

NRC Attributes, Potential Data Elements, Issues, and Alternatives for Microbes

| Attribute and NRC Definition | Potential Data Elements for this Attribute | Issue Identified for this Attributes | Alternatives |
|---|---|--|--|
| <p>Potency: How much of the contaminant is required to cause illness.</p> <p>Dose from single exposure leading to infection of 50% of exposed population (Median Infectious Dose, ID₅₀)</p> | <ul style="list-style-type: none"> ▶ (Infectious dose data for healthy people known for a few pathogens) | <ul style="list-style-type: none"> ▶ Infectious dose depends on health status of host ▶ Infectious dose known only for a few pathogens ▶ Strain variation in potency may be great (e.g., Crypto strains) ▶ Educated guesses may be wildly inaccurate. ▶ For the few pathogens where potency has been determined, data may reflect different endpoints (e.g., inhalation vs. ingestion, ID₅₀ vs. ID_{min}) and different study protocols, making comparisons difficult ▶ Animal data questionable, even if animal model is available. ▶ Human feeding studies not normally repeated; thus | <ul style="list-style-type: none"> ▶ Occurrence of Water borne disease outbreak ▶ Type microbe (protozoa, virus, bacterium, etc.) ▶ Prevalence of disease nationally ▶ Level of protective immunity in population ▶ Level of secondary spread in population |

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| | | uncertainty cannot be defined. | |
| <p>Severity: How bad is the health effect</p> | <ul style="list-style-type: none"> ▶ Severity in healthy populations. ▶ Severity in sensitive physiological subpopulations. ▶ Severity in severely immunocompromised. ▶ Case-fatality rate | <ul style="list-style-type: none"> ▶ Severity may be strain-dependent (e.g., <i>E. coli</i> O157 vs. other <i>E. coli</i>) ▶ How to deal with sensitive subpopulations, where severity is often greater? | |
| <p>Prevalence: How commonly does or would a microbe occur in drinking water.</p> <p>Includes both temporal occurrence, i.e., proportion of time found in specific locale, and geographic occurrence, i.e., proportion of locales nationally where microbe is found</p> | | <ul style="list-style-type: none"> ▶ Almost no data available on presence of pathogen in drinking water. ▶ Some data on presence of microbe in source waters, but almost no data on geographic or temporal occurrence, or density. ▶ Some data on presence of microbes in distribution system biofilm and sediment, but almost no data on geographic or temporal occurrence, or density. | <ul style="list-style-type: none"> ▶ Presence of pathogen in source water ▶ Host range ▶ Effectiveness of common water treatment processes |

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| <p>Magnitude: Density of microbe relative to level that causes perceived health effect, i.e., is the density great enough to result in disease.</p> <p>Magnitude = (Potency x Prevalence)^{1/2}</p> | | <ul style="list-style-type: none"> ▶ Lack of data for potency and prevalence ▶ If Prevalence data not available, then Magnitude cannot be estimated. | <p>▶ Magnitude could be broadened to:</p> <p>(Potency x [Prevalence OR Persistence-Mobility])^{1/2}</p> |
| <p>PERSISTENCE - MOBILITY: What is the likelihood that the contaminant would be found in the aquatic environment based solely on its physical properties (i.e., stability in water, mobility, and potential for amplification in aquatic environment).</p> <p>Used only when Prevalence data not available</p> | <ul style="list-style-type: none"> ▶ General potential to survive environmental stresses ▶ General potential for growth in water distribution system and plumbing system | <ul style="list-style-type: none"> ▶ Survival time in water for particular microbe depends significantly on water temp., normal microbe niche, level of available organic carbon, and other environmental factors. | |