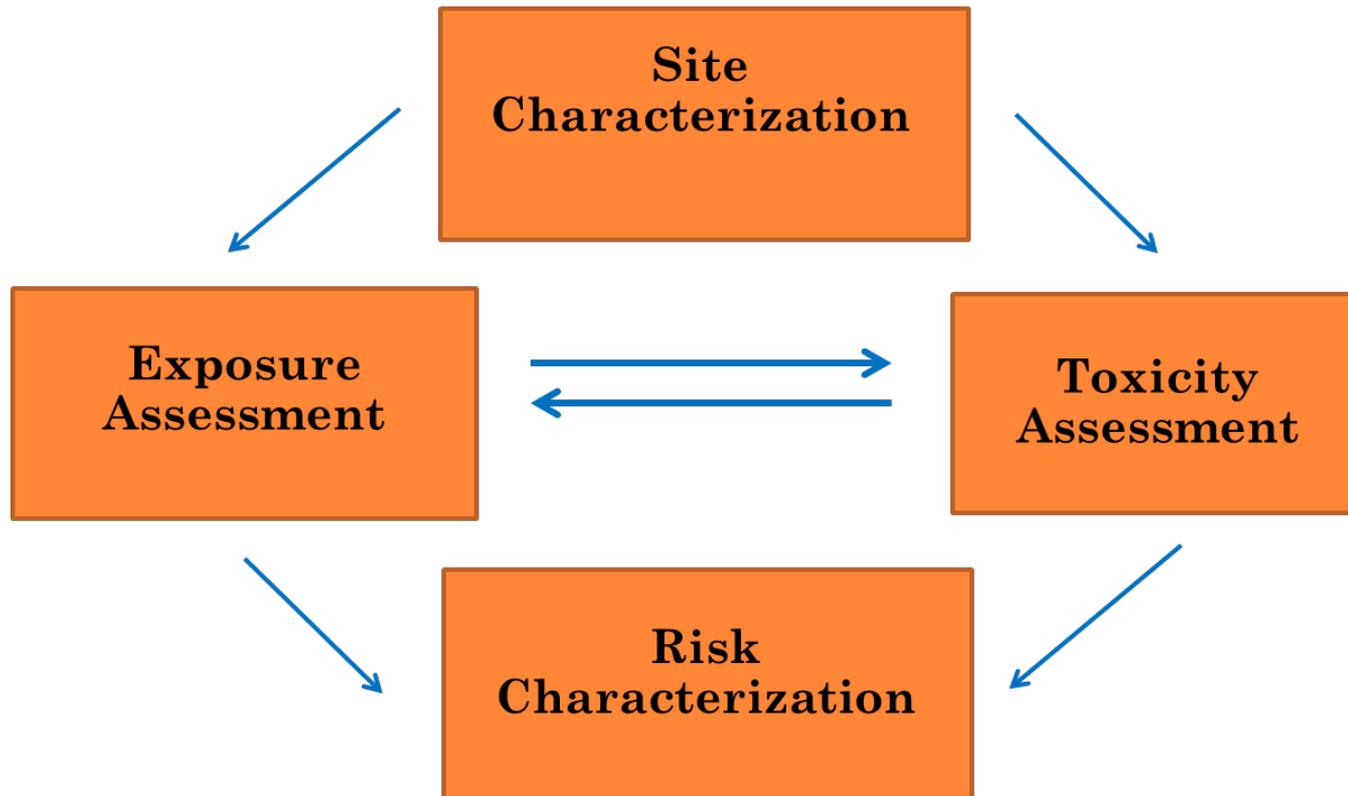


RISK

CHARACTERIZATION

The Final Step in a Risk Assessment

WHAT IS RISK CHARACTERIZATION?



In Risk Characterization, the information from Site Characterization, Exposure Assessment, and Toxicity Assessment are summarized and integrated into quantitative and qualitative expressions of risk.

RISK CHARACTERIZATION

Components of the risk characterization process:

- Review outputs from toxicity and exposure assessments
- Quantify risks from individual chemicals
- Determine individual pathway risk by quantifying risks from multiple chemicals
- Combine risks across exposure pathways
- Summarize and present results qualitatively and quantitatively

