.
- Major air filtration equipment (Baghouses) is continuously monitored for dust loss.
- Roadways, building emissions and other fugitives are estimated using various methods (as described in Section 5.1.2).

Teck monitors air quality in the community in several ways (see Figure 5-4 for the monitoring locations, and Figure 5-2 for recent lead and arsenic monitoring data):

- Measures of total airborne dust (TSP) as well as particulate lead, arsenic and other metals in the air are taken at two testing locations in Greater Trail: Butler Park and Birchbank. Readings are taken over 24-hour periods, bi-daily.
- Total Respirable dust (PM10) measurements are taken at four testing locations in Greater Trail: Butler Park, Birchbank, Warfield, and Columbia Gardens. Readings are taken over 24-hour periods, every 6th day.
- Fluoride monitoring is conducted at Butler Park to evaluate the total gaseous fluoride. Monitoring is continuous and is analyzed weekly.
- Settled dust or dustfall measurements are taken at Birchbank, Downtown Trail, Columbia Avenue, Columbia Gardens, Tadanac, Trail Hospital, Glenmerry, Oasis, Stoney Creek, Waneta and Warfield. These are continuous samples analyzed monthly for total deposited particulate and metals.
- Sulphur dioxide (SO_2) gas is monitored at four locations throughout the valley at Birchbank, Butler Park, Columbia Gardens and Warfield. These stations operate continuously, with real-time data transmitted back to Teck Trail Operations' process control systems. If the SO_2 levels begin to climb (such as during a weather inversion), the plants are automatically notified so that actions can be taken to reduce SO_2 emissions.
- In 2010, Teck added a real-time metals analyzer for ambient dust at Butler Park. A second real-time monitor was installed at Duncan Flats in 2013. These analyzers are linked back to operations. This allows operations to directly and immediately respond to any unexpected metals increase.

This information is collected and analyzed by Teck's environment staff and reported to the Ministry of Environment and the THEC. This information is tracked relative to the three air permits Teck has been issued from the Ministry of Environment for emissions to air from the chemical fertilizer plants located at Warfield (Permit 2690), and the lead and zinc smelters in Trail (Permits 2691 and 2692). Regular monitoring helps identify significant emissions sources, track the effectiveness of emissions and dust control efforts, and track progress on air quality objectives. Monitoring frequency and durations are set to provide achievable, accurate, and long-term air quality data.

5.1.6 *Summary of the Air Quality Program*

The Air Quality Program addresses stack and fugitive dust emissions from Teck Trail Operations, and dust control in the community. Various actions have been taken to reduce stack emissions of lead and other metals by over 99% since the 1990s. The goal of the Air

Quality Program is continuous improvement in air quality, including achievement of the 2018 near-term objectives for lead and arsenic levels in community air. Teck has initiated a specific program to reduce fugitive dust emissions at the Teck Trail Operations site, which is now recognized as the greatest opportunity to further reduce emissions so that the 2018 objectives can be achieved.

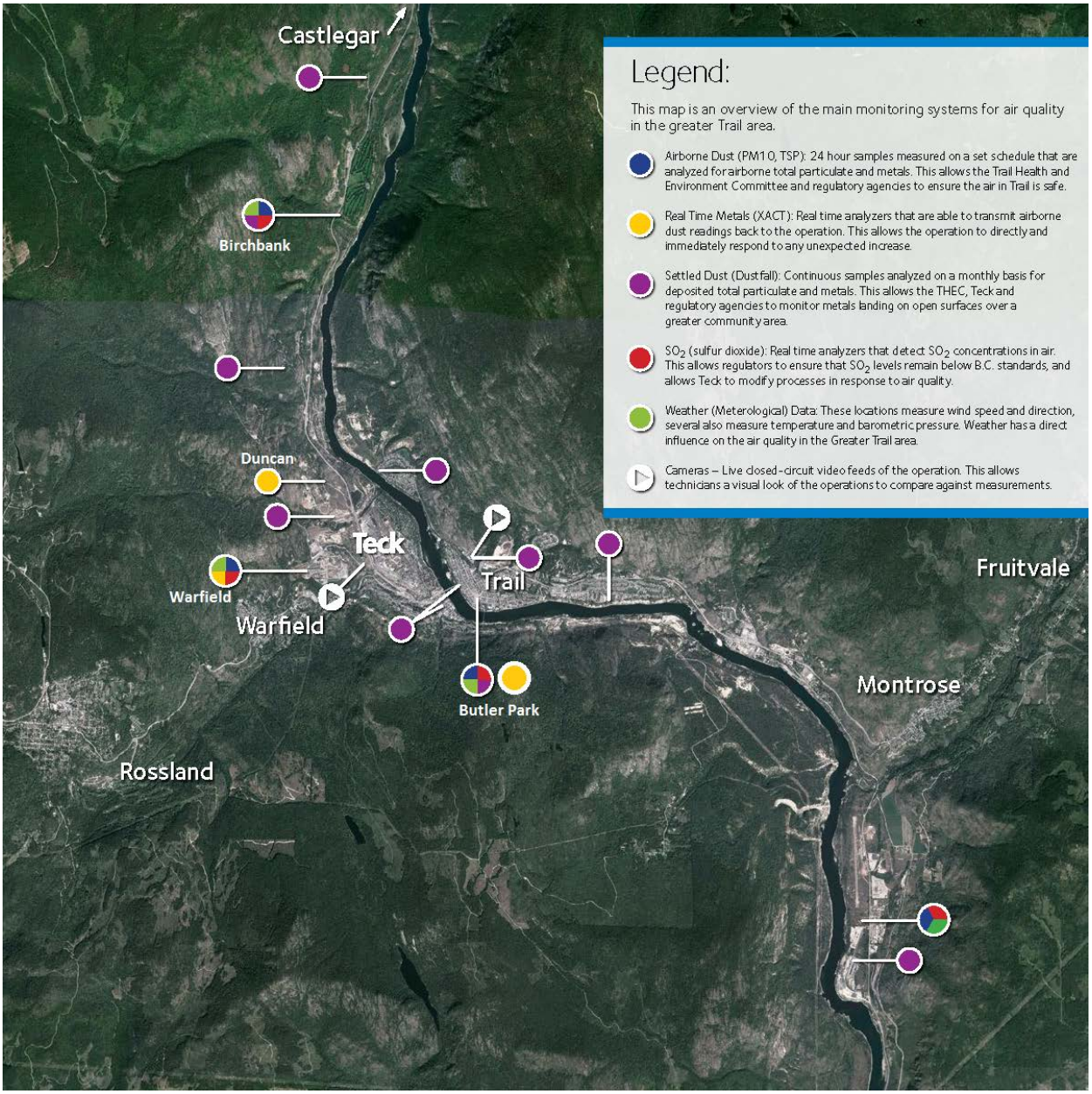

Figure 5-4. Community Air Quality Monitoring Locations

5.2 Family Health

The overall goal of the Family Health Program is to reduce health risks from exposure to lead and smelter metals in the community, within the broader context of promoting children's healthy development and engaging the community in human health issues through the core services of voluntary blood lead testing and education.

Specific goals are:

- To prevent young children's and pregnant women's exposure to lead;
- To inform the community, and particularly expectant families and families with young children, about potential health risks from exposure to lead and other smelter metals;
- To engage the community, and particularly expectant families and families with young children, in addressing potential health risks;
- To help enhance the health and well-being of young children in the Trail area; and,
- To help make the Trail area the best place to raise a family.

The Family Health Program uses a collaborative, relationship-building approach wherever possible to encourage:

- Client (family) engagement, empowerment and informed decision-making to promote children's healthy development and prevent lead exposure;
- Parent/caregiver and community early childhood development service provider participation in the direction and governance of the THEP, and provision of advice on planning, program delivery, and continuous quality improvement;
- Collaborative education, engagement projects and activities with health, social service and early learning providers;
- Seamless service provision to expectant families and families with young children by Interior Health (IH) Community Integrated Health Services (CIHS), Promotion and Prevention (P&P); and,
- The work of multi-sectoral networks aimed at improving early childhood development outcomes in the Greater Trail area, such as Success by 6 and the Family Action Network.

The Family Health Program is delivered by Interior Health (IH), Community Integrated Health Services, Promotion and Prevention. An Interior Health Public Health RN delivers the program out of the Kiro Wellness Centre in Trail supported by management, a Medical Health Officer, an epidemiologist, and IH program supports such as communications, clerical, and laboratory services.

The Family Health Program includes six different components:

- Family and Caregiver Education and Engagement;
- Healthy Families Home Visits;
- Monitoring of Children's Blood Lead Levels;

- Family Case Management;
- Community Collaboration to Enhance Early Childhood Development; and,
- Community Outreach and Communications.

Each of these Family Health Program components is described in detail below.

5.2.1 *Family and Caregiver Education and Engagement*

Education and engagement of expectant parents is done through:

- Presentations and distribution of information to pre-natal and post-natal groups (once per month at the local pregnancy outreach program; on request at pre-natal groups);
- Participation in educational events for expectant parents; and,
- Other communication with expectant families and community service providers such as needs assessments for parent support and providing information on programs.

Education and engagement of parents, young children and health and social service providers and others working with or caring for young children is done through:

- Presentations, hand-washing displays, and distribution of information to: parenting groups; school entry wellness events for 3- and 4-year olds; THEP Home & Garden events; and various community events.
- Hand-washing displays for daycares, nursery schools, schools and general community awareness.

5.2.2 *Healthy Families Home Visits*

The Healthy Families in-home visits program is part of the Healthy Families Healthy Homes Program described further in Section 5.3 Home & Garden. Healthy Families visits are offered to every family in Trail and Rivervale with a child 12 months of age or younger.

The Healthy Families Program includes:

- Visits that offer education, advice, a brief in-home visual review to determine the need for referral to the Home & Garden Program, and provision of information for parents/caregivers[17] to strengthen children's healthy development and prevent lead exposure;
- Educational information on topics including healthy nutrition, hand washing, how to access other public health services for young children/families and early learning programs available in the community, and how to keep dust down in the home and yard;

[17] This may include grandparents or others who are significant caregivers.

- Engagement of parents/caregivers in conversation about their children's health and development, eliciting and responding to parents'/caregivers' questions on strengthening children's healthy development and preventing lead exposure; and,
- As needed, referrals to other health and/or social services.

5.2.3 *Monitoring of Children's Blood Lead Levels*

Voluntary blood lead testing of children aged 6-36 months in Trail and Rivervale is the primary monitoring and evaluation methodology conducted annually, in the fall, to monitor progress in reaching THEC's goal to reduce children's lead exposure and identify children and families requiring case management (Section 5.2.4). An Interior Health Medical Health Officer reviews and confirms the results each year. The blood lead testing clinics are also an opportunity for education and relationship building; Home & Garden staff participates in the clinics as well as, on occasion, other public health and early-learning professionals.

The main clinic is the annual Fall Blood Lead Testing Clinic. It takes place at the Kiro Wellness Centre in Trail over three weeks in September/October, after maximum summer exposure conditions are known to prevail. Research has shown that blood lead levels vary seasonally (see summary in ACCLPP, 2007) with higher levels in the warmer and drier months.

The clinic targets children aged 6–36 months living in Trail and Rivervale (Figure 2-2). Parents of older children up to age 5 years living anywhere in Greater Trail may request testing and are welcome to attend. Children up to age 5 years who are new to the community or living in homes undergoing renovations or with recent renovations in the Greater Trail area are encouraged to attend. Participation is voluntary and parents provide informed consent for testing and sharing of results (aggregate results for community reporting and individual results for their physician's follow-up, if needed).

Up to the year 2000, children aged 6-60 months were tested annually but beginning in 2001, children ages 6-36 months were tested annually with a comparison test of ages 6-60 months in 2005. The results of testing in the 1990s showed that, after 36 months, there was a very low probability of finding a new case of elevated blood lead. Since 2009, annual testing has only targeted children aged 6-36 months[18].

Currently, the clinic tests approximately 190 children, including approximately 120 from the target population, and 70 from outside the target area or age range. The clinic contacts families of approximately 170 children from the target population. The participation rate for Trail and Rivervale (combined) was 73% in 2012 and 74% in 2013 with the overall trend shown in Figure 5-5. The THEC has an objective, approved through community consultation, to have a clinic participation rate of 75% from the target population.

[18] Except for children receiving case management who have blood lead levels above the threshold.

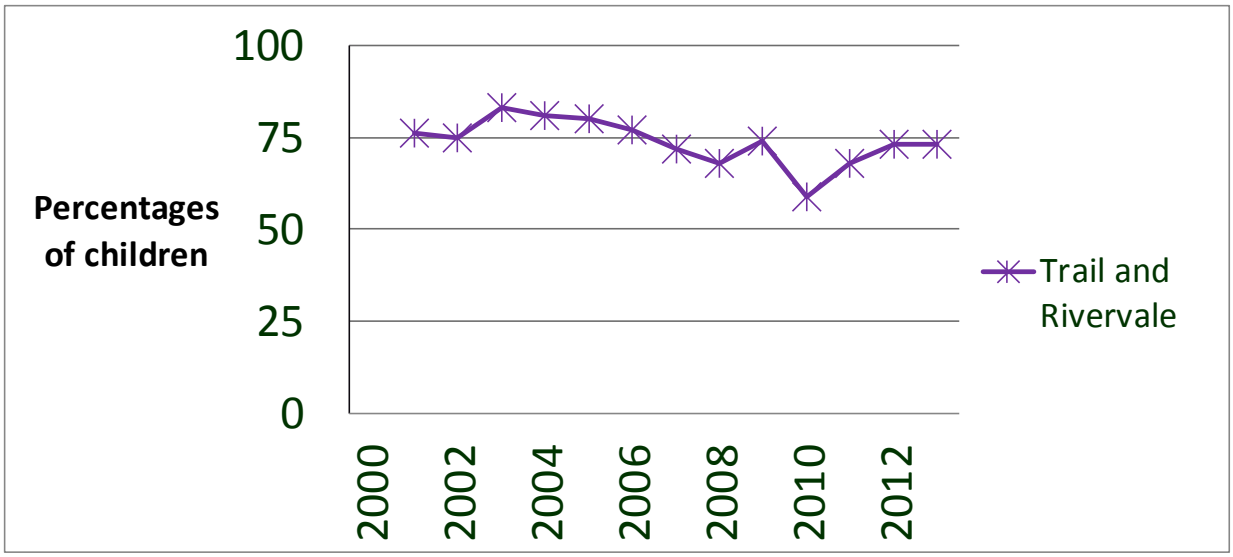

Figure 5-5. Participation Rate in Children's Blood Lead Testing for Trail and Rivervale

An Interior Health phlebotomist conducts the blood draw. The preferred testing method is venipuncture. When venous access is unsuccessful, not possible or is declined by a parent, a capillary sample is attempted. Since 2010, a higher number and rate of capillary samples have been taken. This came to the THEC's attention at the time of 2013 blood lead monitoring and follow-up; prompt action was taken to address the situation and prevent its reoccurrence.

In late 2013, Interior Health conducted a Quality Review of the blood lead clinics. The review determined that capillary samples are prone to skin contamination. Also, capillary samples have had statistically higher lead levels, compared to venous samples, over the history of THEP from 1991 to 2013. This affects the conclusions and comparisons that can be made from the data. It may also have resulted in over-identification of children requiring family case management. No children have missed needed services as a result of this issue.

Based on the Quality Review, Interior Health has decided to report community trends in children's blood lead levels using venous samples only. In addition, Interior Health is moving to a more stringent sampling methodology and family education to reduce the number of capillary samples and ensure that, when they need to be taken, there will be negligible contamination.

The results of children's blood lead testing over the past 23 years are presented in Figure 5-6. Please note that the results for 2001 to the present (red line) are based on venous samples from Trail and Rivervale children aged 6-36 months. The line showing results for the first decade of THEP (blue line) is based on mostly venous samples from Trail and Rivervale children aged 6-60 months. The green line shows the THEC's goal for children's blood lead levels. Also, please note that the term "average" is used to describe the blood

lead level and the blood lead goal. This is done because the word "average" is more widely understood by the public to whom the THEC is accountable. This "average" is really the geometric mean (geomean), the most widely used representation of "central tendency" (one's notion of "middle") for blood lead distributions.

