Defining Background Conditions and Using Background Concentrations in Ecological Risk Assessment (FCSAP Guidance)

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- *Federal Contaminated Sites Action Plan (FCSAP) Ecological Risk Assessment Guidance*
  - Module 1: Toxicity Test Selection and Interpretation
  - Module 2: Selection or Development of Site-Specific Toxicity Reference Values
  - Module 3: Standardization of Wildlife Receptor Characteristics
  - Module 4: Causality Assessment
  - **Module 5: Defining Background Conditions and Using Background Concentrations**

History

- Many areas of Canada have high naturally occurring concentrations of metals
- In mining areas these metals are also contaminants found on sites
- When screening for COPC on these sites we must compare to both guidelines and the natural background concentrations in the area

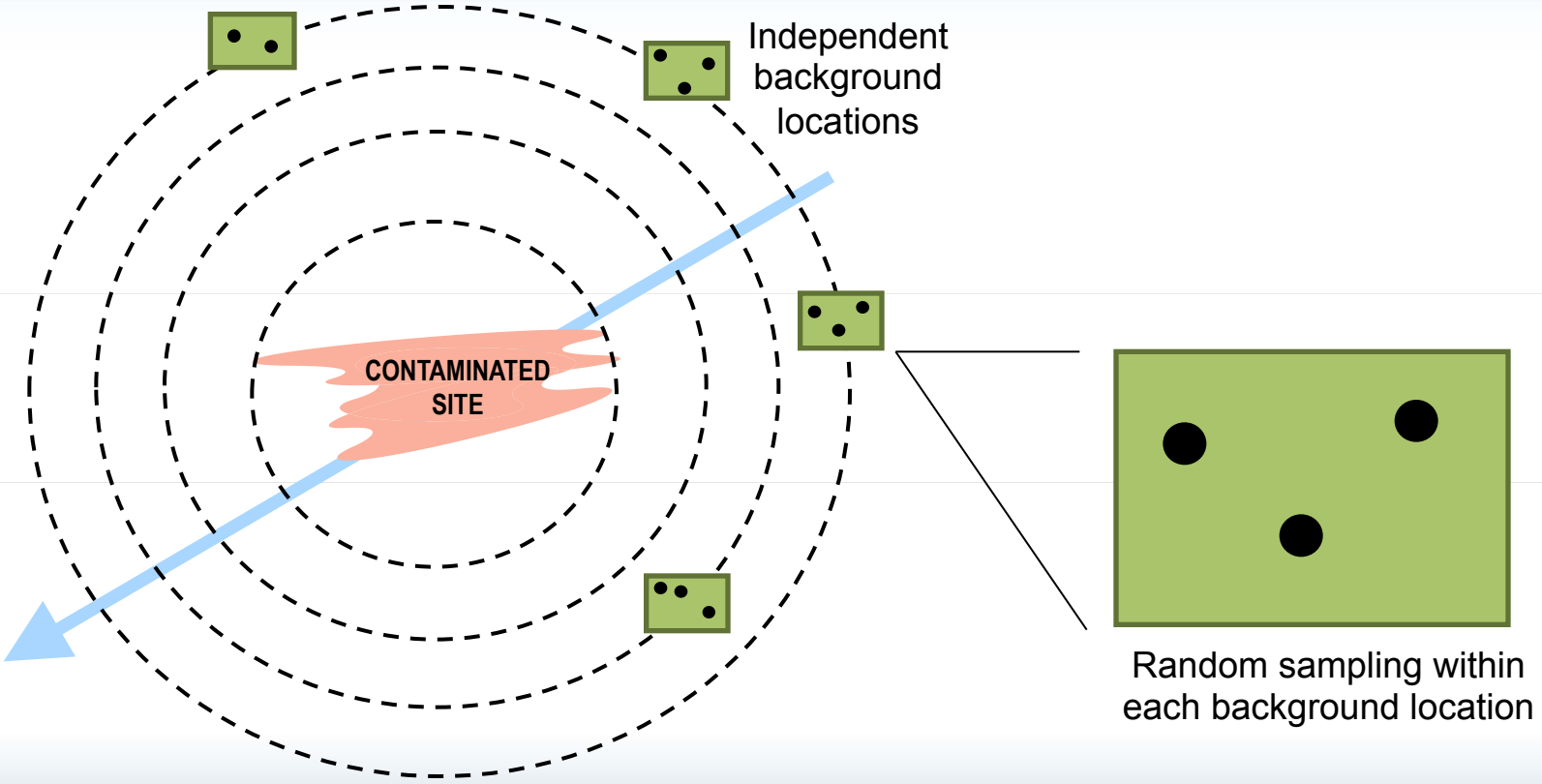
Module 5 Overview

- Guidance on how to deal with sites with high background concentrations of metals:
  - How to screen for contaminants of potential concern when high background concentrations exist at a site
  - How to conduct an Ecological Risk Assessment when receptors are adapted or acclimated to high background concentrations
  - How to set remediation objectives for a site

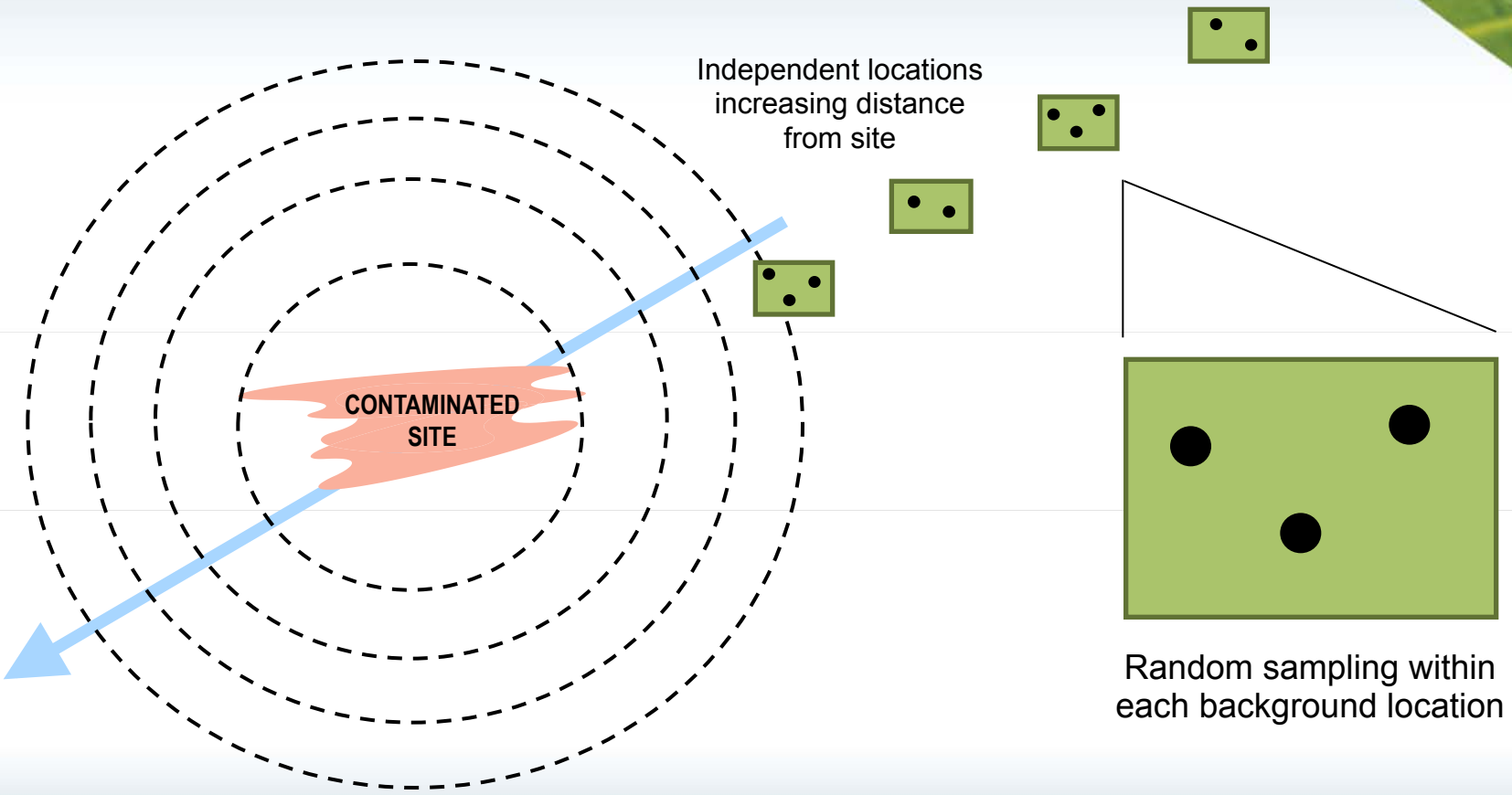
Approaches to taking samples for background in soil:

