



*Combining Risk Assessment and Remedial Approaches
to Address Residual Contamination*



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INTRINSIK

SMART Remediation
Toronto, ON | January 25, 2018

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Combining Risk Assessment and Remedial Approaches to Address Residual Contamination at Brownfield Sites

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January 25, 2018

Objectives

- Benefits of Combining Remediation and Risk Assessment (RA) approaches
- Overview of RA Approach
- Three Combination Strategies

This presentation assumes that the property owner intends on filing a Record of Site Condition



Who We Are – Intrinsic Corp.

- Established as the environmental sciences division of CanTox Inc. in 1985.
- Scientific and regulatory consulting firm providing expert toxicology and regulatory advice for the protection of human health and the environment.
- Core business is providing RA services to ESA firms with no or limited in-house capabilities.
- Conducted RAs in compliance with O.Reg. 153/04 since its inception in October 2004, with over 50 RAs successfully accepted by the MOECC.
- Conducted reviews of RAs on behalf of the MOECC as a Vendor of Record (VOR) since 1997.



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Remediation or Risk Assessment

- If contaminants of concern are identified, the question often becomes remediation **OR** risk assessment?
- There are often opportunities and benefits to combining remediation and risk assessment



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Remediation or Risk Assessment

Remediation	
Advantages	Potential Challenges
No risk management measures (RMMs) and Certificate of Property Use (CPU)	Costs
Increased property value	Technical feasibility of removing all soil, groundwater, or sediment impacts
Larger market for potential purchasers	Time associated with treating impacted groundwater
Easier to receive financing for redevelopment	



Remediation with Risk Assessment

Remediation		With RA
Advantages	Potential Challenges	
No risk management measures (RMMs) and Certificate of Property Use (CPU)	Costs	More cost effective than Remediation-only approach
Increased property value	Technical feasibility of removing all soil, groundwater, or sediment impacts	Address residual impacts
Larger market for potential purchasers	Time associated with treating impacted groundwater	Address existing groundwater impacts
Easier to receive financing for redevelopment	-	-



Remediation or Risk Assessment

Risk Assessment	
Advantages	Potential Challenges
RA process timeline (MGRA)	RA process timeline (Tier 3)
Cost effective	Implementation of RMMs and ongoing monitoring/maintenance
Can potentially address COCs not technically or financially feasible to remediate	RMMs may limit property use or development options
Use site-specific information to rule out potential risks	



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Risk Assessment with Remediation

Risk Assessment		With Remediation
Advantages	Potential Challenges	
RA process timeline (MGRA)	RA process timeline (Tier 3)	Utilize the MGRA approach following a limited remediation program
Cost effective	Implementation of RMMs and ongoing monitoring/maintenance	Reduction in RMM requirements or areal extent requiring RMM application
Can potentially address COCs not technically or financially feasible to remediate	RMMs may limit property use or development options	
Use site-specific information to rule out potential risks		



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O.Reg. 153/04 Risk Assessment

Two (2) common types of RAs that are submitted under O.Reg. 153/04:

- Modified Generic Risk Assessment (MGRAs or Tier 2 RA)
- Tier 3 Risk Assessment

Both approaches can be used in combination with remediation strategies!

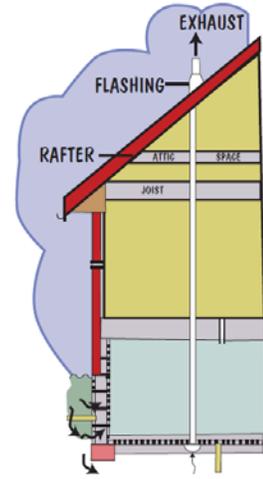


Modified Generic Risk Assessment (MGRAs)

- Uses the MOECC (2016) Approved Model (dated November 1, 2016)
- A number of canned risk management measures (RMMs) or modification of the component values, such as:
 - Modified Ecological Protection (MEP)
 - Cap barriers (Shallow Soil Cap, Hard/Fill Cap)
 - Storage Garage or Building Prohibition
 - Passive/Active Soil Vapour Intrusion Mitigation System
 - Building with no First Storey Residential Use
 - No Ground Water Use for Drinking Water
 - Modified Subsurface Worker Protection
- Reviewed by internal MOECC staff = RA acceptance in 6-8 months.