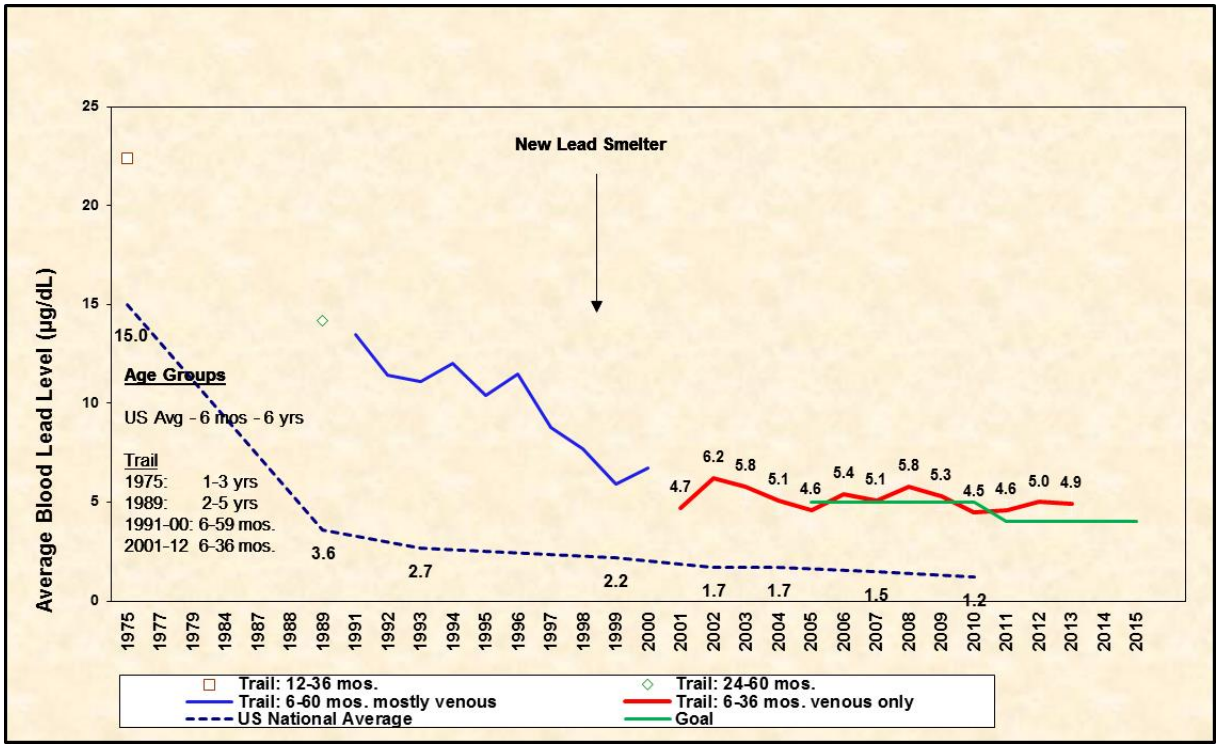

Figure 5-6. History of Children's Blood Lead Levels in Trail

In terms of observed trends, children's blood lead levels decreased significantly when the KIVCET smelter was installed in 1997. In 2013, the average was 4.9 µg/dL; THEC's goal is to have an average of 4.0 µg/dL by 2015.

An annual winter follow-up clinic takes place over one to two weeks in February at the Kiro Wellness Centre. It targets children receiving case management and children who were under 6 months of age at the time of the fall clinic. It currently targets about 100 children and tests about 65 children (65% participation). Research indicates that blood lead levels are typically lower at this time of year.

The THEC's goal is to have 95% of children with a blood lead level below 10 µg/dL by 2015. In 2013, the percentage of children with blood lead levels below 10 µg/dL was 93% (Figure 5-7).

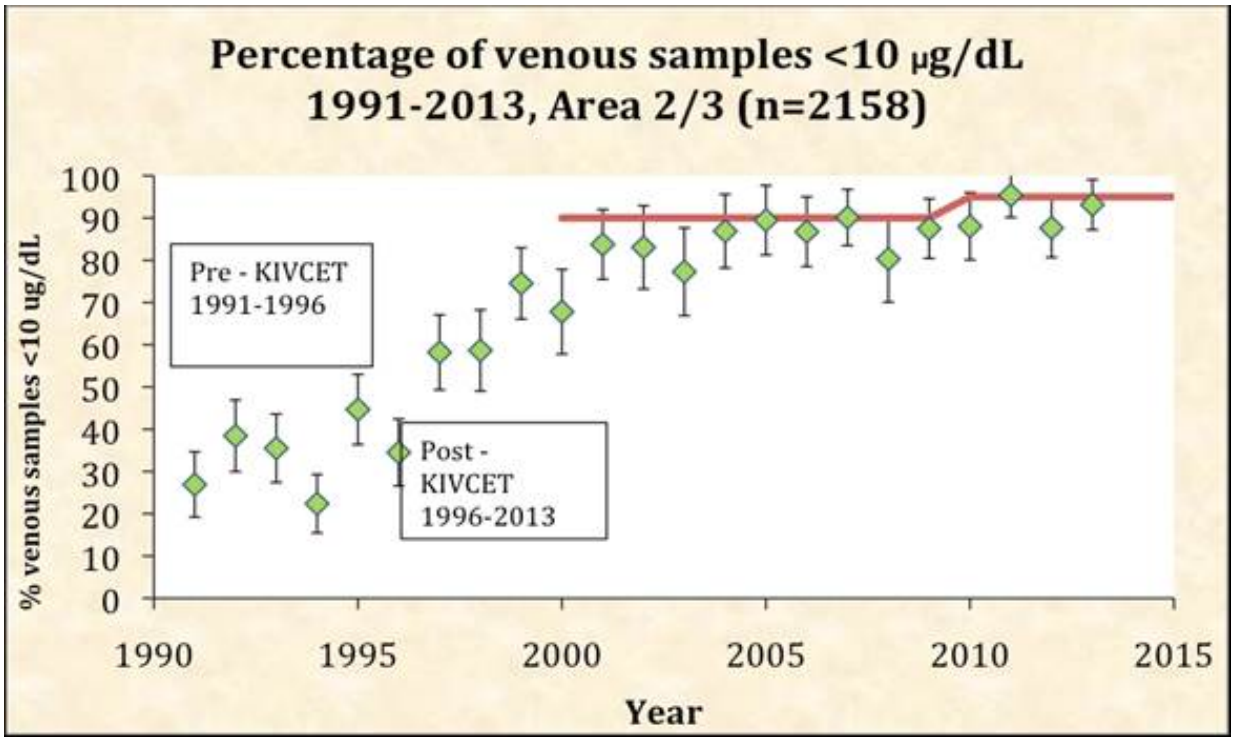

Figure 5-7. Percentage of Children with a Blood Lead Level Less than 10 µg/dL

In the fall of 2013, a one-time clinic was held for Warfield, Oasis, Casino and Waneta. The purpose of the clinic was to determine if children in these communities had blood lead levels above 5 µg/dL and would warrant expansion of programming to these communities. The average blood lead level for children aged 6-36 months from Warfield, Oasis, Casino and Waneta was 2.7 µg/dL with a range from 1.1 – 5.2 µg/dL. Based on these results, Interior Health's Medical Health Officer recommended retesting every 5 years.

The blood lead testing program is a year-round initiative, with significant time spent compiling a comprehensive and accurate database of families, needed to find as many families as possible and support the accuracy of our results. Data are compiled from 5 databases: iPHIS/Panorama, Meditech, BC Ministry of Health Data as per Data Access Agreement, Trail Blood Lead Program database, and Public Health Nurse spreadsheet. Also, names of families are provided by the Home & Garden Team, where permission is given.

5.2.4 *Family Case Management*

Case management is offered to families where children's blood lead levels test 10 µg/dL or higher for children aged 12-36 months, 7 µg/dL or higher for children aged 6-12 months, or where the blood lead level increases by at least 3 µg/dL between two successive fall clinics.

The support for families to reduce lead exposure includes:

- Two Case Management in-home visits are offered, one by an Interior Health Public Health RN and one by the Home & Garden Team (described in Section 5.3.2), to identify the most probable pathways by which the children may be exposed to lead and determine the most appropriate support and follow-up actions.
- The Public Health RN visit includes a home visual review and assessment of possible sources of lead exposure as well as discussing the next steps for exposure reduction and retesting of blood lead levels.

Case management children are monitored until they test below 10 µg/dL at a fall clinic or the family chooses not to continue testing. Children whose results are 15 µg/dL or above are referred to their family physician for a retest within the requested period of time.

5.2.5 *Community Collaboration to Enhance Early Childhood Development*

The Public Health RN participates in a variety of collaborative strategies to improve children's healthy development. These community collaborations occur throughout Greater Trail and surrounding rural areas. More detail is provided in the Community Collaboration section (Section 4.4 and Appendix A).

5.2.6 *Community Outreach and Communications*

The Public Health RN places priority on communication and collaboration between IH and other sectors of the community, including responding to requests for presentations and participating in collaborations to achieve goals. The Family Health Program is emphasized in all of the THEP main communications strategies, including the community newsletter, website, radio ads, brochures, displays, events, and media releases. More information is provided in the Public Outreach section (Section 4.5 and Appendix A, Section A-4.7).

5.2.7 *Summary of the Family Health Program*

The Family Health Program reduces health risks from young children's exposure to lead and promotes improved early childhood development outcomes in the Greater Trail area. Approaches include: family education, outreach and engagement; in-home visits for families with children under 12 months; voluntary monitoring of children's blood lead levels; case management in-home visits; community and stakeholder collaboration; and, communications.

Performance objectives, approved by the community through public consultation in 2010, are:

- To have an average[19] blood lead level of 4 µg/dL for children aged 6 months to 36 months in Trail and Rivervale by 2015;

[19] Geometric mean (geomean) as described in a footnote to the goals in Section 3.0.

- To have at least 95% of children aged 6 months to 36 months in Trail and Rivervale with blood lead levels below 10 µg/dL by 2015; and,
- To have at least 75% of children aged 6-36 months in Trail and Rivervale participate in the annual fall blood lead clinic by 2015.

The Family Health Program has been operating since 1990, offering education and case management since the first year. Annual community-wide testing of children's blood lead levels began in 1991. Many of the approaches, strategies and specific activities of the Family Health Program were determined through research and assessment conducted in the 1990s and summarized in the Task Force Report (2001). Based on 2012 guidance from the US CDC, the Family Health Program has extended the in-home visit program to target families with children under 12 months of age in Trail and Rivervale. A Quality Review of blood lead testing in 2013 confirmed the validity of venous sampling and resulted in best-practice improvements around capillary sampling. A decision was made to include venous samples only in the reporting of community trends in blood lead levels. A one-time blood lead clinic for children in Warfield, Oasis, Casino and Waneta was completed in the fall of 2013 to determine if the blood lead levels of children aged 6-36 months exceed 5 µg/dL and would warrant extension of programming to those communities. Based on a community average of 2.7 µg/dL from that clinic, the Medical Health Officer has recommended blood lead testing in those communities be conducted every 5 years.

5.3 Home & Garden

The goal of the Home & Garden Program is to prevent and reduce health risks from exposure to lead and smelter metals in the home and yard environment. Specific goals are:

- To prevent people's, and particularly young children's and pregnant women's, exposure to lead in their home and yard environments;
- To inform and engage the community, and particularly expectant families and families with young children, about the potential health risks from lead and other smelter metals in the home, yard environment and in the community; and,
- To promote lead-safe practices around the home, yard and garden.

The Home & Garden Program works towards these goals through the following main approaches:

- Healthy Homes Program;
- Support for Family Case Management;
- Residential Soil Assessment;
- Residential Soil Remediation and Yard Improvement Work;
- Home Renovation Support Program;
- Soil Assessment and Remediation in the Community; and,
- Monitoring.

Each of these Home & Garden Program components is described in detail below.

5.3.1 *Healthy Homes Program*

The Healthy Homes Program is part of the Healthy Families Healthy Homes Program. The Healthy Families Healthy Homes (HFHH) Program got underway in April 2013. The Healthy Families component of the HFHH Program is delivered by Interior Health, and the Healthy Homes component is delivered by the Home & Garden Team. HFHH is an extension of the long-standing (over 20 years) family Case Management Program provided by an Interior Health Public Health RN, but with a slightly different focus/intention and much greater involvement of the Home & Garden Program. The HFHH Program reaches out to the entire population of expectant families and families with children 36 months of age or younger in Trail and Rivervale. The in-home visits focus on prevention of lead exposure in the context of healthy children's development and a promotion of a healthy and safe home environment. This shift in programming came about in response to US CDC guidance (ACCLPP, 2012) to increase exposure prevention activities in communities where young children's blood lead levels are above 5 µg/dL.

The Healthy Homes Program is centered around an in-home visit. Home & Garden staff meet with a family at their home to help them identify the best opportunities to prevent lead exposure and keep their home healthy and safe. Visits are offered to every family in Trail and Rivervale (see Figure 2-2) that is expecting children, as well as any families with children 36 months of age or younger who have not previously had a visit. Visits are typically scheduled for a time when soil assessment results are available for the family's yard, as discussed in Section 5.3.3.

This program takes a holistic approach to home health and safety, promoting the Seven Principles of Healthy Homes (US HUD, 2012) – "Keep it dry, clean, safe, ventilated, pest-free, contaminant-free, and maintained." The program is guided by information and best practices from various agencies including Health Canada, the US Department of Housing and Urban Development (HUD), CDC and US Environmental Protection Agency (EPA).

Qualifying families are identified through participation in family-friendly public events, and blood lead clinics as well as through the newsletter, the Program Office and other THEP communications. THEP has a system for obtaining clients' consent to share contact information between the Family Health and Home & Garden Programs.

Healthy Homes visits include a visual review of the home and yard, a review of the soil assessment results (where available), education, information, and advice on home health and safety, as well as documentation and demonstration of exposure prevention strategies.

Educational topics include preventing health risks from lead exposure, keeping dust down in the home and yard, strategies for yard and garden improvement to prevent exposure, lead-safe home renovation including removal of lead-based paint, and other home health topics, as appropriate. Visits end with a discussion of the family's top three opportunities to make a difference in reducing exposure to lead. These opportunities are noted on the Healthy Families Healthy Homes poster that is left with the family.

Families may be offered a Dust Buster Kit, and Greening Your Garden Kit, a covered sandbox, a vacuum cleaner, yard remediation or improvement and/or home renovation supplies to support family actions to prevent lead exposure.

5.3.2 *Support for Family Case Management*

The Home & Garden Team offers an in-home visit in addition to the visit by an Interior Health Public Health RN (as described in Section 5.2.4), as support for families to reduce lead exposure. The Home & Garden Team visit includes a home visual review and soil assessment. Soil remediation may be offered based on the results of the soil assessment.

The Home & Garden Program may provide additional support as needed on a case-by-case basis, such as the offer of a vacuum cleaner, a covered sandbox, or flooring replacement (supplies only).

5.3.3 *Residential Soil Assessment*

Residential soil assessment generally takes place between April and November when the ground is snow-free. Residential soil assessment includes yard soil assessment (grassed areas, bare soil and flower gardens) and vegetable garden soil assessment. It is available for Trail and Rivervale residents to prevent and reduce health risks from exposure to metals that may be present in yard and garden soil. The top priority is as follows:

- Expectant families, families[20] with children 36 months or younger, and families with children who have measured blood lead levels above the Family Health case management thresholds (see Section 5.2.4);
- Residents requesting vegetable garden soil assessment; and,
- Residents of city blocks in areas close to the smelter and where it is suspected that soil metal levels may exceed Remediation Action Levels (see below).

All other requests for yard soil assessment within Trail and Rivervale, and all requests from outside this area are considered on a case-by-case basis.

Remediation Action Levels correspond to the Upper Cap Concentrations set out in Protocol 11 of the BC MoE Contaminated Sites Regulation. For residential yards, this value has been 5,000 mg/kg (parts per million) lead in soil; however, in February 2014, this value was lowered to 4,000 mg/kg. For vegetable gardens, the Remediation Action Level is 1,000 mg/kg. Further details on these Remediation Action Levels are provided in Appendix A, Section A-4.3.

[20] Families include extended families, caregivers and other situations such as daycares where children 36 months of age or younger are present on the property for a significant amount of time.

5.3.4 *Residential Soil Remediation and Yard Improvement Work*

The residential soil remediation program is designed to manage risks related to soil on residential properties where concentrations of smelter metals above Action Levels have been identified through soil assessment. The main health risks are related to young children's exposure to lead, and the main concern is bare soil. However, as long as soil is well covered, the health risks related to metals in soil are negligible. Residential yards and vegetable gardens are prioritized for remediation and/or yard improvement work to prevent or minimize health risks.

Residential properties qualify for remediation in the yard or gardens where soil assessment results exceed remediation Action Levels; for a detailed discussion of the remediation Action Levels, refer to Appendix A, Section A-4.3. Yard improvement work is offered in cases where an expectant family or family with children 36 months or younger is present on the property and where there is bare soil or poor ground cover. Yard improvement work is determined based on the soil assessment results and a visual assessment of ground conditions and property use.

As of 2014, sufficient resources were allocated so that remediation work could be scheduled for all identified HFHH cases (i.e., where an expectant family or family with children 36 months or younger is present on the property) and there will be no waiting list. The trends in number of remediations completed per year are shown in Section 5.3.7 below.

5.3.5 *Home Renovation Support Program*

The Home Renovation Support Program (HRSP) was initiated based on a recommendation by the Trail Community Lead Task Force following the 2000 Community Consultation (Hilts et al., 2001). The recommendation was to "Implement a new program to advise and assist people doing excavation, construction, demolition, or renovation". Further recommendations came from the 2010 Community Consultation and hence the HRSP is evolving into a comprehensive program for lead-safe work practices.

The HRSP supports home owners and tenants doing home renovation and construction projects in Trail and Rivervale. In areas outside Trail and Rivervale, including the communities of Fruitvale, Rossland and Genelle, these supports are available for home owners and tenants renovating homes built prior to 1976 (after which time manufacturers were regulated to phase out lead in paint). This is done to foster lead paint awareness and lead-safe home renovation in the broader community. HRSP supports include advice and information on lead dust generated during renovation and construction projects, and supplies (including HEPA-filtered shop vacuum loans) to prevent lead exposure during renovations. HRSP materials and information are provided free of charge.

The THEP 2010 Community Consultation recommended: "Given strong public support but low awareness of this program, it is a priority to conduct more extensive promotion of the

Home Renovation Support Program….". As a result, several new approaches have been put in place to inform the community about the services within the HRSP, including:

- Extended outreach to young families through the Healthy Families Healthy Homes Program, as described in Section 5.3.1;
- Partnering with the City of Trail to attach a copy of the THEP Home Renovation Support Program brochure when BC One Call requests are responded to;
- Partnering with RDKB to provide a THEP Home Renovation Support brochure with each building permit issued in Greater Trail; and,
- Connecting with roofing and building contractors to develop educational and training materials to promote lead-safe work projects. A new Fact Sheet and web page for contractors are planned for 2015.

