

RISK SCREENING

Kathryn A. Wurzel

NewFields

1349 West Peachtree St. Suite 2000 Atlanta, GA 30309

Phone: (404) 347-9050, email: kwurzel@newfields.com

Introduction

Risk screening is a tool used to promptly identify constituents and exposure areas requiring risk management. Risk-based screening is used to eliminate constituents, areas of a site, and exposure pathways from further consideration. The screening process can limit the scope of the remedial investigation, risk assessment, and ultimately, risk management.

The screening process is generally performed in a step-wise fashion; the preliminary screening is conducting by comparing the maximum detected constituent concentration in an area to established risk-based, chemical and media specific, screening criteria such as the EPA Region 3 Risk-Based Concentrations (RBCs) or the EPA Region 9 Preliminary Remediation Goals (PRGs). If maximum detected concentrations are below their respective screening criteria, no further evaluation is necessary because the site does not pose a potential long-term risk. This conclusion is based on two facts: individuals are not exposed to the maximum concentration for an entire lifetime; and, conservative (i.e., health protective) assumptions are used in the derivation of the risk-based criteria. In the event the maximum concentration for some constituents exceed their respective screening criterion, a site-specific screening may be conducted prior to making the decision that a baseline risk assessment is necessary.

The methodology for risk-based screening (preliminary and site-specific) and factors that are important in the decision to perform a site-specific screening are presented. *Risk Assessment Guidance for Superfund (RAGS) Part D*, is discussed as the format for documenting the screening process.

Discussion

Risk-based screening is used to focus investigation, risk assessment, and risk management. The large number of constituents that are analyzed during an environmental site investigation make the task of determining the source of risk at a site appear rather daunting. Generally the site data available have been collected in a manner that is biased toward finding contamination; this biased sampling is the standard methodology used in the Preliminary Assessment/Site Investigation (PA/SI) phase of site characterization. The PA/SI data, combined with any other site data available, will generally identify the maximum concentrations present at a site. Comparing these maximum concentrations to risk-based screening criteria provides a quick method to narrow the list of potential constituents of concern (COPCs).

The risk-based screening criteria that have been established use conservative, health protective assumptions. Screening criteria are generally based on a carcinogenic risk of one in one million and a non-carcinogenic hazard index of one. Residential criteria assume a daily exposure for 30 years and the industrial criteria are based on a 5-day per week, 50 week per year (250 days per year) exposure for 25 years. Various screening criteria are available and the selection is usually based on the EPA region or state of the subject site. Region 3 soil criteria are based on ingestion of soil, inhalation of soil particulate, and inhalation of constituents volatilized from the soil. Region 6 has developed screening criteria for both indoor and outdoor workers; the outdoor worker scenario may be evaluated with or without dermal absorption. The Region 9 criteria, which are the most widely accepted, are also the most conservative because they include dermal absorption of all constituents under both the residential and industrial exposure scenarios. The October 2002 version of the Region 9 PRGs doubled the soil ingestion rate under the industrial exposure scenario thus making the numbers even more conservative than the other regions.

Dividing the site soil concentration by the risk-based screening criterion is the basis of the screening process. If the site concentration is greater than the screening value, the quotient will be greater than one indicating that there is a *potential* risk at the site and further evaluation is necessary. Figure 1 provides an example of the risk screening calculation for benzene in soil.

Compare the concentration of the COC to the generic risk-based screening level

Example: benzene in soil

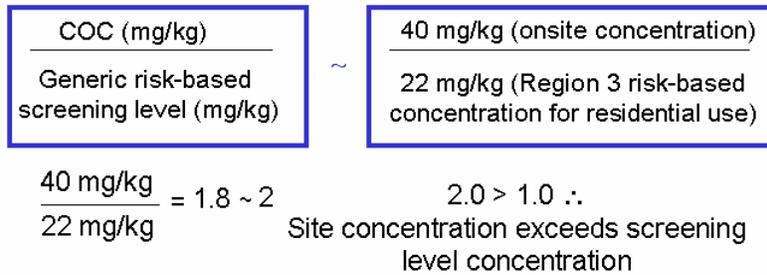


FIGURE 1

RAGS Part D was developed to provide an efficient table format for documenting the procedures used in a risk assessment, including the refinement of COPCs. Table 2.1, *Occurrence, Distribution and Selection of Potential Chemicals of Concern* may be used for the risk screening process and as an interim deliverable for the risk assessment. Table 2.1 requires the information identified in Table 1.