Tier 3 Risk Assessment

- Most common RA approach
- Reviewed by MOECC and external consultant (Vendor of Record)
- Most flexibility in scientific approach and risk management strategies
- RA acceptance typically takes between 12 to 24 months.



RA + Remediation Strategies

Three (3) combination strategies:

- Hot Spot Removal with RA
- Limited Remediation with RA
- Full-Scale Remediation with RA



Risk-Based Hot Spot Removal

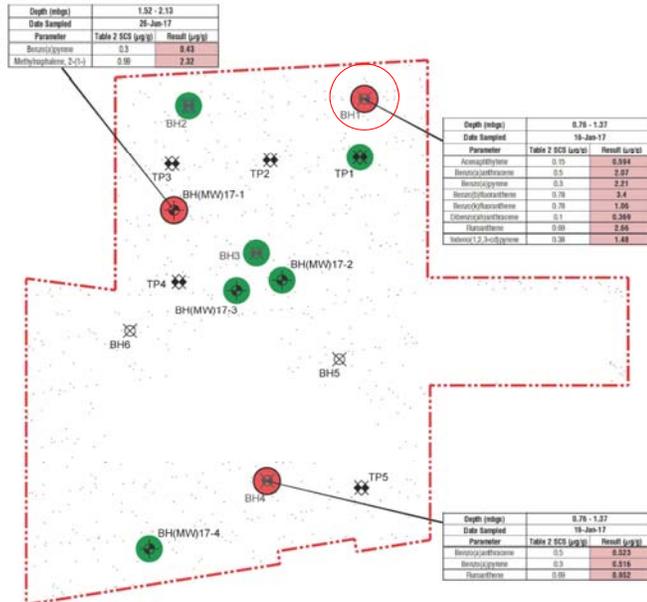
- Removal of a particular RMM
- Limit the areal requirement of an RMM (e.g., capping)
- Allow RA to fit in MGRA approach

Case Study #1

- **Current Property Use:** Vacant commercial property
- **Potentially Contaminating Activities:** Importation of fill material of unknown quality on-site; waste disposal and waste management off-site
- **Contaminants of Concern:** metals, PHC F3, and PAHs in soil; PAHs in groundwater
- **Proposed Property Use:** Residential townhouse complex



Case Study 1: Site Plan (PAH exceedances in soil)



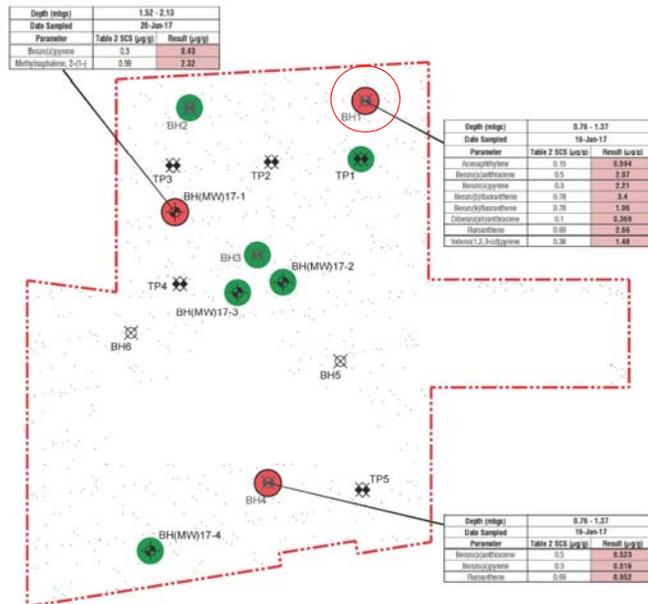
Risk-Based Hot Spot Removal

- **Potential human health and ecological risks:**
 - Residents, outdoor workers, and ecological receptors due to direct contact with metals, PHC F3, and PAHs in soil
 - Residents due to indoor air exposure to acenaphthylene in soil (>0.45 µg/g)
- **Risk Management Measure Options:**
 - Potential direct contact risks:
 - hard/fill cap barrier
 - Hot spot removal **not possible** due to widespread impacts
 - Potential indoor air risks:
 - vapour mitigation measures for future buildings
 - Hot spot removal of areas with elevated acenaphthylene concentrations
- **Solution:** Limited hot spot removal with hard/fill cap barrier. This solution avoided the need to implement a vapour mitigation system and ongoing monitoring requirements.