The HRSP continues to evolve to meet the THEC goal of having all home renovators (including contractors) in Trail and Rivervale, and all renovators of homes built before 1976 in Greater Trail, carrying out lead-safe home renovation practices.

5.3.6 *Soil Assessment and Remediation in the Community*

Soil assessments are conducted for non-residential sites including playgrounds, school yards, parks, picnic areas, rodeo grounds, playing fields and other sites of concern on a case-by-case basis. The requests are received typically from Teck, the City of Trail, or local residents, and generally involve sites receiving considerable use by children or the public, or where there are concerns about metals concentrations.

Sites are evaluated based on proximity to the smelter, amount of public use, and presence of bare soil. The need for and type of remediation is determined based on the same Action Levels as described for residential soil assessments.

5.3.7 *Monitoring*

The Home & Garden Program is monitored through recording and tracking program activities as well as soil assessment results. Information including Healthy Home visits, soil assessment results, remediation and yard improvement work and Home Renovation Support Program requests is recorded in a database at the Community Program Office. Metrics obtained from the database help track the delivery of programs and provide input into program improvements and direction. These metrics are reported to the THEC as part of regular Home & Garden updates.

The Healthy Homes Program began in April 2013. There were 112 in-home-visits completed by the Healthy Homes Program from April to December 2013. Going forward, the number of visits will be tracked annually and will be measured against the near-term objective of a 75% participation rate.

The Home & Garden team has an annual operational goal to sample all requests for soil assessment for top priority properties (i.e., properties of families with children 36 months

of age or younger, expectant families, and families receiving case management, as well as vegetable gardens). Yard and vegetable garden soil assessments are tracked by recording both the number of assessments and soil metal levels, including the number of properties above the applicable Action Levels. Figures 5-8 and 5-9 summarize completed assessments for yards and gardens and the results of the assessments dating back to 2007.

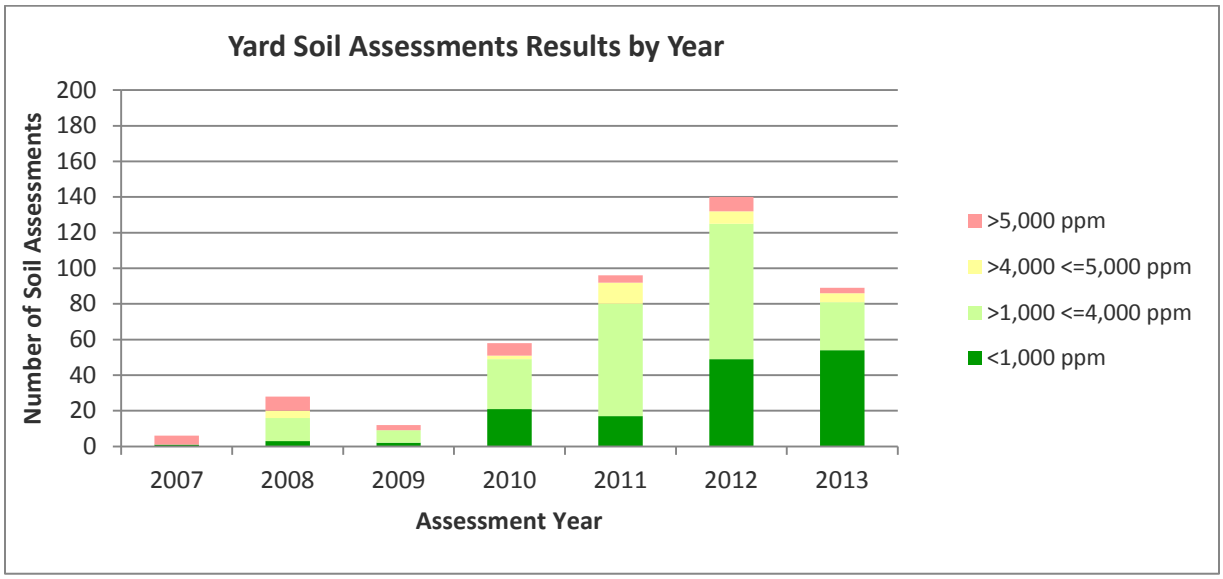

Figure 5-8. Yard Soil Assessment Results Since 2007

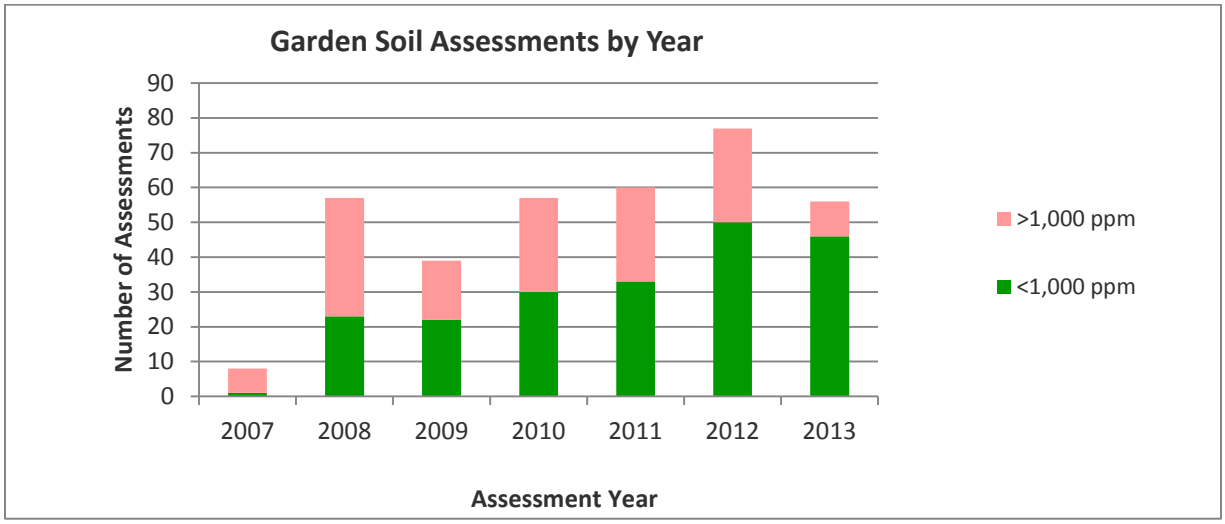

Figure 5-9. Garden Soil Assessment Results Since 2007

The goal for remediation is to remediate all properties with soil metal concentrations greater than the Action Levels. For yard improvement work, the goal is to improve ground cover on properties where young children are present or expected. As shown in Figure 5-10, there was a shift in 2013 from doing mostly yard and garden remediation to more yard improvement work. While remediation of all properties with soil metals levels above

Action Levels continues, soil is being assessed for around 100 families in the Healthy Homes Program, and, in the process, opportunities are being found and fulfilled to reduce lead exposure risks from soil for those families through yard improvement.

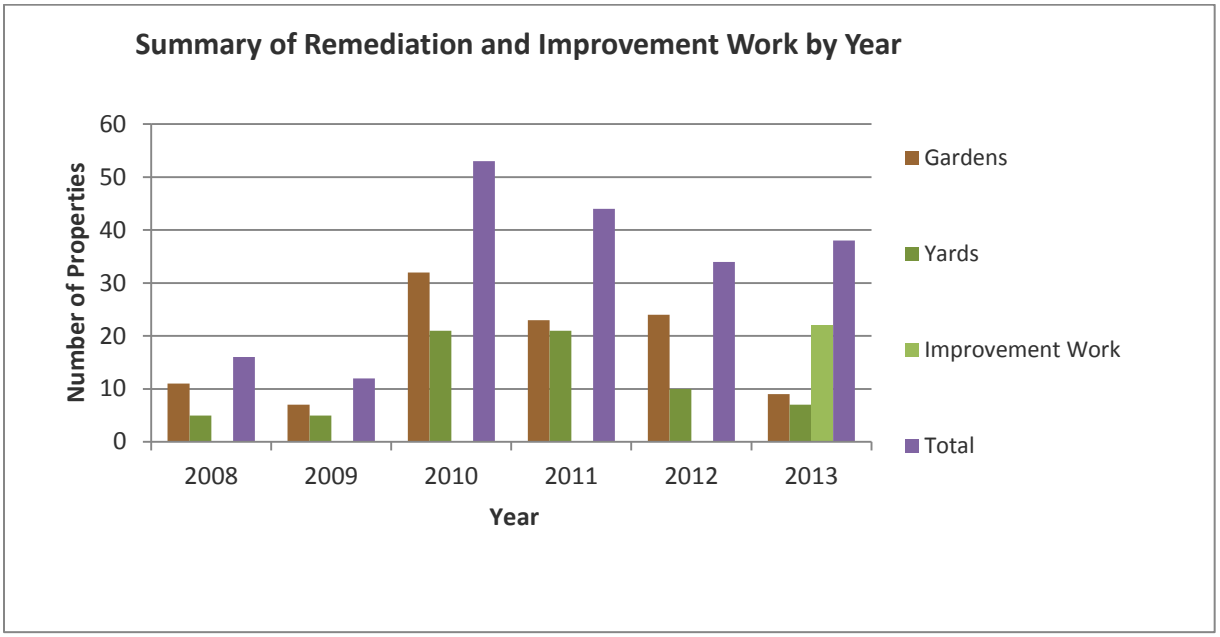

Figure 5-10. Remediation and Yard Improvement Works Since 2008

A monitoring program specific to yard and vegetable garden remediation, referred to as the Long Term Soil Study, began in 2010 with the purpose of evaluating the effectiveness of residential remediation in the presence of a continually operating smelter. Both soil and garden produce are studied, as follows:

- Remediated Soils: A study is being carried out to monitor metals concentrations in remediated yards and vegetable gardens over time. The study is expected to continue over the long-term to determine changes in measured soil metal concentrations after remediation.
- Produce sampling: Each year, a representative sample of garden produce is collected from approximately 30 gardens that have been remediated. Samples are dependent on the produce that the gardeners are growing or have harvested. The sampling is intended to correspond to sampling done for the human health risk assessment, and is currently under evaluation with regard to the effectiveness of garden remediation on metals levels in produce, particularly for cadmium and thallium.

A first draft of the Long Term Soil Study is being submitted to the WARP Steering Committee for review in fall of 2014.

Figure 5-11 shows the number of requests for home renovation support from 2010 through 2013. The total number of requests in 2013 was 94, equal to that from 2011. The

increase in 2013 from 2012 may be due to the implementation of the Healthy Families Healthy Homes Program. In 2011, the increase in requests was due to the 2010 recommendation to build awareness of the program through outreach activities. To that end, the HRSP brochure was revamped and a collaborative promotional event, "Home & Garden Days", was created with local building supply and gardening stores; this event was successful in achieving more HRSP requests and is now held annually in May/June.

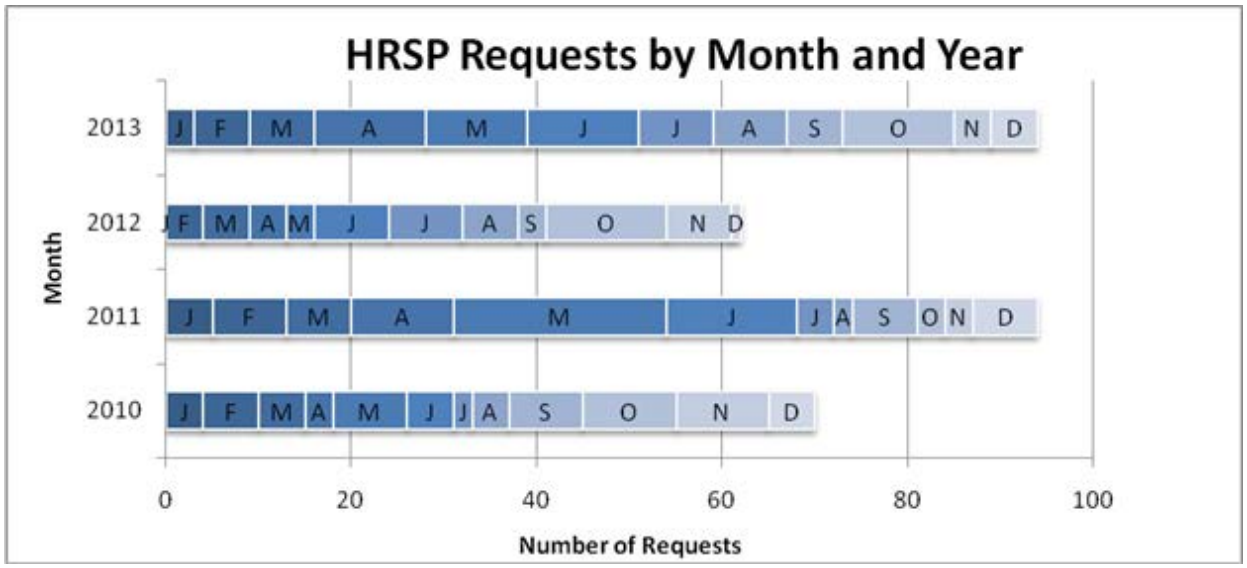

Figure 5-11. Number of Home Renovation Support Program Requests 2010-2013

The Community Program Office began tracking public contact in Fall 2013 by logging THEP-related phone calls and office walk-ins. This is done to document the level of public contact with the downtown storefront office as well as the specific requests or issues being brought forward.

5.3.8 *Summary of the Home & Garden Program*

The Home & Garden Program uses several diverse approaches to prevent and reduce health risks from exposure to lead and other smelter metals in the home and yard environment. The Healthy Homes Program was implemented to extend exposure prevention activities to all expectant families and families with children 36 months of age or younger in Trail and Rivervale. In-home visits are offered as support for families to reduce lead exposure. Residential soil assessment is available for Trail and Rivervale residents to prevent and reduce health risks from exposure to metals that may be present in yard and garden soil. Where Action Levels are exceeded, soil remediation is carried out. Yard improvement work is offered to Healthy Homes and Case Management families to reduce bare soil and improve ground cover; decisions are based on soil assessment results and visual inspection of the property. A Home Renovation Support Program is available to make it easier for people to carry out "lead-safe" home renovation, construction, demolition or excavation activities. In addition, soil assessment may be done at other locations, such as playgrounds and school yards, where children spend a lot of time and

where there may be concerns about metal concentrations or bare soil. These activities combined help meet the goals to:

- Prevent people's, and particularly young children's and pregnant women's, exposure to lead in their home and yard environments;
- Inform and engage the community, and particularly expectant families and families with young children, about the potential health risks from lead and other smelter metals in the home, yard environment and in the community; and,
- Promote lead-safe practices around the home, yard and garden.

5.4 Parks & Wildlands

The Parks & Wildlands Program addresses both human health and ecological issues. Planting to cover bare soil in parks and other green spaces decreases people's exposure to metals in soils. Treatment of soils in parks and wildland areas by adding soil, organic material, lime and/or nutrients can bind the metals in soil and decrease metal exposure for people, plants and wildlife.

The goal of the Parks & Wildlands component of the THEP is to decrease human and ecological exposures and risks by two main approaches:

- Community greening (covering of bare soil); and,
- Land-based ecosystem management to assess, rehabilitate, conserve and enhance wildland ecosystems, via the Lower Columbia Ecosystem Management Program.

These two approaches are described in detail below.

5.4.1 *Community Greening*

Community greening projects within the City of Trail are primarily carried out to meet the THEP objective of suppressing dust by greening areas with bare soil. This reduces people's direct contact with metals in soil and decreases the amount of soil that can be picked up and carried by the wind and transported around the community.

Community greening projects have been ongoing since 1992 (Table 5-1). Most pre-2001 projects were conducted on the Teck Trail Operations site and were directed towards research into soil improvements (such as using biosolids and lime) and trials for growing various plant species. In 2001, as part of a public consultation process, Teck (then Cominco) agreed to continue greening in the community by improving the buffer between the industrial site and the community, and by continuing other re-vegetation efforts around the community.

Table 5-1. Historical Community Greening Projects, 1992-2014		
Year	**Location**	**Project Scope**
1992-96	City of Trail	Projects including hydro-seeding, application of turf, and paving or gravel applications to cover bare soil.
Pre-2001	Tadanac	Approximately 300 conifer and 20 deciduous trees planted in community.
2001	Tadanac	80 large trees planted on Teck private lots, along buffer, end of soccer field; bare soil seeded with grass. Total area ~1.8 ha.
2001	Shaver's Bench	Biosolids and grass seed applied.
2001	Trail Airport	Biosolids transported to site and trees planted by Trail Model Flyers organization.
2002	Shaver's Bench	Biosolids and grass seed applied.
2002	Tadanac	30 trees planted to extend row planted in 2001.
2003	City of Trail	Biosolids supplied for Shaver's Bench and Columbia River bank stabilization.
2004	Glenmerry	Biosolids supplied to greening project by Glenwood Motel.
2005	Teck site	Most work done in and around Industrial site.
2005-2012	Riverbank	Teck Riverbank restoration work.
2013	Various	On-site perimeter greening, Duncan Slopes highway corridor, THEP biosolid and hydroseeding on Shaver's Bench site.
2014	Teck site; City of Trail	Planting of 50 9-foot conifer trees in two locations along the Highway 22 corridor; continuation of the Shaver's Bench planting project and JL Crowe Secondary School planting project.