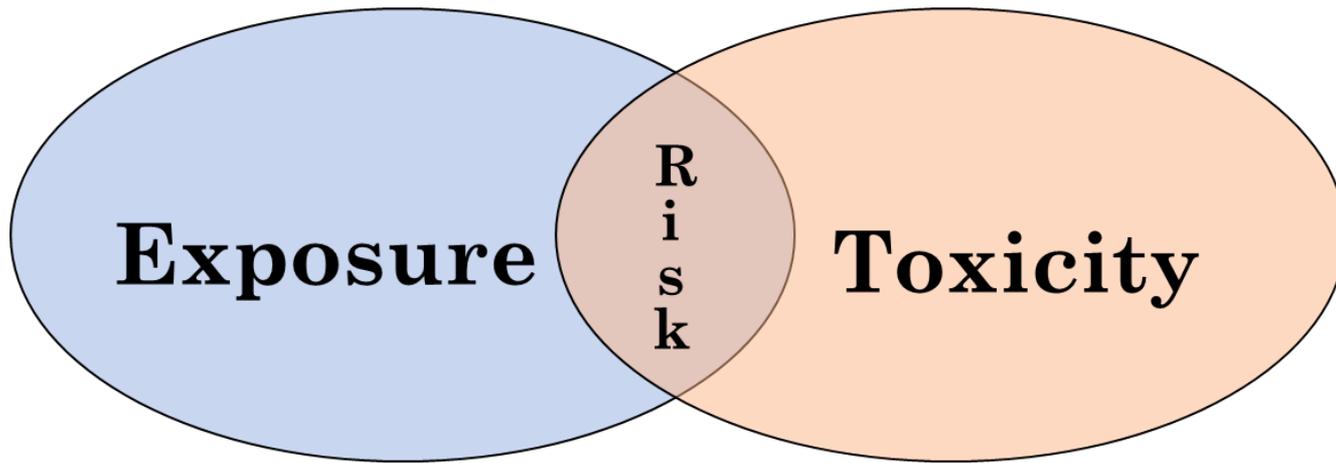
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REVIEW TOXICITY AND EXPOSURE ASSESSMENT OUTPUTS

- The first component in risk characterization is to gather, review, compare, and organize the outputs of the exposure and toxicity assessments
 - Exposure duration, frequency, and magnitude
 - Pathways and receptors
 - Toxicity values



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QUANTIFY RISKS FROM INDIVIDUAL CHEMICALS

- Risk calculated for each chemical utilizing exposure and toxicity data
- Risk expressed in numerical form
- Non-carcinogenic hazard and carcinogenic risk

QUANTIFYING NON-CARCINOGENIC HAZARD

- Non-carcinogenic effects are evaluated by comparing an exposure level (dose) with the toxicity value
- Expressed as a hazard quotient
- The hazard quotient assumes that there is a level of exposure below which it is unlikely to experience an adverse non-carcinogenic health effect



QUANTIFYING NON-CARCINOGENIC HAZARD

- The hazard quotient (HQ) is the ratio of the exposure level at a site to the reference dose

$$\text{HQ} = \frac{\text{site exposure (i.e., ADD)}}{\text{reference dose}}$$

- Hazard quotient values are variable, with values less than and equal to 1 generally considered indicative of acceptable hazard

$$1 \div 2.1 = 0.5$$

QUANTIFYING CARCINOGENIC RISK

- The potential for carcinogenic risk is expressed by estimating the probability of cancer incidence in a population of individuals for a specific lifetime (excess lifetime cancer risk, ELCR)
- Utilizing receptor exposure levels and chemical toxicity data

Cancer risk = exposure (ADD) x tox data (SF)

- Cancer risk expressed as a unitless probability of an individual in a population developing cancer over a lifetime

QUANTIFYING CARCINOGENIC RISK

Number and how it reads in various scientific notations			
0.1	1×10^{-1}	1.0E-1	One in ten
0.01	1×10^{-2}	1.0E-2	One in a hundred
0.001	1×10^{-3}	1.0E-3	One in a thousand
0.0001	1×10^{-4}	1.0E-4	One in ten thousand
0.00001	1×10^{-5}	1.0E-5	One in a hundred thousand
0.000001	1×10^{-6}	1.0E-6	One in a million
0.000000001	1×10^{-9}	1.0E-9	One in a billion



RISK CHARACTERIZATION

Components of the risk characterization process:

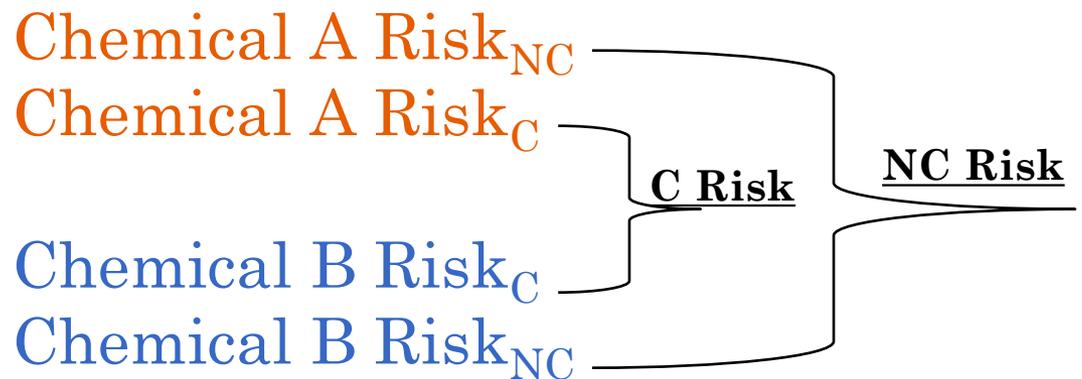
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DETERMINE INDIVIDUAL PATHWAY RISK BY QUANTIFYING RISKS FROM MULTIPLE CHEMICALS