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Case Study 1: Site Plan (PAH exceedances in soil)



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Limited Remediation with RA

- Removal of a particular RMM
- Limit the areal requirement of an RMM (e.g., capping)
- Allow RA to fit in MGRA approach

Case Study #2

- **Current Property Use:** Forested area (formerly apple orchard) surrounding residential development
- **Potentially Contaminating Activities:** Historical use of lead arsenate insecticides
- **Contaminants of Concern:** Metals (e.g., arsenic, lead) and inorganic parameters in soil and groundwater
- **Property Use:** Public parkland



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Case Study 2: Site Plan



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Limited Remediation with RA

- **Potential human health and ecological risks:**
 - Outdoor maintenance workers and parkland visitors due to direct contact with arsenic in soil
- **Risk Management Measure Options:**
 - Potential direct contact risks:
 - hard/fill cap barrier
 - wide area soil removal
 - limited soil removal in areas with arsenic concentrations above the calculated risk-based concentrations (RBC)
- **Solution:** Limited soil removal prior to the filing of the RSC. This solution avoided the use of heavy equipment to remove soil and/or the need to implement a cap barrier; both of which would have resulted in the removal of trees (neighbouring home owners opposed to tree removal).



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Case Study 2: Site Plan (Arsenic concentrations above RBC)



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Full-Scale Remediation with RA

- RA to address residual impacts following full-scale remediation efforts

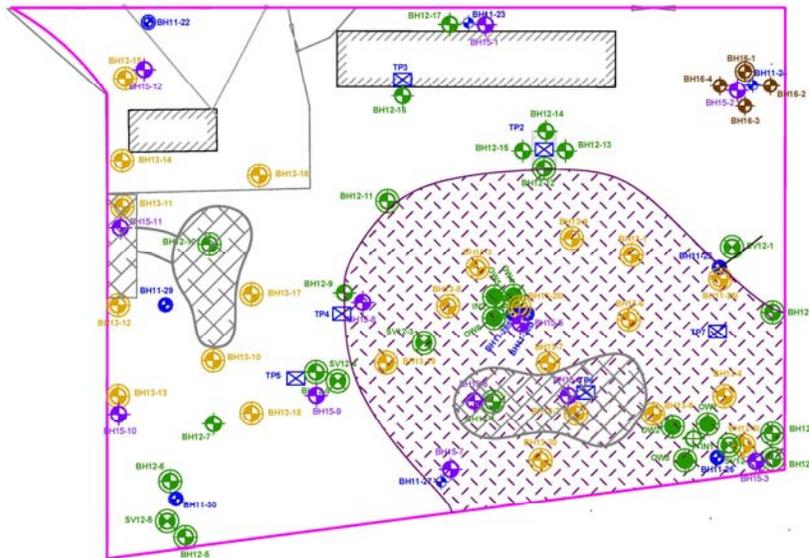
Case Study #3

- **Current Property Use:** Former industrial property
- **Potentially Contaminating Activities:** importation of fill material of unknown quality; salvage yard; historical coal storage; rail yards, tracks, and spurs; gasoline and associated products in storage tanks; *etc.*
- **Contaminants of Concern:** Metals and inorganic parameters, VOCs, PHCs, and PAHs in soil and groundwater; PHC free product was also identified
- **Proposed Property Use:** Mixed commercial-residential development



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Case Study 3: Site Plan



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Full-Scale Remediation with RA

- **Approach:**

- In-situ chemical oxidation (ISCO) to reduce cVOC concentrations in groundwater
- Limited soil removal of areas with PHC free product
- Conduct an RA on residual impacts



- **Potential human health and ecological risks:**

- Residents due to indoor air exposure to COCs in soil and groundwater
- Human and ecological receptors due to direct contact with COCs in soil
- Off-site aquatic organisms due to COCs in soil and groundwater



- **Risk Management Measures:**

- Hard/fill cap barrier, health and safety plan, and vapour mitigation measures



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Final Thoughts

- **Don't forget about Risk Assessments!**

Many benefits to combining Remediation with Risk Assessment:

- An RA can be used to address residual impacts following remediation program
- More cost effective than remediation-only approach
- Reduction in RMM requirements or areal extent requiring RMM application



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Thank you!

Please feel free to contact us if you have any questions.

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