Community greening projects are reviewed annually between Teck and the City of Trail. A list of eligible locations is generated each year in consultation with the City of Trail staff. Projects are given a ranking value based on their ability to meet objectives with respect to dust control, sustainability, aesthetics, erosion control, and biodiversity. The highest ranked project is then planned in more detail, resources are determined, and a consultant is contracted to implement the project. The consultant reviews the draft plan and the project objectives, and then provides a more detailed plan, including plant species and overall planting configuration. Final approval is provided by Teck and City of Trail personnel. The contractor then conducts the planting and the first year's watering to meet maintenance requirements. The project sites are generally dry, south-facing slopes that can lose moisture very rapidly. Variable weather patterns each year can also determine the extent of the watering effort needed. Once plants are considered established, manual watering of the site stops.

Success is determined by the size of area planted each year and by survival of plants after two years of growth. A survival rate for plants of at least 50% is considered a success. Generally speaking, the greater the area covered and the greater the plant survival, the greater the success of the project.

Plants are sourced from a number of locations including commercial greenhouses, private tree and shrub farms and from the JL Crowe Secondary School greenhouse and community garden. The high school has partnered with Teck to produce tall rooted deciduous trees (see Figure 5-12), and, in the Fall of 2013, students collected seeds from shrubs in the area and propagated them in the school's indoor greenhouse for Spring 2014 community planting.

Figure 5-12. JL Crowe Outdoor Education Students Planting Cottonwood Trees Grown in the Secondary School Community Garden

A related THEP initiative is the greening of buffer zones around the smelter, by planting trees and shrubs around the perimeter of the Teck facility. Community projects are proposed by groups such as Trail's Communities in Bloom and the Tadanac Community Association. Each group has provided a wish-list of prioritized projects with their main objective being community aesthetics and a secondary objective of dust suppression. Aesthetic appeal is enhanced, mainly along the perimeter of the industrial site, by providing a green visual backdrop between the community and the Teck industrial site. Dust suppression is enhanced by either planting on bare soil or by increasing the density of plantings in an area (in-fill planting). Although not a primary objective, ecological enhancement is achieved by providing green structure, in the form of trees or shrubs, on the landscape.

5.4.2 *Lower Columbia Ecosystem Management Program*

The Lower Columbia Ecosystem Management Program (LCEMP) is a collaborative approach to assess, rehabilitate, conserve and enhance land-based wildland ecosystems, including wetland and riverbank or creekbank areas, in the LCEMP area. LCEMP is a collaboration between Teck, regulators and other stakeholders, to meet regulatory requirements under the CSR.

The LCEMP arose out of the need for Teck to address ecological impacts in a portion of the ecological risk assessment (ERA) study area around the Trail smelter. The ERA of land-based ecosystems (Intrinsik et al., 2011) concluded that plant communities in wildland areas may be impacted from historical smelter emissions in up to 7,860 ha (yellow areas in Figure 5-13). Wildlife may be affected when there are changes in their habitat, so changes in the plant communities also can affect wildlife diversity or abundance. Ecological impacts attributable to historical smelter emissions were ruled out for the remainder of the ERA Area of Interest (grey area in Figure 5-13).

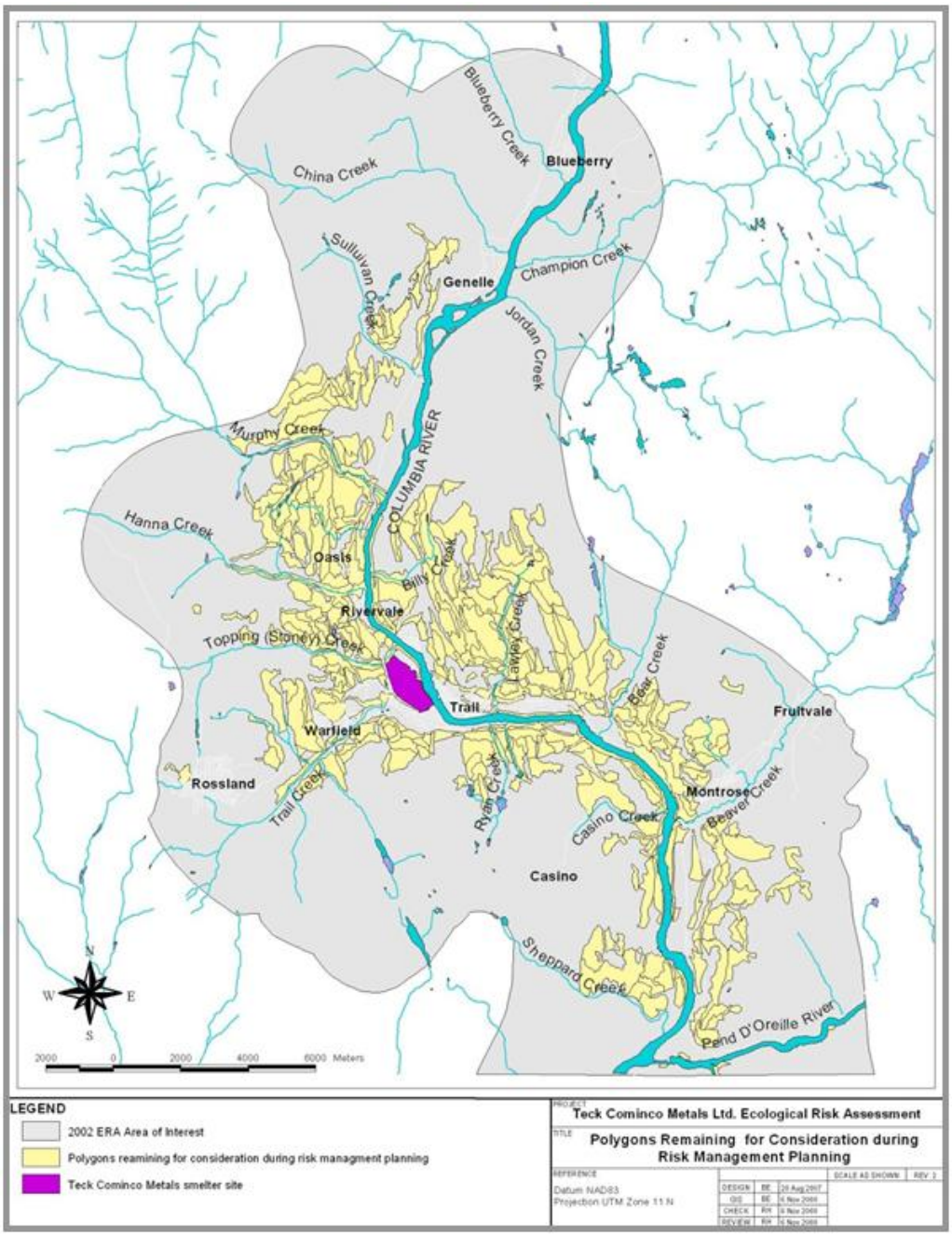

Figure 5-13. Impacted Areas Based on the Ecological Risk Assessment

While LCEMP considers management options for all of the lands identified in the land-based ERA as potentially impacted by historical smelter emissions (the 7860 ha), only some of these lands (approximately 4640 ha) may have metal concentrations in soil that exceed CSR soil standards for the protection of plants and soil invertebrates. The remaining lands (approximately 3220 ha) have a low probability (less than 10%) of having metal concentrations in soil that exceed these standards. Management and restoration activities for the areas that do not have metal concentrations in soil that exceed these standards are considered voluntary. Plant community impacts in these areas are more likely a result of historical SO_2 releases from the smelter, or other factors (e.g., historical fire).

The guiding principles developed for LCEMP are:

- The program will focus on ecological values and associated impacts.
- The program will consider impacts of habitat management on the socio-economic and cultural well-being of surrounding areas.
- The program will strive for consensus among stakeholders while recognizing landowner and statutory rights and responsibilities.
- Management actions will cause "no net harm", and are intended to yield a net benefit, as confirmed through effectiveness monitoring and adaptive management.

Teck will be developing remediation and restoration strategies for the areas highlighted in yellow in Figure 5-13. However, it may not be feasible to remediate or actively restore some of these areas, either because the area is inaccessible (e.g., steep gradient, no roads to the area), or because site conditions preclude successful remediation and rehabilitation. These areas may need to be offset by restoration or conservation activities in other areas.

In spring 2013, Teck submitted to BC MoE a document that summarized the literature on biodiversity offsetting, and included a framework for the use of offsetting within LCEMP (Teck, 2013). The BC MoE responded in January 2014 with a letter of support for the LCEMP process, while recognizing that some issues will require further consideration (BC MoE, 2014). Because there are so many potential offset projects, a strategic approach is being developed for evaluating options to determine which project would best serve as an offset for a particular impact. Additional details about LCEMP are provided in Appendix A, Section A-4.6.

5.4.3 *Monitoring*

Community greening projects are monitored and success is determined by the size of area planted each year and by survival of plants after two years of growth. At least 50% survival of plants is considered a success.

Monitoring of the Lower Columbia Ecosystem Management Program, LCEMP, is at the planning stage. An Effectiveness Monitoring Plan will be written to describe the monitoring requirements for different types of projects conducted under LCEMP. This includes Teck's internal covenants, weed management and other types of habitat management or enhancement actions. Monitoring programs and results will be reviewed periodically to

determine the need for adaptive management (i.e., changes in management actions if results do not meet expectations).

5.4.4 *Summary of the Parks & Wildlands Program*

The Parks & Wildlands Program serves to decrease human and ecological exposures and risks by two main approaches:

- The Community Greening Program which works to suppress dust through the greening of bare soil sites within the City of Trail.
- The LCEMP, which is a collaborative approach to assess, rehabilitate, conserve and enhance land-based wildland (including wetland and riverbank or creekbank) ecosystems in the area. The Program addresses Teck's obligation to remediate and rehabilitate areas that have been affected by smelter emissions under the CSR. It builds on work Teck is already doing on its own lands, but it also creates opportunities for additional conservation gains by encouraging collaboration with other area stakeholders and landowners to identify and implement activities that result in the greatest environmental benefit.

5.5 Property Development

The goal of the Property Development Program (PDP) is to address metals in surface soil (or other media such as groundwater, surface water or sediment, if contamination is present) that may be present from historical smelter emissions such that the property is remediated to risk-based standards as defined in the CSR (refer to Appendix A) and so that a Certificate of Compliance could ultimately be obtained for the property.

The PDP works with property owners and developers to address metals in surface soil during the redevelopment or new development of commercial, industrial or residential property within the Community Program Area (Figure 2-2). The PDP excludes work on existing residential properties; this is addressed on a prioritized basis through the Home & Garden Program. The PDP exists as a separate program from the Home & Garden Program because new developments/redevelopments typically involve significant excavation, and movement of soil and potentially new fill, creating a specific opportunity to address soil contamination on the property.

The PDP is triggered where demolition and/or new development on a Trail property is proposed and remediation is required in order to obtain the approval of the City or the Approving Officer to any of the following:

- Subdivision;
- Rezoning;
- Development permit or development variance permit;
- Soil removal permit; or,
- Demolition permit.

Teck will consider, on a case-by-case basis, requests for the PDP on properties that are not triggered. In some cases that are triggered, it may be found through the process that it is not advantageous or necessary to address soil contamination at the time.

The PDP is delivered by the Community Program Office on contract to Teck Metals Ltd. The PDP is structured to take place in conjunction with development planning for the property. Landowners are encouraged to contact the Community Program Office as early as possible so that the PDP can be initiated. The process will vary for each unique property development but will generally involve the following steps:

- Property Development Program Application and Confidentiality Agreement;
- Preliminary Site Screening;
- Property Development and Remediation Planning;
- Legal Agreement;
- Risk Based Remediation of Smelter Metals; and,
- Property Development Program Closure.

Further details on the PDP, specifically with respect to regulatory considerations, are provided in Appendix A, Section A-4.5.

6.0 PROGRAM EVALUATION AND CONTINUOUS IMPROVEMENT

Program evaluation and continuous improvement are integral to the Trail Area Health & Environment Program. Every THEP Program Delivery Partner maintains high quality standards, includes quality control monitoring and practices adaptive management. Also, the THEC, as a committee, regularly assesses monitoring results and makes recommendations for follow-up. This THEP document also will require regular updates.

The overall goal of the THEP is to reduce exposure to lead and other smelter metals in the community on a continual improvement basis. The current near-term objectives to address this goal are:

1. To have an average blood lead level of 4 µg/dL for children aged 6 months to 36 months in Trail and Rivervale by 2015;
2. To have at least 95% of children aged 6 months to 36 months in Trail and Rivervale with blood lead levels below 10 µg/dL by 2015;
3. To have an annual average of lead in community air[21] of 0.20 µg/m^3 or lower by 2018;
4. To have an annual average of arsenic in community[21] air of 0.01 µg/m^3 or lower by 2018;
5. To have a minimum of 75% of children aged 6 months to 36 months in Trail and Rivervale participate in blood lead testing clinics each year;
6. To have all home renovators in Trail and Rivervale, and renovators of pre-1976 homes throughout Greater Trail use the Home Renovation Support Program;
7. To have at least 75% participation[22] in the Healthy Families Healthy Homes Program each year.

Given that THEP is a comprehensive and integrated program, it is not possible to measure the contribution of each individual Program component to overall THEP success. That being said, emissions reduction makes by far the biggest contribution to improving air quality and reducing people's exposure to lead in the community. Currently, the Fugitive Dust Reduction Program is recognized as the greatest opportunity to further reduce emissions.

Evaluation is the systematic assessment of the outcomes, strategies and activities of a program with the intent of furthering its development and improvement. The desired outcomes are the objectives, goal and vision; strategies and activities are the means by which the THEC works toward them. Evaluation helps the THEC understand the progress towards the objectives and how efficiently and effectively the work has been carried out.

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[21] As measured at Butler Park station, in total suspended particulate for lead, and in PM_{10} (inhalable particulate) for arsenic.

[22] As measured by the number of families visited out of the total list of families (in a given year) with children in the target age range living in Trail and Rivervale: children 12 months and younger for Healthy Families; children 36 months and younger and expectant families for Healthy Homes.

The THEC has a strong focus on assessing progress towards the blood lead and air quality objectives, but pays attention to all of the objectives as well as the broader context of people's and ecosystem health, a thriving economy, children's healthy development and an engaged public. The THEC is committed to upholding the public's trust in every aspect of its work. To support this, the THEC uses a Continuous Improvement approach. Continuous Improvement is an approach to program management that uses regular ongoing assessment of monitoring data and program operations to refine programs and stay on track towards objectives and goals.

THEP evaluation and continuous improvement takes place through the following activities:

<u>THEC and Related Meetings</u>
Program monitoring results are reported to the THEC at its regular meetings (approximately five per year). This includes:

- Teck Trail Operations – Air Quality Program report including quarterly tracking of lead and arsenic levels in community air, semi-annual report on the Fugitive Dust Reduction Program, annual report on dustfall, additional reports on special issues as needed;
- Interior Health Public Health RN who supports the Family Health Program – Family Health Program report including annual presentation of the results of children's blood lead testing (presented at the November meeting);
- SNC-Lavalin – Home & Garden Program report;
- THEP Program Manager report; and,
- Reports of the Executive Committee and any active Working Groups.

The THEC identifies program elements that may require review and potential refinement based on its own assessment, external feedback, new scientific information or best practices, and regulatory changes. This may involve assignment of specific tasks to working groups or sub-committees.

The Air Quality Technical Working Group (refer to Section 5.1) provides a specific venue for THEC members to review Air Quality Program results, and discuss the adaptation that may be required in order to meet objectives.

In 2012, the US CDC guidance led to a THEC discussion about improvements to the THEP to bring it into alignment with the new guidance. This included a teleconference with Mary Jean Brown, Chief, Healthy Homes & Lead Poisoning Prevention Branch, US CDC. A working group examined all aspects of THEP in detail, noting that the THEC had already incorporated much of the scientific updates into THEP programming, and developed proposed recommendations. The THEC issued a set of recommendations in Fall 2012 based on the results of those discussions (THEC, 2012).

Program delivery activities are brought forward for discussion and, if necessary, refinement at regular (5+ per year) Program Team meetings based on professional assessment by Program Team members and/or external feedback.

Other Organizational, Program and Project Management

The partner organizations that deliver THEP services examine their activities and performance on a regular basis. Teck has numerous processes for assessing its emissions reduction programs including the Plan Do Check model used to guide the Fugitive Dust Reduction Program. Interior Health reviews and refines Public Health programming on a regular basis, including services provided by an Interior Health Public Health RN who supports the Family Health Program. In 2013, Interior Health conducted a Program Review of children's blood lead testing clinics leading to recommendations for quality improvement.

Professional Development

All Program Delivery Partners maintain high professional standards, stay abreast of the research, and ensure that THEP staff participate in important professional development opportunities. Family Health and Home & Garden staff frequently attend the annual US CDC Healthy Homes and Lead Poisoning Prevention National Training Center which focuses on lead exposure prevention. Other training opportunities may include the Lead Collaborative Consortium (held at McMaster University), and the National Healthy Homes Conference (organized by HUD).

Literature Reviews

The THEC stays abreast of the latest information on exposure to metals, health effects and effective programs. The THEC commissioned two literature reviews in 2013 to update knowledge about lead exposure preventions and the factors other than blood lead affecting children's healthy development. The second review also examined the effectiveness and benefits of in-home visits and community collaborative initiatives as well as the features of those programs that protect health equity. These reviews are discussed in Section 2.6.