- CAS number
- Chemical name
- Minimum detected concentration
- Maximum detected concentration
- Units
- Location of maximum
- Detection frequency
- Range of detection limits
- Concentration used for screening
- Background value
- Screening toxicity value
- Rationale for inclusion or exclusion

TABLE 1

Following completion of the basic, preliminary screening, there are several possible outcomes as shown in Figure 2.

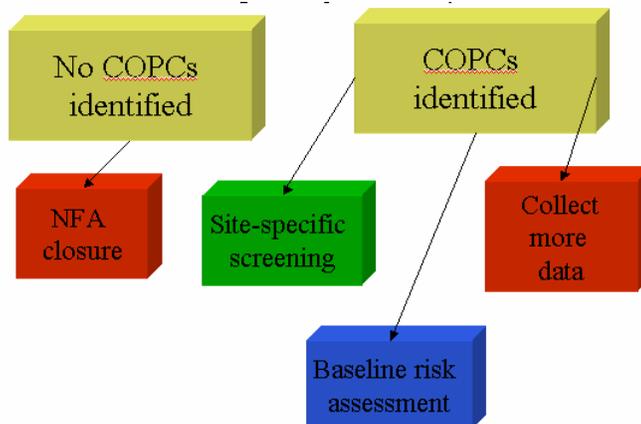


FIGURE 2

If the basic, preliminary screening does not indicate a potential long-term risk (COPC/Screening Criteria<1), no further evaluation is necessary. The identification of COPCs can result in the decision that additional data is necessary to make an adequate determination of the potential site risk, a site-specific screen will be performed using more site-specific data (e.g., average concentrations, land use scenarios, exposure parameters), or a baseline risk assessment may be initiated. Some of the factors that may influence the decision are the number of data points available and their distribution across the site, the magnitude of the exceedence (>1), and the complexity of the site.

One of the factors to consider prior to conducting the site-specific screen is whether the risk-based screening criteria were exceeded by orders of magnitude. The refinements possible by applying site-specific information are not likely to significantly impact the potential risk (orders of magnitude reduction). Other factors to consider are the certainty of the future land use and whether the default exposure assumptions used to derive the screening criteria are representative of the site conditions. Uncertainty in future land use generally results in using the most conservative (health protective) assumptions in establishing screening criteria (residential or default industrial). If the default exposure assumptions are representative of the site activity, refinement of the assumptions will have minimal impact on the estimated risk.

An evaluation of the potential impact based on the specific constituents present at the site should be conducted prior to approaching the regulatory agency for approval to use an alternate land use for screening refinement (using the default industrial rather than residential). Depending on the constituent, the impact of the alternate land use may be minimal (Figure 3).

Constituent	Residential	Industrial
Benzene	0.63	1.4
Butylate	3300	34000
Cadmium	9.0	850
TCE	3.2	7.0

FIGURE 3

Refinement of the exposure parameters for a particular land use (default residential or industrial) scenario may include modifying the number of days exposure to soil occurs based on climatic conditions (snow cover, frozen ground, or wet conditions). Other factors such as the salinity of groundwater or yield of the aquifer may eliminate the use of groundwater as a potable supply. Zoning restrictions, wetlands and coastal zone restrictions and institutional controls may also support the use of alternative exposure scenarios and/or exposure parameters.

The use of average concentrations as representative exposure point concentrations is another method for further refining the screening assessment. The use of average concentrations is consistent with RAGS and allows for the use of all the site data to calculate the long-term exposure point concentrations. The 95% upper confidence level (UCL) of the mean is generally used as the average concentration in risk assessments.

Summary

The risk screening process is used to limit the scope of the remedial investigation, the risk assessment, and risk management. Preliminary and site-specific screening may be conducted to eliminate constituents of concern (COCs), areas of a site, or exposure pathways. Comparison of the maximum detected concentration to published risk-based screening criteria is the most conservative method of screening. Refinement of the screening can be accomplished by using site-specific information such as land use and exposure frequency, or the screening concentration may be modified by using all the available data to calculate an average exposure point concentration more representative of long-term exposure. The potential consequences of the refinements should be determined prior to approaching the regulatory agency for approval. Some agencies will allow the use of a site-specific screening in lieu of a baseline risk assessment if the site is not complex and the screening assumptions are consistent with the most conservative future use of the site.