- Independent Sites Approach
- Gradient Based Approach

Soil Sampling
Independent Sites



Soil Sampling
Gradient Based Approach



Surface Water and Sediment

- Surface water and sediment should be collected as a pair at each sampling location.

- To allow for meaningful comparisons of sediment quality within contaminated areas, a minimum of 4 independent sampling locations (with 2-3 random samples taken within each) is recommended.

Screening for COCs

- A compound is considered as a contaminant of concern when:
  - Concentration exceed the relevant environmental quality standards.
  - Concentration is statistically above background and compound is from an anthropogenic source
  - Concentration exceedance of > than 20 % above background (**under consideration**)

Once we have COCs….

- We perform an ecological risk assessment to determine:
  - whether there is risk to the receptors
  - what our remediation objectives should be

- Problem is that the receptors are adapted or acclimated to these high background concentrations already present on site

What our remediation objectives should be on site

- Current guidance says to remediate to the background concentration
- But…is this too clean?
- We need to determine the remediation objective using risk…. ERA!!

Risk through Hazard Quotients

- HQ = exposure / TRV (acceptable effect level)

- Problems:
  - TRVs are based on receptors that are not adapted or acclimated to high background concentrations;
  - TRVs are sometimes below the background concentration on site;
  - If the HQ is already above 1 due to background concentrations how do we determine if there is risk to the receptors on site

Current Practices:

- 1) HQ = exposure / TRV
  - Issue: TRV is not valid for the receptors on site
- 2) HQ on site minus HQ off site
  - 150/20 – 50/20 = 7.5-2.5 = HQ = 5
  - Therefore there is risk to the receptor on site.
  - Issue: Not linear relationship; unknown where the threshold for effects is
- 3) Exposure on site minus exposure off site / TRV
  - 150-50/20 = HQ = 5
  - Issue: Not linear relationship; unknown where the threshold for effects is