Process to Update the THEP Document

Given that the THEP is going to evolve in future, there is a need to document the processes by which this document will be updated. The document is to be updated every 5 years. Changes taking place in the interim are to be addressed as follows:

- Ongoing program changes – These will be recorded on an Addenda list at the time they are documented in THEC meeting minutes and appended to the electronic version of the THEP document.
- Changes to performance objectives – The timing of the blood lead and air quality objectives should be brought into alignment when the children's blood lead objectives are next renewed. The blood lead objectives are set to be renewed after the results of the 2015 Fall Clinic are reviewed and accepted (planned for November 2015). This will give rise to a round of public consultation in 2016, which would logically include the air quality objectives and potentially all program objectives and any program changes since the last consultation.
- Changes to the program/document based on ongoing review by the BC Ministry of Environment Land Remediation Section via the Wide Area Remediation Plan (WARP) Steering Committee. Approval of the THEP as a WARP will also require

some form of public consultation, which could coincide with and/or be part of the same public consultation as for new program objectives in 2016.

It is proposed that the start date of the 5-year cycle for updating the THEP document be timed to coincide with the end of that public consultation and formal approval of new program objectives in 2016.

The ultimate measure of the success of the THEP is to uphold the vision of a community with healthy children and families, a clean environment and thriving economy. This is difficult to measure, with all the factors that influence health, the environment and the economy. As such, the THEP integrates activities that contribute to children's healthy development, ecological rehabilitation, and economic growth.

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ACRONYMS AND DEFINITIONS

Acronym	Definition
µg/dL	Microgram per deciliter - a measurement of concentration; used to measure lead in blood
AiP	Approval in Principle - a legal instrument in British Columbia issued when a remediation plan has been reviewed and approved
AREMP	Aquatic Receiving Environment Monitoring Program - activities to evaluate the ecological condition in the Canadian portion of the Columbia River as part of a permit requirement for Trail Operations effluent discharge
BLL	Blood Lead Level - the concentration of lead in blood
CIHS	Community Integrated Health Services
CPO	Community Program Office - a storefront at 1319 Bay Avenue in Trail that serves as a public resource for the THEP.
CRIEMP	Columbia River Integrated Environmental Monitoring Program - activities completed by stakeholders from government and industry to assess the status of ecological health of the Canadian portion of the Columbia River
CSR	Contaminated Sites Regulation - the law under the Environmental Management Act that addresses the assessment and remediation of areas containing elevated concentrations of chemicals
ECD	Early Childhood Development
Enclosure	Three dimensional structure that completely seals off the Trail Operations process from the community air
ERA	Ecological Risk Assessment - a process that evaluates the likelihood that adverse effects may occur or are occurring to non-human organisms, as a result of exposure to chemicals and other stressors
FAN	Family Action Network
HHRA	Human Health Risk Assessment - a process that evaluates the likelihood that adverse effects may occur in people, as a result of exposure to chemicals
HRSP	Home Renovation Support Program - activities within the THEP that provide free safety supplies, advice and assistance to people doing residential excavation, construction, demolition or renovation
IH	Interior Health Authority - a branch of the BC government that ensures publicly-funded health services are provided to residents of the Southern Interior; participates on the THEC; responsible for delivering the Family Health Program within THEP
LCEMP	Lower Columbia Ecosystem Management Program - activities to remediate and restore land-based ecosystems impacted by the Trail smelter
MoE	Ministry of Environment - branch of the government responsible for management and protection of land, water, air and living resources

PM_{10}	Particulate Matter (<10 µm in diameter) - solid particles in the air that are smaller than 10 µm in diameter
PDP	Property Development Program - activities within the THEP that address metals in surface soil during the redevelopment or new development of residential, commercial or industrial lands
PSI	Preliminary Site Investigation - Evaluation of existing information for a site to determine the areas of potential environmental concern that may require further investigation
RDKB	Regional District of Kootenay Boundary - the regional government authority that includes Trail
SO_2	Sulphur Dioxide - a gas emitted as a result of smelter operation
THEC	Trail Area Health & Environment Committee - a partnership between the local community, Teck, Interior Health Authority and the BC Ministry of Environment; provides governance for the THEP
THEP	Trail Area Health & Environment Program - a comprehensive and collaborative set of activities to improve the Trail area environment, and promote the health of the community related to smelter operations
TSP	Total Suspended Particulate – airborne dust
UCC	Upper Cap Concentration - the concentration of a substance in soil, water, sediment or vapour above which could pose a high risk to the environment or human health
US CDC	United States Centers for Disease Control and Prevention - part of the US Department of Health and Human Services that works to protect America from health, safety and security threats in the US
US EPA	United States Environmental Protection Agency - branch of the US government responsible for the protection of human health and the environment
US HUD	US Department of Housing and Urban Development - a US federal agency that works to create strong, sustainable, inclusive communities and quality affordable homes for the people of the United States
WARP	Wide Area Remediation Plan - a clean-up plan for a wide area site

APPENDIX A

REGULATORY ASPECTS OF THE TRAIL AREA HEALTH & ENVIRONMENT PROGRAM

APPENDIX A: REGULATORY ASPECTS OF THE TRAIL AREA HEALTH & ENVIRONMENT PROGRAM

This appendix provides details on the regulatory framework and requirements in relation to the THEP.

A-1.0 ENVIRONMENTAL MANAGEMENT ACT

The *Environmental Management Act* (EMA) (replacing the former *Waste Management Act* and the *Environment Management Act* in July 8, 2004) is the main law governing the management of the environment in the Province of British Columbia. Regulations brought into force under the EMA include:

- The Contaminated Sites Regulation (CSR) was brought into force in April 1, 1997, and lays out standards for site identification, assessment, and cleanup ("remediation"). The Ministry of Environment, Land Remediation Section administers these legal requirements.
- The Waste Discharge Regulation (WDR) was enacted July 8, 2004 (replacing previous provisions of the former *Waste Management Act)* and governs the way in which the Ministry of Environment authorizes the introduction of waste into the environment in a manner which will not cause pollution. The Ministry of Environment, Environmental Protection Division administers these legal requirements in the form of Permits issued to Teck Metals Ltd.

Section A-3.0 further describes the organizational relationship between the THEP, Teck's other environmental programs, and the BC Ministry of Environment.

A-2.0 CONTAMINATED SITES REGULATION RISK-BASED STANDARDS AND WIDE AREA REMEDIATION PLAN

The CSR provides numerical and risk-based standards to determine when remediation is needed and satisfactorily completed. There also are site-specific and Director's interim standards. A site is contaminated if substances in the environment (soil, water, sediment, vapour) at the site exceed the numerical standards.

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 apply; or;
- Contained and managed onsite – where the risk-based standards apply.

Because of the large geographic area, the risk-based approach is used in Trail.

Furthermore, there are sections of the CSR which provide special provisions for sites with many parcels of land whose contaminants came from one or more specific sources, in particular provisions for approving a Wide Area Remediation Plan for wide area sites.

Section 18.1 of the CSR provides specific provisions for the application of risk-based standards for wide area remediation plans based on the recommendation of a Medical Health Officer. These risk-based standards can take the form other than that of a hazard index or cancer risk; recommended alternate levels may be based on biomonitoring (e.g., blood lead levels) but must be specific numerical risk levels. This approach is widely accepted as a means of tracking exposures to lead and is being used in Trail to monitor ongoing efforts to manage and reduce lead exposures. Such a recommendation must be supported by an appropriate public community-based consultation process, acceptable to the Medical Health Officer. The Medical Health Officer would need to make written recommendations and provide supporting rationale, with the endorsement of the Provincial Health Officer. The responsibility of the Medical Health Officer, as outlined in Section 18.1 of the CSR, is documented in the report "Acceptable Level of Human Health Risks Resulting from Smelter Contaminants in the Trail Area" (Ames, 2001) in which the Medical Health Officer at that time, Dr. Nelson Ames, stated that he supported all the remediation recommendations filed by the Trail Community Lead Task Force.

A-3.0 ORGANIZATIONAL RELATIONSHIPS

Figure A-1 illustrates the relationship of the THEP as a Wide Area Remediation Plan (WARP) with Teck's other programs and related activities, as well as with BC Ministry of Environment.

The WARP Steering Committee oversees progress towards a remediation plan to address human health and land-based ecological issues, formally as per the Contaminated Sites Regulation, and informally as complementary to Permit requirements. Teck has been issued three permits from the Ministry of Environment for emissions to air from the chemical fertilizer plants located at Warfield (Permit 2690), and the lead and zinc smelters in Trail (Permits 2691 and 2692). The WARP Steering Committee was formed in 2001 at the conclusion of the Lead Task Force as part of a Memorandum of Understanding between Teck and the BC Ministry of Environment (MoE). The mandate of the Steering Committee was to oversee the completion of the human health and ecological risk assessments and then, ultimately, to oversee submission and approval of a WARP. The committee is jointly chaired by Teck and MoE representatives, and is responsible for the scheduling and coordination of the WARP process and deliverables in accordance with the CSR.

The THEP/Wide Area Remediation Plan addresses wide area human health and the land-based ecological environment as follows:

- Human health issues are addressed by the THEC by means of the THEP.
- Land-based ecological issues are addressed by the Lower Columbia Ecosystem Management Program (LCEMP). LCEMP is overseen by its own Steering Committee, but is also part of the Parks & Wildlands Program of the THEP. Further details on LCEMP are provided in Section A-4.6 below.

The aquatic environment and Teck Operational Site are addressed under separate programs as follows:

- Aquatic Environment: The Aquatic ERA (see Section A-4.1) did not identify wide-scale effects that would require risk management. Issues that were identified in the Aquatic ERA are not included in the THEP/WARP because they were geographically focused on small areas, and possibly related to physical (not chemical) effects. Rather, aquatic issues are being addressed primarily by the Aquatic Receiving Environment Monitoring Program (AREMP). AREMP was developed in consultation with the BC MoE to serve as an ongoing program that monitors the ecological condition of the Columbia River as a Permit requirement for Trail Operations ongoing effluent discharge. In this manner, aquatic issues are addressed by Teck directly with BC MoE Environmental Protection on an ongoing basis. The results from the most recent AREMP sampling (2012; Hawes et al., 2014) showed that the potential smelter-related effects observed in the Aquatic ERA are no longer seen. In addition, Teck supports other regional initiatives via participation in the Columbia River Integrated Environmental Monitoring Program (CRIEMP) and the Upper Columbia White Sturgeon Recovery Initiative (UCWSRI). Teck also will address localized issues, as they arise, with site-specific monitoring, risk assessment and/or management actions as part of the Soil and Groundwater Management Program.
- Teck's Operational Site: A separate Soil and Groundwater Management Program (SGM Program) is being developed to address conditions within the Teck Trail Operations Site footprint, as well as groundwater migration off-site, including localized areas of ecological impact in the Columbia River. Thus Operational site issues are separate from the THEP and addressed by Teck directly with BC MoE Land Remediation and Environmental Protection through the SGM Program and Permitting.

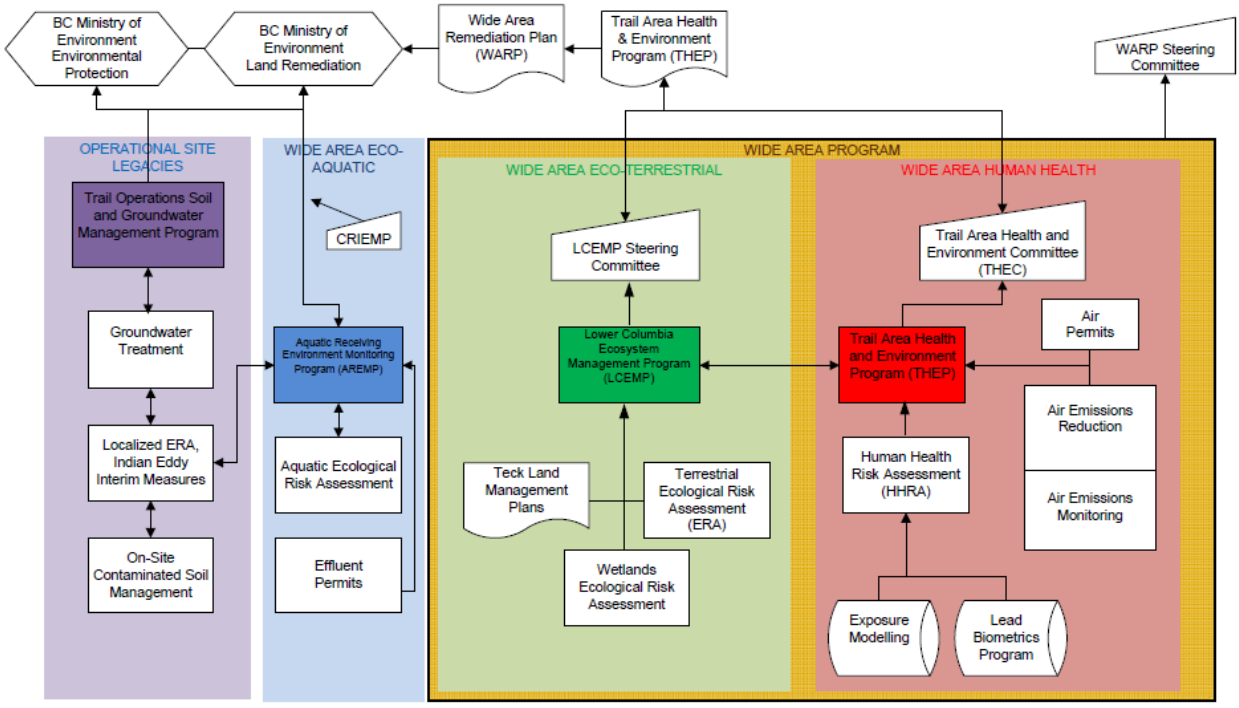

Figure A-1. The Organizational Relationship between the THEP, Other Teck Programs and Activities, and BC Ministry of Environment

A-4.0 THE THEP AS A WIDE AREA REMEDIATION PLAN

The Trail Area Health & Environment Program described in this document meets the requirements of a wide area remediation plan under the CSR as follows:

- Section A-4.1 describes the delineation of wide area contamination as well as the human health and ecological risk assessments;
- Section A-4.2 identifies remediation and risk management alternatives;
- Sections A-4.3 through A-4.5 outline the soil Remediation Action Levels and the soil remediation process, including the Property Development Program (PDP), respectively;
- Section A-4.6 provides details on LCEMP to address ecological risks;
- Section 6 of the Main Report describes the Program evaluation and continuous improvement activities for the THEP; and,
- Section A-4.7 provides details on public consultation and communications.

A-4.1 Delineation of Contamination and Human Health and Ecological Risk Assessment Overview

Delineation of Contamination

As part of the risk assessment studies described below, environmental media were sampled to delineate (determine the extent of) contamination over the wide area. The sampling results and interpretation are elaborated in the studies, a comprehensive listing for which is provided in Section A-6 and thus not reiterated here.

With the exception of slag used for fill in a specific area of downtown Trail (for which a separate risk-based investigation is under way as part of the SGM Program), the use of waste materials for fill has not been found to be prevalent in the Trail area. As such, this Program contemplates only the deposition of metals via aerial emissions.

Delineation to the most conservative CSR standard is confounded by background concentrations, particularly for cadmium, since the background levels are very close to and indistinguishable from the current standards. On a priority basis, the THEP focuses on and applies to the areas closest to the smelter where risks may be present. Delineation of the areas of the lowest levels of contamination is currently a less important issue in terms of the application of the current Program priorities; however, it is recognized that this will need to be addressed in the future. The Program component boundaries are described in Section 2.2.

Human Health Risk Assessments

As described in Section 1, the Trail Community Lead Task Force was established in 1990, to address health issues associated with lead in the community. The Task Force implemented several activities to measure and reduce environmental exposures, and in 2001 recommended the establishment of the Trail Area Health & Environment Committee.

In 1997, the Task Force began studying whether other smelter-related contaminants also might represent potential health risks. 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).

The Phase One HHRA report was completed in 1997. The purpose of this report was to compile the available data for metals in soil, dust, and vegetables, to review the quality of these data, to provide recommendations for the collection of any additional data, and to screen the maximum metal concentrations in soil against the soil screening criteria from the BC MoE. The data analysis showed that eight metals (antimony, arsenic, cadmium, mercury, selenium, thallium, tin, and zinc) required further evaluation in a detailed risk assessment.

The Phase Two HHRA report was completed in 1998 and concluded that there was no imminent (short-term) threat to human health from metals other than lead. Additionally, the potential adverse health effects were very limited for long-term residents of these communities. The report stated that the focus of ongoing study should be continued air monitoring for arsenic and cadmium, and that PM_{10} also should be measured.

The Phase Three HHRA report was completed in 2000. The purpose of this report was to update the conclusions of the Phase Two HHRA by including more recent air data, from the Trail communities and from a location considered to represent background conditions, indoor dust data, and home-grown produce data. The Phase Three HHRA concluded that there was no imminent threat to human health in the Trail communities from metals other than lead, and the potential for adverse health effects from long-term residence in the Trail communities was very limited. The Phase Three HHRA indicated that the main focus of ongoing studies should be to continue air monitoring of arsenic, cadmium, and lead, and to measure metals in PM_{10}.

The Phase Four HHRA report was completed in 2008. The purpose of this HHRA was to evaluate risks on an area-wide basis (that is, for all neighbourhoods combined), as well as evaluate neighbourhood-specific risks for East Trail, Rivervale, Tadanac, Waneta, and West Trail. The Phase Four HHRA concluded that area-wide non-cancer health risks were below the BC Ministry of Environment levels of concern. Non-cancer health risks also were below levels of concern for agricultural and commercial areas. For residential areas, non-cancer risks slightly exceeded the acceptable level for the neighbourhoods closest to the smelter; however, these slight exceedances did not approach exposure levels known to result in increased health risks. Additionally, the urinary bio-monitoring study conducted in 2002 suggested that risks may be overestimated for thallium. Both area-wide and neighborhood-specific cancer risks exceeded the BC Ministry of Environment acceptable cancer risk level (1 in 100,000) but were below a risk level above which the US Environmental Protection Agency (EPA) generally considers a response action is required (1 in 10,000). It was noted that alternative acceptable cancer risk levels may be considered if recommended by the Medical Health Officer after public consultation (see Section A-2.0 above). The Phase Four HHRA report also indicated that since there was strong correlation between lead and other site-related metals, the remediation of lead in soil would address elevated soil concentrations of other metals.

