



REGION 4

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Ground-Water Exposure Point Concentration: EPA Region 4 Interim Guidance

The purpose of this interim guidance on the definition of the ground-water exposure point concentration is to present a simplified interpretation of draft EPA national guidance on this issue. This draft national guidance may be finalized with modifications in the future. Therefore, this statement by the EPA Region 4 Waste Division, Office of Technical Services (OTS) should not be considered as a final statement regarding the appropriate procedure used to estimate risk from ground-water contamination and should be applied as an interim guidance only for sites in Region 4.

EPA's draft "Supplemental Guidance to RAGS: Estimating Risk from Groundwater Contamination" (EPA Office of Solid Waste and Emergency Response, December 1993) presents draft EPA guidance concerning the selection of monitoring points for calculating potential exposure to ground-water contaminants. This draft guidance was never finalized; however, it is to date the sole Agency-wide statement on the issue of selection of exposure point concentrations for ground water risk assessments. The following items taken from that draft guidance summarize how it addresses the issue of selection of exposure point concentrations for risk assessment calculations:

- "The Superfund program uses a reasonable maximum exposure (RME) or high-end risk calculation as the basis for remedial decisions."
- "The concentration term is best described by an arithmetic average... Time and resource considerations generally preclude collecting enough data to calculate a true average; therefore, Superfund has relied on an upper-confidence limit on the arithmetic mean (UCL₉₅) to represent the average concentration."
- "Risk assessment should be based upon the likelihood that a person will be continuously exposed to the contaminants at the site over time. In a true assessment of risk, the usability of the aquifer must be considered."
- "For ground water...adequate data may not be available for risk analysis... If the available data cannot support statistical calculation of a pollutant's average concentration, the risk assessor is forced to calculate risk values from a single concentration measurement, usually relying on a maximum value."
- "...it is appropriate for the (risk) assessor to target data from wells in the 'center' of the plume...for the concentration term in ground-water risk assessments, it is sufficient to take the simple arithmetic average of sample data obtained from two to three wells in the 'center' of the plume...to account for the impact of seasonal variations, data from at least

two quarters is required..."

essence, the draft guidance is summarized as follows:

Because of typical limitations in the amount of ground-water monitoring data available, the preferred method of estimating ground-water exposure point concentrations is generally inapplicable and the risk assessor should therefore rely on the arithmetic average of at least two quarters of data from two or three wells in the center of a ground-water contaminant plume to calculate an exposure point concentration.

For purposes of this draft interim guidance, EPA Region 4 considers a contaminant plume as an area of ground-water contamination that originates from a discernable contaminant source area. The center of the plume is ideally simply defined as the area of maximum contaminant concentrations. For an idealized contaminant plume, all contaminants of potential concern will be at their highest concentration at a specific monitoring location, at their next highest concentration at a well closest to the well with the highest concentrations, and so forth. Additionally, in an idealized plume, the risk from ground-water exposure will be highest where the contaminant concentrations are highest. However, these idealized conditions are often not present at a site, e.g., multiple contaminants exist with maximum concentrations in different wells. Therefore, the following points apply to the analysis of ground-water exposure:

EPA is ultimately concerned about risk, not concentrations. Therefore, a risk assessor should estimate the risk (carcinogenic and noncarcinogenic) at each monitoring location for all COPCs (a screening-level analysis of risk is acceptable for this task). Then, the risk assessor should define the center of the plume as encompassing the well with the highest summed risk and one or two wells in close proximity to that well. To be considered as center of the plume wells, the summed risk from each of these wells should be within an order of magnitude and the wells must be in relatively close proximity. The risk assessor proceeds with calculating the average concentrations at those points.

Both carcinogenic and noncarcinogenic risk are evaluated in the risk assessment. For most contaminant plumes, wells that define the center of the plume should have order of magnitude-comparable carcinogenic and noncarcinogenic risk (similar contaminants of potential concern at similar concentrations). For an atypical contaminant plume where this condition does not apply, the definition of the center of the plume based on the risk criterion may be complicated. In such cases, the risk assessor should consult with EPA Region 4 Office of Technical Services to determine how to define the center of the plume.

There may be some sites where there is only one well with the high concentrations and highest degree of risk that defines the center of the plume. EPA's national draft guidance specifies that the ground-water exposure should be calculated from wells in the center of the plume. Therefore, if only one well is representative of the center of a plume, only data from that well (not two or three wells as stated in the draft national guidance) can be used to calculate the exposure point concentration. On a site-specific basis, there may be an option of adding monitoring wells in the center of the plume area to better define an actual exposure point

concentration that would be used in the risk assessment.

Once the "center of the plume" wells have been established, calculation of risk at the theoretical exposure point is straightforward. Presuming that two sample results are available from two wells (the simplest condition accounted for by the draft national guidance) the four concentrations for each contaminant of potential concern are averaged and that average value is then used to calculate risk. If two rounds of data are available from one well and three rounds of data are available from another well in the center of the plume, then the point-specific averages at each location should be calculated first. Those point-specific averages are then averaged to estimate the overall risk at the center of the plume.

Note that one caveat to the above discussions concerns sites where waste is to be managed in place. An example of this condition would be a closed and capped municipal solid-waste landfill. In such situations, EPA considers the point of exposure to ground water to be the downgradient margin of such a waste disposal area. Therefore, risk calculations would consider the wells defining the "center" of the plume outside of the waste management area boundary and proceed as described above.