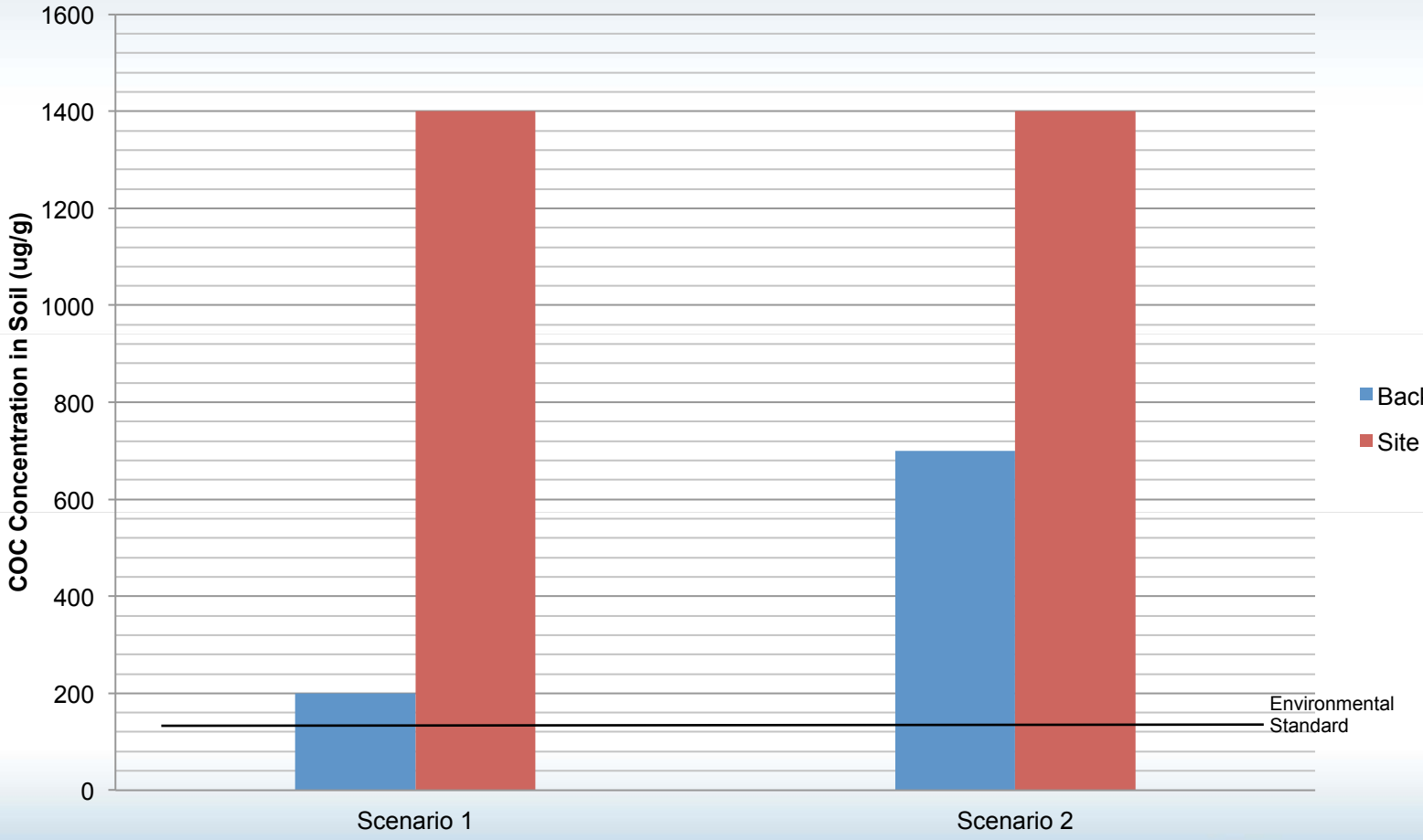
Current Practices cont:

Receptor	Contributions to Total HQ From Site LOAEL	Contributions to Total HQ From Background LOAEL	Total HQ
Foraging range larger than site area	0.6	0.5	0.6 + 0.5 = 1.1
Foraging range smaller than site area	0.5	0.4	Site > Background

Hazard Quotients

- Problems:
  - If the HQ is already above 1 due to background concentrations, how do we determine if there is risk to the receptors on site?
  - Need for additional lines of evidence.
  - But… other than doing a site specific study (ex. density/ diversity on- and off-site) is there a way to calculate a realistic HQ???
  - For screening level assessments doing this is very expensive.