As part of the Long Term Soil study (see Section A-4.3.3 below), an update to the HHRA with respect to produce consumption is being completed; a first draft of this study is being submitted to the WARP Steering Committee for review in fall 2014.

Ecological Risk Assessments

In 2000, an ecological risk assessment (ERA) was initiated to determine whether there were ecological effects caused by smelter emissions. This also was done using a phased approach between 2000 and 2011. The purpose of the Problem Formulation reports (Cantox Environmental et al., 2001; Golder, 2003) was to compile the available data for metals in soil, water and sediment, to identify ecological species to assess in the quantitative ERAs, to complete a screening-level risk assessment, and to provide recommendations for the collection of any additional data. Subsequent reports (Cantox Environmental, 2003; Intrinsik, 2007) incorporated a greater amount of site-specific data and used more advanced modelling to assess exposures and risks. The Final Terrestrial ERA report (Intrinsik et al., 2011) recommended that risk management be considered for up to 7900 ha of wildland. This is being addressed by LCEMP, as described further in Section A-4.6 below.

The Final Aquatic ERA report (Golder, 2010) did not identify wide-scale effects that would require risk management. The main Aquatic ERA conclusions were: there were no impacts on fish, except for white sturgeon (and impacts on sturgeon were not strongly linked to the smelter); there may be impacts on the benthic community but only at two sites; and, there may be impacts on periphyton but only at the site within the Initial Dilution Zone (IDZ) and one other site. The Aquatic ERA recommended that additional monitoring be done because either there was no strong link between some observed effects and smelter chemicals, or there were other possible causes of effects to aquatic species. As mentioned in Section A-3.0 above, this is being addressed by AREMP and UCWSRI.

The ERAs did not include an assessment of wetlands. Wetlands are currently undergoing risk assessment studies under the review of the LCEMP Steering Committee.

A-4.2 Remediation and Risk Management Alternatives

According to the HHRAs and ERAs (Section A-4.1), metals in air and particularly dust are the primary contributors to health and environmental risks and impacts. Soil contamination is currently a relatively minor contributor to metals exposure and human health risk, with air and dust concentrations having the greatest influence on blood lead trends. The THEP focuses risk management priority on these most important pathways and combines all of the elements necessary to protect and enhance the health and environment of the Trail community.

The diverse remediation and risk management measures that comprise the THEP are described in Section 5 of this document, specifically:

- Section 5.1 (Air Quality) addresses emission (source) reduction and dust suppression;

- Section 5.2 (Family Health) addresses educational outreach, case management, and counselling approaches to decrease exposure;
- Section 5.3 (Home & Garden) and 5.5 (Property Development) address soil assessment and removal, with additional detail below in Sections A-4.4 and A-4.5;
- Section 5.4 (Parks & Wildlands) addresses greening and habitat restoration, with additional detail below in Section A-4.6.

All of these THEP elements reduce risk. Monitoring of children's blood lead levels informs our progress towards our health goals.

A-4.3 Soil Remediation Action Levels

The current Remediation Action Levels, and the rationales for these Action Levels, are described below.

A-4.3.1 Remediation Action Levels for Yards and Flower Gardens

For yard and flower garden remediation, the current Action Level corresponds to the Upper Cap Concentration (UCC), set out in Protocol 11 of the BC Ministry of Environment, Contaminated Sites Regulation. Where representative[1] soil concentrations are greater than the UCC, remediation of some or all of the yard is offered. For residential yards, this action level has been driven by 5,000 mg/kg lead in soil; however, remediation is also offered for other smelter metals that exceed their respective UCC. Effective February 1, 2014, the MoE lowered the UCC for lead to 4,000 mg/kg, and thus the THEP's inventory of yards with lead concentrations greater than 4,000 mg/kg will be offered remediation retroactively. The remediation involves soil removal to a depth of 30 cm (approximately 1 foot), installation of a demarcation layer (visual barrier fabric) and replacement of at least 30 cm using approved fill material.

For yard soil and flower gardens with concentrations less than the UCC, yard improvement work is offered in cases where an expectant family or family with children less than three years of age is present on the property and where there is bare soil or poor ground cover. Yard improvement work is determined based on the soil assessment results and a visual assessment of ground conditions and property use. Areas of particular concern are: areas of poor ground cover or bare ground, drip zones, play areas, parking areas, pathways, patios, as well as vegetable and flower gardens. In these cases, the yard improvement work typically consists of removing existing surface soil and ground cover and replacing it with better ground cover (such as sod, gravel, mulch, concrete, as appropriate). The objective is to prevent young children's exposure to metals in dust and soil.

[1] The yard soil concentrations are calculated as the 95% Upper Confidence Limit of the Mean (UCLM) from a number of (at least ten) discrete yard samples, collected on a grid basis to a depth of 0.1 m. Garden concentrations are determined from composite samples, since gardens are generally well mixed.

A-4.3.2 Remediation Action Levels for Vegetable Gardens

For vegetable gardens, the current Action Levels correspond to risk-based values developed for lead through the HHRA (Integral, 2008). Property owners with vegetable gardens with representative soil metal concentrations greater than 1,000 mg/kg lead are offered remediation. The remediation involves soil removal to a depth of 60 cm (2 feet) across the vegetable garden, the installation of a demarcation layer, and the replacement of at least 60 cm of soil.

A-4.3.3 Rationale for Current Remediation Action Levels

The THEC has the vision of a community with healthy children and families, a clean environment and thriving economy. Trail is a dynamic and complex area where current and historical smelter activities are a primary source of metals exposure. With an operating smelter, air quality improvements (emissions reductions) remain the greatest opportunity for reducing metal exposures and health risks in Trail.

While Teck continues to reduce air emissions and evaluate the effectiveness of soil remediation, families are being offered home visits, soil assessment and support through the Healthy Families Healthy Homes Program, as discussed in Sections 5.2 and 5.3. These activities support children at a critical stage in their development and work to prevent children's exposure to metals in soil and indoor dust. Educating and supporting families to reduce indoor dust may present a greater opportunity than soil remediation for reducing metals exposure to young children.

Based on experiences at other smelter sites, soil remediation is one of the factors that can influence blood lead levels, but it will likely have only a modest effect on reducing blood lead levels, particularly while the smelter continues to operate and fugitive dust is the primary pathway (Aschengrau et al., 1994; Hilts, 2003; Taylor et al., 2013; US EPA, 1998; Weitzman et al., 1993; Yeoh et al., 2009). Prior to the late 1990s, it was thought that soil lead in the communities around smelter sites was the main environmental problem causing elevated blood lead levels. However, studies in the US, Australia and Canada, including at Trail, found that atmospheric lead dust was likely the dominant source causing elevated blood lead levels in children (Hilts, 2003; Taylor et al., 2013). The Trail study (Hilts, 2003) showed that decreasing lead in air emissions was a significant factor in decreasing lead loadings in outdoor dustfall, street dust, and indoor dustfall, with the result being a dramatic decrease in blood lead levels (from 11.5 µg/dL in 1996 before the new smelter technology started in 1997, to 5.9 µg/dL in 1999). In the summer of 2001, smelting and refining operations in Trail were shut down for three months, and the average blood lead level decreased to 4.7 µg/dL. These data suggest soil concentrations are only one of the factors contributing to blood lead levels when there is an active air emission source.

More attention should be paid to active sources of highly bioavailable and mobile lead-containing dusts (Hilts, 2003). Dust from smelter emissions also was found to be a major contributor to children's lead exposure near an active lead smelter in Port Pirie, Australia (Taylor et al., 2013). Where there is no ongoing source of lead, studies (Aschengrau et al., 1994; US EPA, 1998; Weitzman et al., 1993) have shown that there may be a modest

reduction in blood lead after soil remediation, but that no benefit was found when dust was the main exposure pathway (e.g., for children living in apartments, homes with persistently elevated dust lead loadings). Closures of a lead-zinc smelter in Boolaroo, Australia, and a lead smelter in Noyelles-Godault, France, both resulted in decreased children's blood lead levels after the closure, without soil remediation (Dalton and Bates, 2005; Declercq et al., 2006). A recent attempt to conduct a detailed evaluation (meta-analysis), to determine the effectiveness of soil abatement alone in reducing blood lead levels, was not possible due to insufficient evidence (Yeoh et al., 2009). Inhalation exposure also was found to be a small contributor to risk (Hilts, 2003). Most studies have looked at sites where blood lead levels were greater than 10 µg/dL. Strategies to lower blood lead levels that are below 10 µg/dL may differ. Therefore, several approaches are being used, and interventions focused on decreasing dust, including yard improvement, may provide better opportunities to decrease exposures than soil removal. Having good ground cover (such as sod, gravel, mulch, concrete) helps reduce dust tracked into the home and reduces indoor dust, the primary exposure risk for children less than 3 years of age.

Yard soil remediation is being offered for all or part of a residential yard where soil metal concentrations are greater than the current UCC. Over the next few years, the Home & Garden Program will continue to remediate properties above the UCC and evaluate the effectiveness of the soil remediation efforts through a Long Term Soil Study, the first draft of which is being submitted to the WARP Steering Committee for review in fall of 2014. Once properties with soil metals concentrations greater than the UCC are remediated, yards with lower concentrations may be considered.

Soil in vegetable gardens has a risk-based Action Level that is lower than the UCC due to the higher potential for exposure of children to bare soil, as well as the potential risks associated with consuming garden produce, as determined by the HHRA (Integral, 2008). Remediation is based on the Action Level for lead because there is a relationship between concentrations of lead in soil and concentrations of other smelter metals such as arsenic, cadmium and thallium. Therefore, the remediation of vegetable gardens with soil lead above the Action Level is consistent with protecting residents from potential exposure to other metals that may be present in their garden soil. Nevertheless, the concentrations of all metals are evaluated, and garden remediation is offered in cases where any metal is greater than its respective UCC (for example, occasionally cadmium > 30 mg/kg).

It is expected that a combined effort of improving air quality, reducing indoor dust, educating families and remediating soils will help achieve the goals of the THEP.

As air quality, in particular fugitive dust emissions, is improved, future remediation priorities are expected to become adjusted through the THEC's adaptive management approach to continuous improvement. For example, in the longer term, there may be justification for focusing on soil remediation to lower levels than the current action levels.

A-4.4 Soil Remediation Process

The remediation process is documented in an Operating Procedure for Residential Soil Remediation and involves the following key steps. All data and information is tracked and stored within a comprehensive database managed by the Community Program Office.

- Reviewing soil assessment results and developing the scope of remediation or yard improvement work required (remediation of whole or partial yard, yard improvement, vegetable garden remediation).
- Submitting additional soil samples as necessary, for laboratory analysis to determine levels of leachable metals for soil disposal purposes.
- Preparing regulatory documentation for the BC Ministry of Environment, Land Remediation Site Advisor for properties receiving remediation of all or part of the yard. This includes the Notification of Independent Remediation (NOIR), a Site Risk Classification Report, an Exposure Pathway Questionnaire, a survey plan, a copy of the land title and a map of metals concentrations in the soil[2].
- Obtaining signed consent to access the property from the property owner and developing a remediation/yard improvement workplan in consultation with the property owner/tenant and contractor.
- Scheduling remediation/yard improvement work based on a prioritized list of properties.
- Submitting documentation to the BC Ministry of Environment as listed above[2].

Performing the remediation/yard improvement work as described in the Remediation Operating Procedure, includes the following steps:

- For remediation of yards and flower gardens, removal of soil to a depth of at least 30 cm.
- For remediation of vegetable gardens, removal of soil to a depth of at least 60 cm.
- For yard improvement work, the improvement of cover in specific areas may include removing soil to a shallow depth, fertilizing and topdressing sod to encourage better grass cover, and the replacement of bare areas with more permanent ground cover. The improvement work is determined on a case-by-case basis.
- Disposing of excavation material (if any) at a designated and approved location.
- Sampling the base of any excavations to record soil conditions and ensure all soil greater than UCC is removed.
- The placement of a geotextile at the base of any remediation to act as a visual demarcation layer of the extent of the remediation work.
- The replacement or installation of suitable contaminant-free cover material (soil, gravel, mulch, etc.).

[2] Note that the submissions to the MoE are proposed to change following approval of the wide area remediation plan. The proposed method, subsequent to an approval, is to carry out remediation and yard improvement work throughout the year and update the MoE annually with a summary document listing all properties and the work completed.

- Sampling surface soil to document metals concentrations on the property.
- The replacement of surface features such as sod and landscape plants as required.
- Completing the work and obtaining a sign-off from the property owner that the work has been completed to their satisfaction.
- Submitting a Notification of Completion of Independent Remediation (NCIR) to the BC Ministry of Environment[2].
- For High Risk Sites as determined under Protocol 11 of the CSR, providing a Site Reclassification Report signed by a Contaminated Sites Approved Professional (CSAP) to change the high-risk designation on the Site Registry to either non-high risk or a risk-managed high risk site[2].
- Providing a summary of the remediation/yard improvement work to the property owner and to Teck.

A-4.5 Property Development Program

The PDP exists as a separate program from the Home & Garden Program because new developments/redevelopments create a specific opportunity (since significant ground works are usually required as part of the development) to address soil contamination (or contamination of other media if present) at the property during the development[3]. The goal of the PDP is to address metals in surface soil that may be present from historical smelter emissions such that the property is remediated to risk-based standards as defined in the CSR (see Section A-4.5.5 below). Depending on the type of development this may involve either removing contaminated soil from the site, or capping the site with one metre of non-contaminated soil.

The PDP is triggered where demolition and/or new development on a Trail property is proposed and remediation is required in order to obtain the approval of the City or the Approving Officer to any of the following:

- Subdivision;
- Zoning;
- Development permit or development variance permit;
- Soil removal permit; and
- Demolition permit.

However, Teck will consider on a case-by-case basis requests for the PDP on properties that are not triggered. In some cases that are triggered, it may be found through the process that it is not advantageous to address soil contamination at the time[4].

[3] Also, until the Program receives approval from the Ministry of Environment, any developments that require rezoning, subdivision or a municipal permit require a Site Profile which triggers a Contaminated Sites Regulation process that requires the same risk-based standards to be met. Note that Home & Garden Program remediations currently do not apply for a Certificate of Compliance.

[4] In such cases, the property would not be documented as "remediated", and eventually the property would need to be remediated before a Certificate of Compliance could be obtained.

The PDP is delivered by the Community Program Office (CPO) on behalf of Teck Metals Ltd. The PDP is structured to take place in conjunction with the development planning for the property. Landowners are encouraged to contact the Community Program Office as early as possible so that the Property Development Program can be initiated. The process will vary for each unique property development but will generally involve the following steps:

- Property Development Program Application and Confidentiality Agreement;
- Preliminary Site Screening;
- Property Development and Remediation Planning;
- Legal Agreement;
- Risk Based Remediation; and,
- Property Development Program Closure.

A-4.5.1 Property Development Program Application and Confidentiality Agreement

To initiate the PDP, the landowner must fill out an Application Form with assistance from the CPO, which will include a confidentiality agreement. The purpose of the application is to provide information on a proposed development without entering into a legally-binding agreement, other than ensuring that confidentiality can be maintained.

The Application Form includes:

- Contact Information (landowners, 3rd parties, etc.);
- Property Location and Legal Description;
- Land Use History;
- Current Land Use;
- Future Land Use; and,
- Information on Development Permits and Rezoning Applications.

The Property Development Program Application does not replace other applications required of landowners or developers by the City of Trail or Regional District of Kootenay Boundary. The CPO records information from the Application Form in the Program database for future tracking.

A-4.5.2 Preliminary Site Screening

Landowners and Teck both participate in the Preliminary Site Screening. Landowners are responsible for completing a Stage 1 Preliminary Site Investigation[5] (Stage 1 PSI) while Teck is responsible for conducting a surface metals screening investigation. The purpose of the preliminary site screening investigation is to provide information on historical and current contamination on the property.

[5] This is a standard requirement that most property purchasers or financial lenders require in any case, as part of good business practice across the province.

The Stage 1 PSI involves searching existing records for information about a site, interviewing people who are or have been involved with the site, and determining the general location and degree of any historical contamination. Stage 1 PSIs must be completed by qualified professionals and be suitable for submission under the BC Ministry of Environment CSR. Information on the Stage 1 PSI process is available on the BC Land Remediation website and a checklist is included in MoE Technical Guidance 10[6].

After landowners have submitted the Program Application and provided a qualified Stage 1 PSI, Teck will authorize the CPO to complete a metals screening investigation for surface soil.

- The metals screening will be performed in a manner similar to the Residential Yard Soil Assessment Program – Soil Assessment Operating Procedures (see Resource Compendium). It will collect sufficient data to get an early indication of smelter metals levels for current and future land use. Additional investigation and risk assessment may be required prior to remediation work.
- The metals screening investigation focuses on surface soils. Surface soils will be screened using an x-ray fluorescence analyzer that will provide a screening-level indication of metals concentrations on the property. Depending on the results, samples may be submitted for confirmatory laboratory analysis. Surface soil sampling will follow the same methods as outlined in the Residential Yard Soil Assessment Program – Soil Assessment Operating Procedures. The number of samples collected on the property will vary depending on the size of the parcel.

