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What are HAC values?

The first step in assessing the potential public health impact of exposure to chemicals in the environment is to compare environmental sampling data to **health assessment comparison (HAC)** values. HAC values are media-specific contaminant concentrations used by health assessors to screen contaminants for further evaluation. By comparing contaminant concentrations to HAC values for both non-cancer and cancer end points, scientists are able to consider what possible implications the contaminant may have on the community. Exceeding an HAC value does not necessarily mean that a contaminant represents a public health threat, but does suggest that the contaminant warrants further consideration.

Noncancer health assessment comparison values, environmental media evaluation guides and reference dose media evaluation guides, are based on ATSDR's **minimal risk levels (MRLs)** and EPA's **reference doses (RfDs)**. The MRLs and RfDs are estimates of daily human exposure to a contaminant that is unlikely to cause adverse noncancer health effects over a lifetime.

ATSDR derives MRLs when reliable and sufficient data exist to identify the target organ(s) effected or the most sensitive health effect(s) for a specific duration and for a given route of exposure to the substance. MRLs are based on noncancer health effects only. Inhalation MRLs are exposure concentrations expressed in units of parts per million (ppm) for gases and volatile chemicals, or milligrams per cubic meter (mg/m³) for particles. Oral MRLs are expressed as daily human doses in units of milligrams per kilogram per day (mg/kg/day). Radiation MRLs are expressed as external exposures in units of millisieverts.

ATSDR [1] uses the no observed adverse effect level/uncertainty factor (NOAEL/UF) approach to derive MRLs for hazardous substances. They are set below levels that, based on current information, might cause adverse health effects in the people most sensitive to such substance induced effects. MRLs are derived for acute (1 to 14 days), intermediate (>14 to 364 days), and chronic (365 days and longer) exposure durations, and for the oral and inhalation routes of exposure. Currently MRLs for the dermal route of exposure are not derived because ATSDR has not yet identified a method suitable for this route of exposure. MRLs are generally based on the most sensitive substance-induced end point considered to be relevant to humans. Exposure to a level above the MRL does not necessarily mean that adverse health effects will occur. MRLs are intended to serve as a screening tool to help public health professionals focus their evaluation. Most MRLs contain some degree of uncertainty because of the lack of precise toxicological information on the people who might be most sensitive (e.g., infants, elderly, and nutritionally or immunologically compromised) to effects of hazardous substances. ATSDR uses a conservative (i.e., protective) approach to address these uncertainties

consistent with the public health principle of prevention. Although human data are preferred, MRLs often must be based on animal studies because relevant human studies are lacking. In the absence of evidence to the contrary, ATSDR assumes that humans are more sensitive than animals. Thus the resulting MRL may be as much as a hundredfold below levels shown to be nontoxic in laboratory animals. When adequate information is available, physiologically based pharmacokinetic (PBPK) modeling and benchmark dose (BMD) modeling have also been used as an adjunct to the NOAEL/UF approach in deriving MRLs. Each MRL is subject to change as new information becomes available.

The RfD^[2] is a benchmark dose derived from the NOAEL by consistent application of generally order-of-magnitude uncertainty factors (UFs) that reflect various types of data sets used to estimate RfDs. These uncertainty factors are intended to account for the variation in sensitivity among the members of the human population. For example, a valid chronic animal NOAEL is normally divided by an UF of 100.

Cancer health assessment comparison values are called **carcinogenic risk evaluation guides** or **CREGs**. They are based on EPA's chemical-specific cancer slope factors and an estimated excess lifetime cancer risk of 1-in-1-million persons exposed for a lifetime. Standard assumptions are used to calculate appropriate HAC values.

[1] <http://www.atsdr.cdc.gov/mrls.html>

[2] <http://www.epa.gov/iris/rfd.htm>