Reference Dose (RfD)

What are they?

RfD is the amount of a substance, per unit of body weight, that a person could consume every day for their rest of their life with no increased likelihood of negative health effects. RfDs are measured in mg/kg/day – milligram of toxin per kilogram of body weight per day. (*Note:* RfDs do not address cancer risks; there is no 'safe' level for a cancer-causing toxin. See *Cancer Slope Factor* for more.)

How are they used?

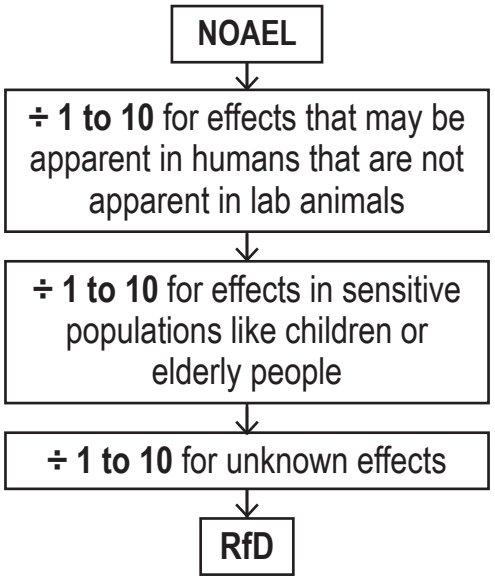
RfDs are not legally binding by themselves, but they are the "building blocks" of almost all risk assessment. Health-based standards should be set so that a person with typical daily exposure won't get more than the RfD of the contaminant. For example, a toxicologist knows a typical (154-lb) person drinks 2 - 4 liters of water per day. They might set the MCL for a toxin in drinking water so someone drinking that water would not exceed the reference dose.

Another example: A risk assessor focused on risks from contaminated soil might see if anyone's exposure to that soil might lead to them absorbing more than the RfD of a toxin. Risk assessors also look at multiple paths of exposure: If someone is exposed to a toxin through the soil, water, and air, do all of those exposures add up to exceed the RfD?

A risk assessor might find that the level of contamination in a particular case is unlikely to be harmful even if it exceeds a particular standard. If exposure is less than typical (people rarely drink this water or come into contact with this soil) then there is less risk of exceeding the RfD.

How are they determined?

RfDs are based on tests of laboratory animals. Sometimes they are based on human health studies from accidental exposure. Scientists start with a level of the toxin that has shown no observable negative effects (NOEL/NOAEL), or the lowest level of the toxin that *has* shown negative effects (LOEL/LOAEL) in lab animals. They then make that number smaller by safety factors:



In this way, an RfD may end up being 1,000 times smaller than a NOAEL.

How are they related to human health?

RfDs are set based on health risks, and are intended to be very conservative. They assume a lifetime of daily exposure at the RfD, so exposure slightly above the RfD for a short time is unlikely to increase health risks. Again, RfDs are for *non-cancer* effects. See *Cancer Slope Factor.*

For More

epa.gov/iris/subst - or check your state's environmental agency's website.