Scenario 1



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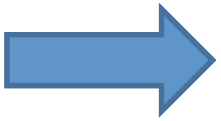
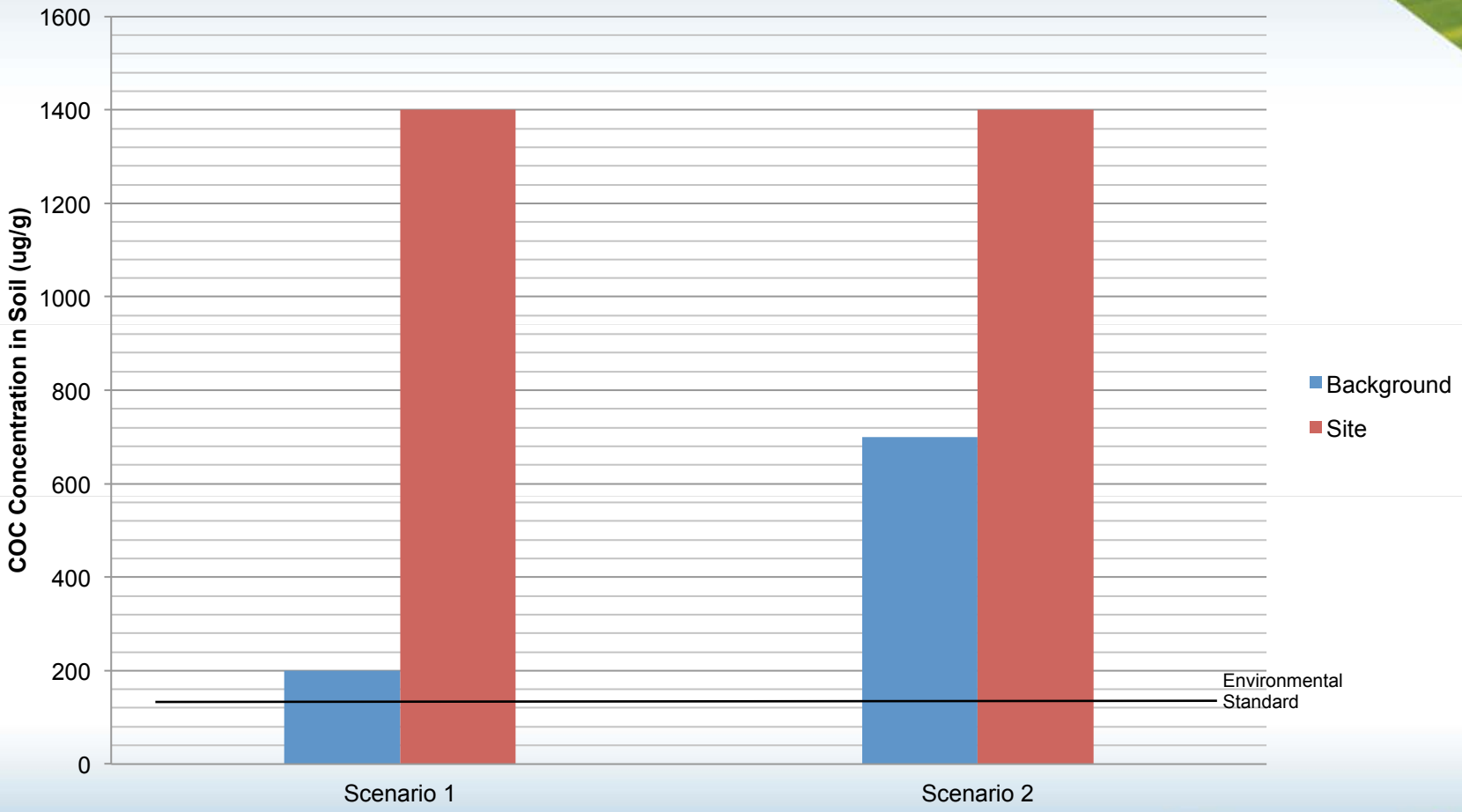
Scenario 1

- Background provided a negligible contribution to the total risk
- No need to validate this further with additional lines of evidence



Use HQ!!!

Scenario 2



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Scenario 2

- Background provided a significant contribution to the total risk
- Need to validate this further with additional lines of evidence
  - site-specific toxicity testing and either quantitative or qualitative assessments of habitat.

→ Additional LOE!!!

Remedial Objectives From the ERA

- Risk-based remedial targets would be calculated based on no-effect levels identified with the correlation of site chemistry with site-specific toxicity testing or habitat assessment (additional lines-of-evidence)

- Guidance available from Amy Sparks and soon available on IDEA

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