The CPO will review and summarize the Stage 1 PS1 and the metals screening results for Teck's review.

A-4.5.3 Property Development and Remediation Planning

Once the preliminary site screening investigations are complete, Teck, with support of the Community Program Office, will arrange to meet with landowners to discuss the results and property development plans and schedules. It may take more than one meeting to achieve the following:

- Gather development plan information from the landowner (i.e., development permits and plans, sequence of development, location of access roads, borrow pit areas, equipment and material lay down areas, etc.);
- Discuss the results of the metals screening investigation with the landowners;
- Introduce the landowner to risk management options where preliminary metals screening suggests risk management is required to obtain closure for the property;
- Identify data gaps and soil disposal areas;
- Complete additional site investigation and risk assessment work to confirm results;
- Provide remediation options;
- Develop a proposed development schedule and budget; and,

[6] http://www.env.gov.bc.ca/epd/remediation/guidance/technical/pdf/tg10.pdf

- Develop a proposed Legal Agreement.

A-4.5.4 Legal Agreement

Based on the information collected, Teck will develop and provide a proposed legal agreement. A legal agreement is in the interest of both parties and is required before Teck provides further technical and/or financial support to the landowner. Part of the agreement will require the landowner to proceed with the planned development project, in order for funding to continue, to protect Teck from expending resources on a property that is not developed; however, the exact agreement will vary depending on the development.

A-4.5.5 Risk-based Remediation of Smelter Metals

Surface soil (or other contaminated media if present) on properties in the PDP will be remediated to risk-based standards as defined in the CSR. The risk-based standards are determined by a property-specific risk assessment and typically differ from (are lower than) the Remediation Action Levels defined in Section A-4.3 above. Soil above the risk-based standards will be remediated with the goal to have the property eligible for a Certificate of Compliance under the CSR. Depending on the type of development, this may involve either removing soil with concentrations greater than risk-based standards from the site, or capping the site with one metre of non-contaminated soil.

The landowner will be responsible for retaining all professional consultants and contractors to complete the remediation activities. Teck will reimburse the developer for the incremental costs that the developer occurs only because of metals from the smelter.

Teck, through the CPO[7], will monitor key milestones of the remediation scope:

- Confirming the depth of excavation and that the scope of work was followed;
- Collecting samples at the base of any excavation and screening for metals;
- Testing and approving backfill materials prior to bringing onsite; and,
- Collecting post-remediation samples to record metals levels in replaced soil.

Teck will reimburse the landowner for the remedial costs outlined in the remediation agreement. Teck will not be responsible for non-smelter related contamination.

A-4.5.6 Property Development Program Closure

The final phase of the Property Development Program requires the CPO or the developer's consultant to write a Confirmation of Remediation Report for a Certificate of Compliance with the Ministry of Environment.

[7] Alternatively, the developer's consultant will complete this work under the agreement with Teck.

A-4.6 Lower Columbia Ecosystem Management Program

In 2008, Teck met with BC Government representatives (Ministry of Environment, Ministry of Forests) to present the concept of a Lower Columbia Ecosystem Management Program (LCEMP). The LCEMP is a collaborative approach to assess, rehabilitate, conserve and enhance terrestrial wildland ecosystems (including wetland and riparian areas) in the LCEMP Program area. A Steering Committee was formed including participation by BC Ministry of Environment; Ministry of Forests, Lands and Natural Resource Operations; local Regional Districts (Kootenay Boundary and Central Kootenay); the Kootenay Conservation Program; the Columbia Basin Fish and Wildlife Compensation Program; as well as Teck and its consultants. The purpose of the Steering Committee, as outlined in its Terms of Reference (LCEMP SC, 2013), is to oversee and provide technical assistance and recommendations regarding LCEMP through the development, implementation and subsequent performance monitoring phases of the program; and, to support the Ministry of Environment approval process under the CSR. Steering Committee meetings have been held in April 2010, June 2012, May 2013 and October 2013.

The LCEMP considers management options for lands identified in the terrestrial ERA as potentially impacted by historical smelter emissions (polygons shaded yellow totaling approximately 7860 ha; Figure A-2). Some of these lands (approximately 4640 ha) may have metal concentrations in soil that exceed CSR soil standards for the protection of plants and soil invertebrates. However, none of these areas are expected to have metal concentrations in soil that exceed 10x CSR standards for the protection of plants and soil invertebrates (i.e., no areas would be considered "high risk"). The remaining lands (approximately 3220 ha) have a low probability (≤10%) of having metal concentrations in soil that exceed these CSR soil standards. Management and restoration activities for the areas that do not have metal concentrations in soil that exceed these standards are considered voluntary. Plant community impacts in these areas are more likely a result of historical SO_2 releases from the smelter, or other factors (e.g., historical fire).

Teck has committed to funding and participating in the development and implementation of the LCEMP. Teck will integrate management recommendations from the LCEMP on its own lands based on priorities and allocated budget, and consistent with overall Teck principles, policies and procedures. Teck also will collaborate with other landowners and managers to meet shared objectives. Teck will consider opportunities to contribute financially to habitat restoration and enhancement initiatives on Crown and private lands in the LCEMP area, contingent on such actions being recognized by the BC Ministry of Environment as a contribution to their remediation and rehabilitation obligations (Teck, 2013). Teck will allocate LCEMP funding each year; the amount may vary from year to year. Until the project list is more advanced, a detailed funding structure cannot be determined.

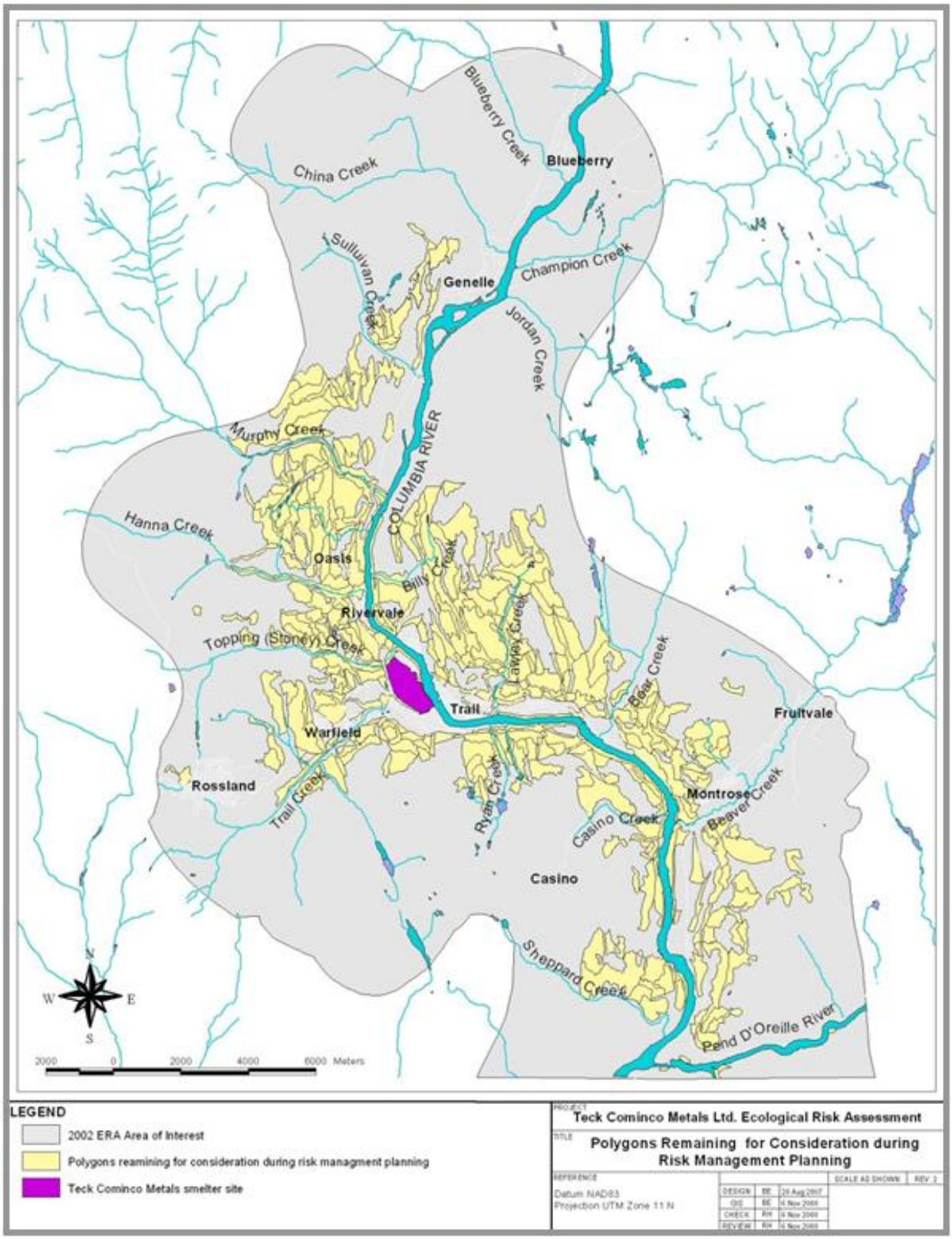

Figure A-2. Polygons Requiring Management Consideration

Realistic remediation and risk management options to address ecological risks include:

- Natural attenuation/regeneration and monitoring;
- Habitat or habitat element inventory, protection, enhancement or creation (in upland, wetland and riparian settings);
- Establishment of wildlife nest or roost boxes, platforms, lodges, dens, basking sites, etc.;
- Weed inventory and control of species not designated as noxious;
- Ecosystem rehabilitation through soil amendments and/or silviculture treatments (e.g., prescribed fire, selective tree thinning);
- Forest health and disease management, research and monitoring;
- Access control and use restrictions and monitoring;
- Listed animal or plant species inventories, research and monitoring;
- Interpretive signage or public education/awareness initiatives; and,
- Establishment of conservation covenants, stewardship agreements or other conservation approaches.

The LCEMP is linked to the ERA and other land management activities as described briefly below, and illustrated in Figure A-3:

- The ERA (Intrinsik et al., 2011) was submitted to BC MoE and concluded that the plant communities in wildland areas may be impacted in up to 7,860 ha (Figure A-2). Wetland areas were not evaluated in the ERA and therefore studies are being conducted to assess potential impacts. Impacted areas must be considered for potential remediation activities.
- Teck has been developing Land Management Plans for its own lands. These plans identify routine or regular land management activities (e.g., removal of noxious weeds, wildfire control), as well as opportunities for rehabilitation, enhancement and conservation initiatives that go beyond routine obligations. Although these Land Management Plans are internal Teck documents, information from these plans may be made available to the LCEMP Steering Committee. Conservation initiatives in these plans may be considered as offsets for areas of the valley that have been impacted by the smelter but for which remediation or rehabilitation is not feasible or considered likely to succeed.
- There also are other public and private stakeholders in the area that own or manage lands outside the 7860 ha ERA area, who may wish to partner with Teck in conservation initiatives on their lands. It is hoped that communication and consultation with a variety of stakeholders will encourage partnerships in conservation with area landowners.

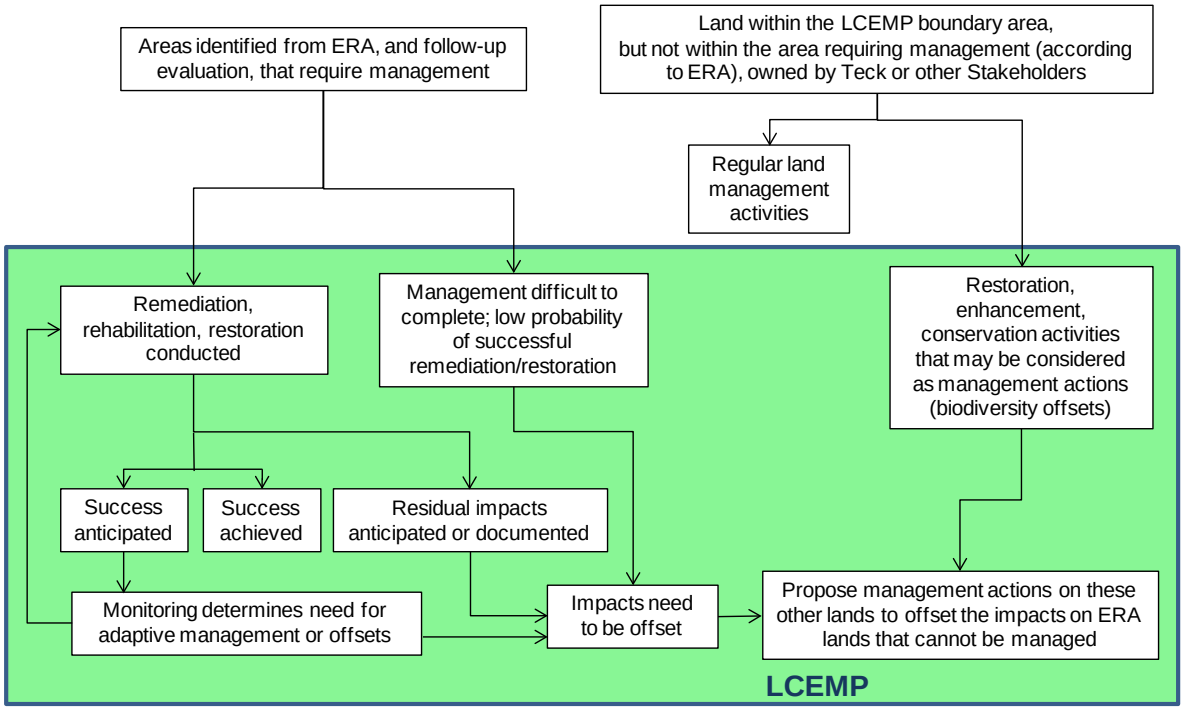

Figure A-3 Linkages between LCEMP and the ERA and Land Management Activities

One of the key features of the LCEMP is the opportunity for biodiversity offsetting. Biodiversity offsets are gains in ecological conservation in a location other than that which has been impacted by a project. These conservation gains may result from activities such as: intervention to stop ecosystem degradation; restoration or creation of habitat; and protection of areas of biodiversity. The biodiversity offsetting approach was developed for use with new development projects, where there will be a known impact on the ecosystem caused by the project, but it can also be applied to sites with existing impacts (BBOP, 2012a). According to this approach, the company must first try to avoid significant environmental impacts. Where impacts are unavoidable, they must take steps to minimize the impacts (to reduce the duration, intensity and/or extent of impacts), and then attempt to rehabilitate degraded ecosystems. If there are impacts that cannot be avoided, minimized, or rehabilitated, then offsetting is used to ensure there is no net loss of biodiversity, and preferably a net gain (BBOP, 2012b), by undertaking conservation activities in nearby locations.

As mentioned earlier, there may be areas where Teck is committed to do remediation or rehabilitation, but where it is not feasible to do so, either because the area is inaccessible (e.g., steep gradient, no roads to the area), or where remediation and rehabilitation activities may not be successful (there is a high probability of failure due to the site conditions). These areas are the ones that may need to be offset by conservation gains in other areas. Therefore, LCEMP includes lands beyond the ERA Area of Interest (the grey shaded area in Figure A-2) owned either by Teck, the Crown, and interested landowners (Figure A-4). Projects in this broader area may be considered, particularly for those lands that require offsetting to address historical SO_2 impacts, to take advantage of the best biodiversity opportunities.