Determine cumulative risk of each exposure pathway by adding risk from each individual chemical in that pathway



Total Pathway Risk



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COMBINE RISKS ACROSS EXPOSURE PATHWAYS

Non-Carcinogenic Hazard

Soil direct contact = 0.2
Indoor air = 0.1

Total non-carcinogenic
hazard at site (HI) = 0.3

Carcinogenic Risk

Soil direct contact = 3×10^{-6}
Indoor air = 4×10^{-6}

Total carcinogenic
risk at site (ELCR) = 7×10^{-6}

Compare calculated risk values to applicable risk goals

RISK CHARACTERIZATION

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RESULTS SUMMARIZATION AND PRESENTATION

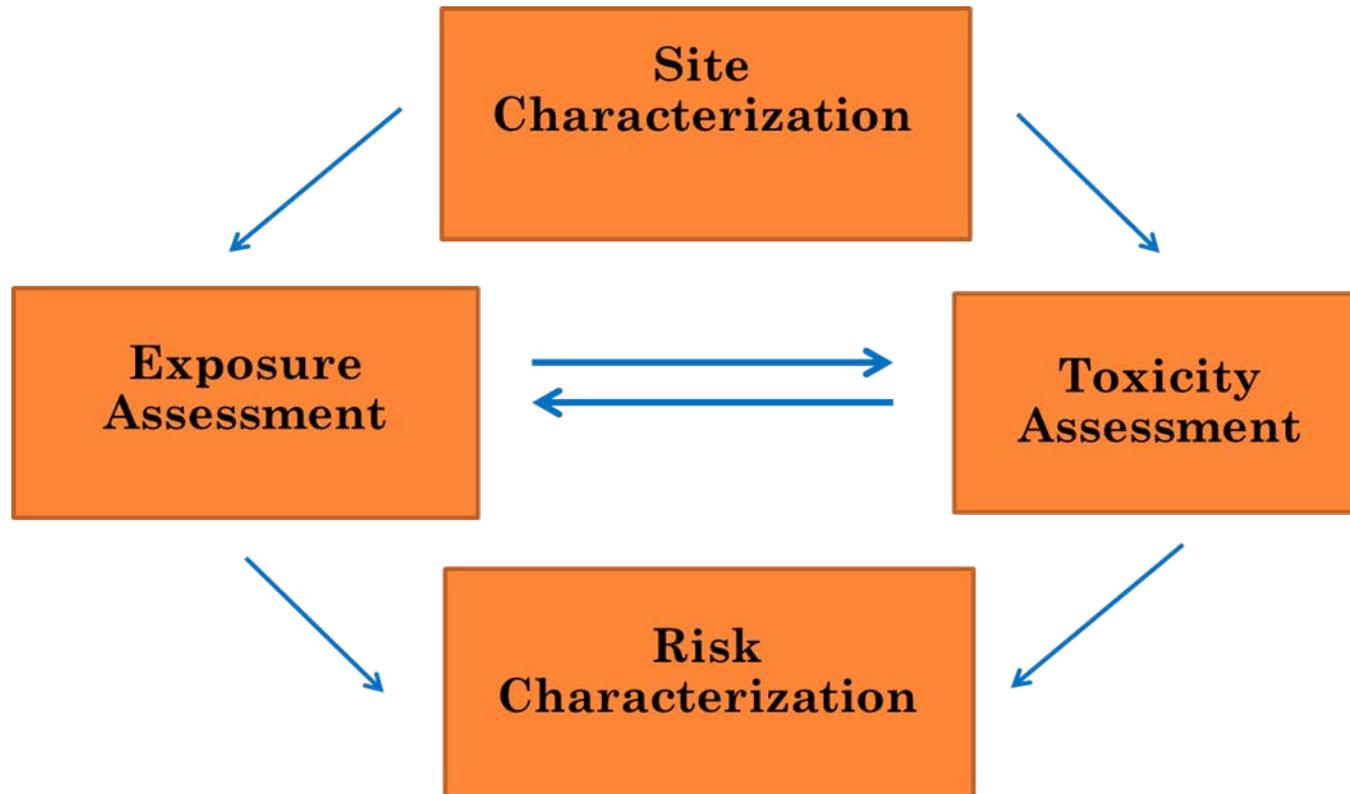
- Quantitative AND qualitative presentation- very important to provide discussion along with the HI and ELCR values
- Places the numerical estimates of risk in the context of what is known and what is not known about the situation, and in the context of decisions to be made about selection of remedies
- A risk characterization cannot be considered complete unless the numerical expression of risk are accompanied by explanatory text interpreting and qualifying the results

RISK CHARACTERIZATION “SUM UP”

- Review outputs from toxicity and exposure assessments
- Quantify risks from individual chemicals
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- Combine risks across exposure pathways
- Summarize and present results qualitatively and quantitatively

At the conclusion of the risk characterization, the results will highlight the potential sources of risk at a site so that these sources may be dealt with effectively in the remedial process

Thank you!



Questions?