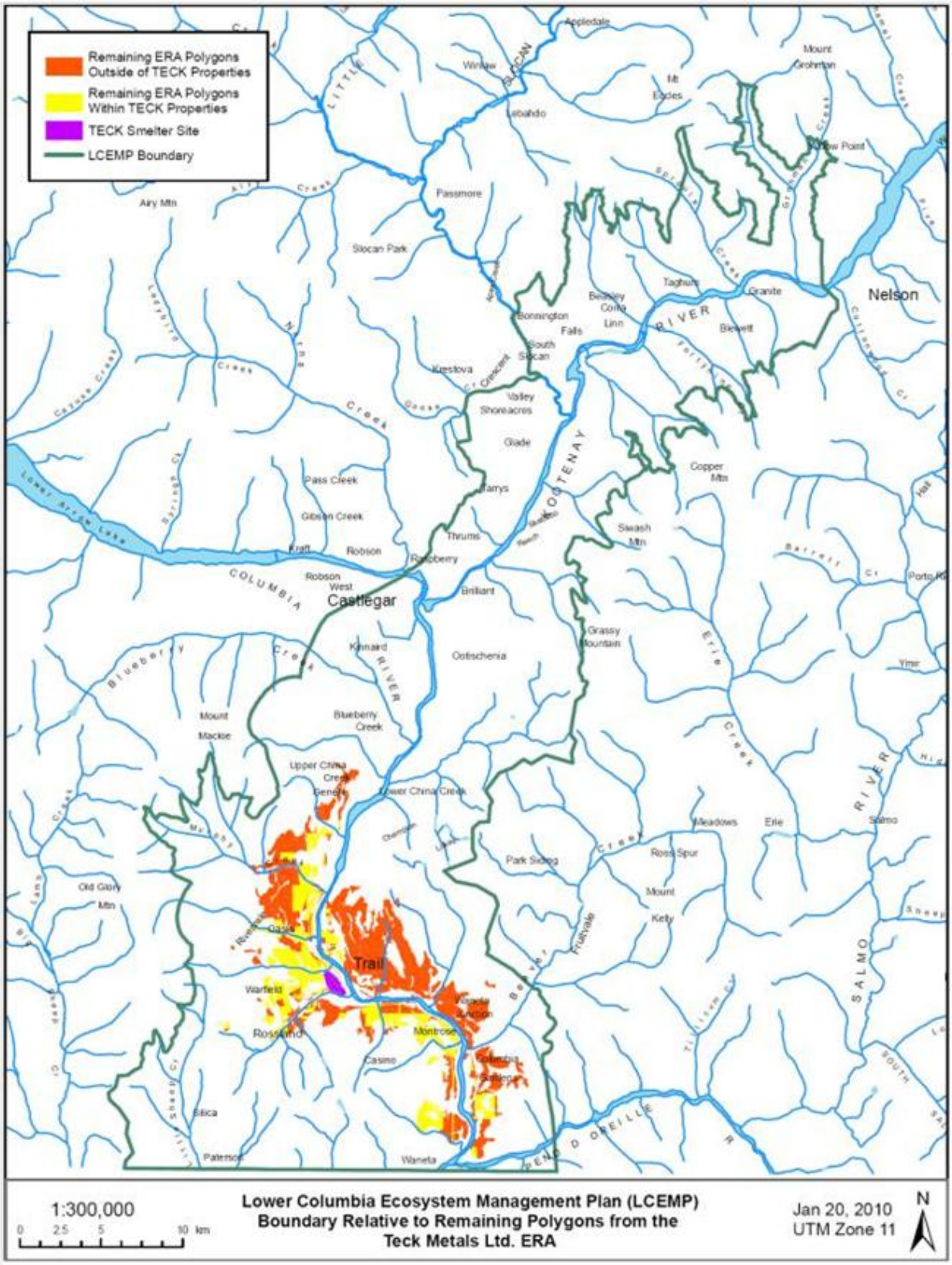

Figure A-4. LCEMP Program Area Boundary

In spring 2013, Teck submitted to the BC MoE a document that summarized the literature on offsetting, and included a framework for the use of offsetting within the LCEMP (Teck, 2013). The BC MoE responded in January 2014 in a letter that articulated the MoE Environmental Protection Division support for the LCEMP process, while recognizing that some issues will require further consideration (BC MoE, 2014). Because there are so many potential offset projects, a strategic approach is being developed for evaluating options to determine which project would best serve as an offset for a particular impact. In addition, an Effectiveness Monitoring Plan will be written to describe the monitoring requirements for different types of projects conducted under LCEMP, such as Teck internal covenants, weed management, other types of habitat management or enhancement actions. Monitoring programs and results will be reviewed periodically to determine the need for adaptive management (i.e., changes in management actions if results do not meet expectations).

A-4.7 Public Consultation and Communication

Information on community engagement was introduced in Section 4.0. Details on public consultation and communication activities are provided below.

A-4.7.1 Public Consultation

The THEC has held two major public consultations since the inception of the THEP. These are the formal consultation activities that have been held in addition to all the regular outreach and communication activities described in Section 4 and Section A-4.7.2.

2000/2001

The first public consultation was held in 2000 and led to the Task Force Report and recommendations to the BC Minister of Environment in 2001. The purpose of the consultation was to incorporate the public's long-term expectations for remedial activities. In addition, international experts were consulted so that the Task Force could benefit from their combined experience and knowledge of remedial efforts. The consultation methods, results and evaluation were summarized in Ferraro et al. (2000).

2009/2010

A second public consultation took place in 2009 and 2010. The purposes of the consultation were to update the public on health risks from smelter metals, assess public acceptability of new blood lead and air quality goals and program activities to meet those goals, and obtain input into a long-term plan to be submitted for approval to the BC Ministry of Environment under the Contaminated Sites Regulation. The consultation methods, results and evaluations were compiled in Circle B Services (2011).

The following is an excerpt from the executive summary:

> "Public consultation launched on April 29, 2010 with a focus on the Family Health, Home & Garden, and Air Quality components of THE Program as well as proposed

tougher blood lead and air quality goals. The consultation used a variety of methods to engage the public, including a community newsletter, a website www.thep.ca, a focus group dinner, meetings with stakeholder groups, and on-site consultation materials at the Community Program Office storefront in downtown Trail.

Public input was primarily gathered by means of a survey, available electronically and in print. 210 participants completed the survey. Results showed that 85% of respondents fully supported the proposed blood lead goal to attain a community average of 4 µg/dL among children aged 6-36 months by 2015. 76% of respondents fully supported the goal to reduce the concentration of lead in air to 0.2 µg/m^3 by 2018. 79% of respondents fully supported the goal to reduce the concentration of arsenic in air to 0.01µg/m^3 by 2018. 80% of respondents fully supported the Family Health Program staying basically the same. 75% fully supported the Home Renovation Support Program staying the same and 84% fully supported the Soil Program staying the same. 84% of respondents indicated that they knew little or nothing about the health and environment program.

A second phase of consultation, including property issues, was provisionally planned for the fall of 2010. This phase was deferred pending resolution of regulatory issues with the BC Ministry of Environment. The consultation closed on December 7, 2010.

The consultation was successful in achieving its quantifiable goals regarding number of participants, completion of materials, meetings held, website development and so on. Even with statistical limitations, it's reasonable to conclude that participants gave strong support to the new goals and provided useful questions and suggestions for future developments. The data gathered indicate that the program is not well known or understood by the broad public. It is assumed that the consultation process increased awareness and understanding for some people."

The consultation also provided opportunities for adaptive management of the THEP, particularly as it relates to community engagement. This is described below in another excerpt from the executive summary:

"Over the 16 months of consultation planning the scope of work expanded to incorporate several enhancements to THE Program. A new website was developed, www.thep.ca, new fact sheets and FAQ materials were created with an emphasis on plain language communication for a wide public audience. A new logo and brand were approved, providing a consistent, audience-friendly, look and feel to program materials. A Community Program Office was established at 1319 Bay Avenue to increase public access."

As outlined in Section 6 of the main document, it is anticipated that additional public consultation will occur in 2016, and that public consultation will occur regularly as new objectives are set.

A-4.7.2 Public Communication

Public communication is accomplished via several means, including parent and caregiver engagement, community collaboration, the Community Program Office, branding, the THEP website, news releases, brochures, community newsletters, and radio ads.

A-4.7.2.1 Parent and Caregiver Engagement

The THEC and the THEP Program Team use every opportunity to engage parents and caregivers of young children in governance as well as in providing advice and evaluative feedback on programs.

- Governance – The THEC regularly seeks representation from parents, caregivers and family/child health advocates on the Committee. At times, it has been difficult to get or maintain such representation, potentially due to the overwhelming time demands on parents of young children and the technical nature of THEC business. Currently, the THEC has one member who is a parent of young children and another who works as an early childhood development advocate.
- Advice – Parents participate, and have participated in, a variety of advisory roles in support of program planning and design. In 2011/2012, one parent participated in the Website Revamp Advisory Committee. Parents continually provide advice, and are asked for advice, on the services and supports they receive. The THEC wants to make sure that what is offered meets families' needs. For example, parents participate in planning soil remediation and yard improvement work to optimize the durability of ground cover in the areas of the yard they use most. Parents have provided, and continue to provide, input into the Healthy Homes Program's Dust Buster and Yard & Garden Kits. Healthy Homes Program staff gets ongoing feedback on the usefulness of the products in the kits as well as parent preferences around product details.
- Evaluative input – The THEC and the THEP Program Team continuously seek client feedback on program delivery. Parent feedback is used to inform adaptive management on an ongoing basis. As an example, after the 2010 consultation, the THEC sought post-consultation interviews with parents. Four parents provided additional input on the consultation, the THEP and what community improvements they'd like to see (Circle B Services, 2011).

A-4.7.2.2 Community Collaboration

The THEP collaborates with many groups and organizations in the Trail area to extend outreach to families and build cross-sectoral networks to support children's healthy development, promote lead-safe home renovations, enhance community greening, and support other objectives. Collaborations include:

- Participation in collaborative strategies with early learning service providers to improve children's healthy development (e.g., Greater Trail Success by 6). Activities include:
    - Information and resource sharing;

    - Participation in family-friendly community-based events; and,
    - Outreach and engagement of families.
- Participation in, and collaborative strategies with, community stakeholders to improve children's healthy development (e.g., the Family Action Network (FAN)). Activities include:
    - Needs assessments;
    - Community-wide strategic planning and priority setting;
    - Coordination and service improvements;
    - Community awareness-building regarding the importance of the early years of life;
    - Family-friendly events organized by the FAN;
    - Environmental improvement strategies;
    - Literature reviews and learning events/opportunities regarding ECD best practices; and,
    - Policy development and advocacy.
- Collaboration from time to time with the Trail Communities in Bloom Committee as part of an ongoing commitment to support their volunteer efforts toward community greening and environmental enhancement in the City of Trail.

A-4.7.2.3 Community Program Office

The Community Program Office (CPO) is a storefront located at 1319 Bay Avenue in downtown Trail. This office is a key component of the THEP community outreach and engagement efforts.

THEP clients and members of the public can get information or sign up for programs, raise issues or concerns, get home renovation support, or get their questions answered about lead and healthy home issues (or be referred to other THEP professionals for a further response, as needed). The CPO holds an Open House each year during Silver City Days in Trail.

The CPO also supports delivery of the Home & Garden Program by providing information, advice and support for residents on how to prevent or minimize exposure to metals in soil or dust, including dust stirred up by home renovations. As a community service, the CPO also responds to inquiries about related issues such as lead-based paint, radon, asbestos, and mould, and coordinates the distribution of radon test kits in Greater Trail.

Program Office staff continuously update their resources/information, utilizing the most current best practice information available from sources such as Health Canada, WorkSafe BC, the US Centers for Disease Control and Prevention (US CDC), the US Environmental Protection Agency (EPA) and the US Department of Housing and Urban Development.

A-4.7.2.4 Branding

The THEP has an identifiable visual brand that supports public outreach with a consistent image that conveys THEC values of health, environment, community, trust and accessibility/friendliness. The brand is comprised of the THEP "leaf heart" (orange heart)

logo, similar to the THEC logo (red heart), which has a long history in the community. This is used on educational and promotional materials, signage, the community newsletter, fridge magnets, posters, labels and other outreach tools. On major print materials, report covers, audio-visual presentations, display boards, etc., a green hills, blue river and sky landscape image is used. Within the THEP brand, the Program has a "Healthy Families Healthy Homes" logo for use with that program.

A-4.7.2.5 Website

The website www.thep.ca is an ongoing means of community engagement. The website url is included in all THEP news releases, community newsletters, educational display boards, program brochures and rack cards, radio ads and signage on the side of THEP vans and on a sandwich board outside the Community Program Office.

A-4.7.2.6 News Releases

The THEC issues news releases to announce the results of annual children's lead testing each November. Additional news releases are issued as needed for such information as program changes, updates on health risks from lead exposure, lead exposure prevention tips and special events.

A-4.7.2.7 Brochures

The THEP utilizes brochures, posters, fridge magnets and rack cards for educational purposes and to promote programs. These materials are handed out at educational and family fun events, at the Community Program Office, during program delivery, and by partner organizations. A full list of the brochures and other materials is available from the Community Program Office.

A-4.7.2.8 Community Newsletter

The THEP publishes a four-page, full colour, glossy, community newsletter twice each year, typically in May and September. The newsletter promotes THEP activities and addresses educational topics of interest to families with young children and other community residents. The spring/May newsletter typically focuses on home renovations. The fall/September issue promotes the children's blood lead clinics. The newsletter is mailed by Canada Post to approximately 4,000 residential addresses in Trail and Rivervale. In addition, it is mailed in a personalized envelope to approximately 250 families on the Healthy Homes Program database. The newsletter is posted to the website. The current newsletter is available at http://www.thep.ca/pages/newsletter-current/.

A-4.7.2.9 Radio Ads

The THEP reinforces its main educational messages through radio ads that run on a popular local radio station from around mid-May to mid-September each year. The radio ads stress the importance of the early years of life to a child's lifelong health and promote hand washing, lead-safe home renovations, nutrition, and keeping dust down in the home

and yard. In addition, THEP has banner ads on the radio station website during the same May-September time period.

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APPENDIX B

TRAIL AREA HEALTH & ENVIRONMENT COMMITTEE
TERMS OF REFERENCE

City of Trail

Select Committee of Council
Terms of Reference

NAME OF COMMITTEE:

Trail Health and Environment

MANDATE:

To reduce exposure to lead and other smelter metals in the community on a continual improvement basis.

FUNCTIONS:

Within their mandate, the Committee is to:

- Monitor, coordinate and advise Council on the implementation of the Trail Area Health & Environment Program ;
- Facilitate public communication and oversight with respect to delivery of services and progress towards the Committee's mandate;
- Provide for public financial accountability, especially in terms of public input on priority setting;
- Participate directly in the development of the final remedial plan for the area.

MEMBERSHIP:

Membership on the Committee shall consist of the following:

- The Mayor, or designate from City Council, who shall act as Chair;
- 1 member of City Council;
- 1 member appointed by the following organizations, or their designate:
  - Village of Warfield
  - RDKB Electoral Area 'A'
  - RDKB Electoral Area 'B'
  - Teck Metals Ltd.
  - Ministry of Environment
  - United Steelworkers, Local 480
- 2 members from the Interior Health Authority
- 4-6 members appointed from the public at large who are broadly reflective of the community.

Membership on the Committee shall reflect the desired experience, knowledge and expertise necessary to fulfill the Committee's mandate.

Members shall serve on the Committee without remuneration.

Once the remedial plan has been approved, the role of the Committee will be re-evaluated.

MEETINGS:

Meetings of the Committee shall be held at least quarterly and shall be open to all members of the public and media. A meeting of the Committee may also be called at the discretion of the Chair.

A quorum is 6 members.

On all matters requiring a decision, the Committee shall attempt to reach said decision by a process of concensus. If the Committee is unable to achieve a concensus, the decision shall be decided by majority vote.

Agenda packages will be sent to the members before the meeting and will exclude confidential information.

If any member considers an agenda item confidential, they will advise the Chair and that item may be discussed in camera at the discretion of the Chair.

BUDGET & EXPENDITURES:

Teck Metals Ltd. will provide funding, facilities and/or equipment if needed by the Committee to conduct meetings (eg: presentation equipment, photocopying, minute taking).

REPORTING:

The minutes of each meeting of the Committee must be legibly recorded and highlight key discussion points and record any decisions or recommendations the Committee may decide on.

The minutes shall be submitted to the Corporate Administrator's office for circulation to Council as soon as possible after the meeting. As the minutes will be available to the public, they will include reporting on items of general discussion and exclude any and all confidential material.

The Mayor shall report on the activities of the Committee at the next Regular Council Meeting after any Committee meeting.

The following parties shall submit a report to the Committee as noted:

- City of Trail staff will report to the Committee on street washing and dust suppression on alleys. City staff will also report to the Committee on community greening initiatives undertaken by the City.

- Teck Metals Ltd. representative will report to the Committee on the results of environmental monitoring and remedial activities including emissions reduction and monitoring, dust control, the Home Renovation Support Program, soil testing and remediation, primary prevention and case management services, property development remediation programs, greening, and environmental management planning.. The Teck representative may delegate reporting on the Home & Garden Program to their designated contractor, SNC Lavalin Environment.

- The Interior Health Authority staff responsible for the blood lead testing, primary prevention home assessments and education, family case management and education programs will report to the Committee on those programs. A Medical Health Officer will provide advice, including written guidance, to the Committee on an as needed/requested basis.
- The Trail Area & Environment Program Manager will report to the Committee on activities carried out in their role managing the implementation of services/actions in accordance with approved annual workplans.

APPENDIX C

TECK PROJECT ENGINEERING AND APPROPRIATION STAGE GATING PROCESS

APPENDIX C: Teck Project Engineering and Appropriation Stage Gating Process

Implementation of each and any project to reduce emissions is dependent on the project successfully passing Teck's Project Stage Gating process – which is based on engineering best practice - due to the anticipated required expenditures and to ensure the most effective engineering solutions are implemented at the best return on investment. This five-step process ensures that the project is fully vetted by all Teck stakeholders from initial definition through to execution and is made up of the following steps:

- Stage 1 – Pre-scoping: The overall objective at this stage is to inform Senior Management of the project, its scope and justification (establish the need) and to ensure that it is in line with Trail Operations' Strategic Plan.
- Stage 2 – Scoping: The objective at this stage is to evaluate major technology alternatives and project options and to establish the conceptual scope, the order-of-magnitude costs and benefits for the options considered.
- Stage 3 – Prefeasibility: The objective at this stage is to improve the level of definition of the project objectives, design criteria and scope and to establish a pre-feasibility level cost estimate. The goal is to recommend one option for advancement to the next level and confirm the justification of the project. A project will only be advanced to the next stage if it is almost certain that the project will be executed.
- Stage 4 – Feasibility: The objective at this stage is to complete the feasibility level of engineering, evaluate the site conditions, define an execution strategy and establish a feasibility level cost estimate suitable for funding appropriation. This stage also includes verification that the project can achieve what is intended, or evaluation of whether there is a better or more efficient way to achieve the objective. The appropriation for funding is forwarded to Teck's Corporate office in Vancouver where it is evaluated against all company projects, including other environmental projects, for its cost/benefit and where it is ensured that it adds to the overall sustainability of the company.
- Stage 5 – Execution: Once the appropriation of funding has been approved, the execution of the project can commence. It concludes with the completion of construction and commissioning activities, and formal handover of the facility to the department within Teck that will operate it. This stage is completed when process materials are entered into the facilities.

Projects are reviewed at each gate by a committee made up of Teck Trail Senior Management, Engineering representatives, Teck Trail's Financial Controller and the department leading the project to ensure the justification is valid and that it has sufficient priority to proceed to the next stage. The accuracy of the estimate at each stage is consistent with the standards of the American Association of Cost Engineers.