

The 95% confidence lower bound on the dose associated with a 10% extra risk (LED10) is based on the prevalence of animals demonstrating liver toxicity. After an exposure adjustment to the LED10 (1.2 mg/kg/day), an RfD of 0.01 mg/kg/day was calculated using an overall uncertainty factor of 100 (10 for interspecies extrapolation and 10 for protection of sensitive individuals) (USEPA 2001b).

Coincidentally, the benchmark dose and the traditional NOAEL/LOAEL approaches yield the same RfD number (USEPA 2001b). The NOAEL/LOAEL approach is also based on the Heywood study (1979) which had a LOAEL of 15 mg/kg/day for evidence of liver toxicity. After an exposure adjustment to the LOAEL (yielding 12.9 mg/kg/day), an RfD of 0.01 mg/kg/day was calculated using an overall uncertainty factor of 1000 (10 for interspecies extrapolation, 10 for protection of sensitive individuals, and 10 for using a LOAEL instead of a NOAEL) (USEPA 2001b).

ii. *Relative source contribution.*

Another factor in determining the MCLG is the relative source contribution (RSC). The RSC is used when the MCLG is set at a level above zero. Its purpose is to ensure that the contribution to exposure from drinking tap water does not cause the lifetime daily exposure of persons to a contaminant to exceed RfD. The RSC is thus a factor used to make sure that the MCLG is protective even if persons are exposed to the contaminant by other routes (inhalation, dermal absorption) or other sources (e.g., food). If sufficient quantitative data are not available on exposure by other routes and sources, EPA has historically assumed that the RSC from drinking water is 20 percent of the total exposure, a value considered protective. If data indicate that contributions from other routes and sources are not significant, EPA has historically assumed a less conservative RSC of 80 percent (54 FR 22,062, 22,069 (May 22, 1989)(USEPA 1989a), 56 FR at 3535 (Jan 30, 1990)(USEPA 1991a), 59 FR 38,668, 38,678 (July 29, 1994)(USEPA 1994b)).

Today, EPA is proposing an assumption of a 20 percent RSC. This is in consideration of data which indicate that exposure to chloroform by other routes and sources of exposure may potentially contribute a substantial percentage of the overall exposure to chloroform.

In the 1998 Stage 1 DBPR NODA, EPA considered an MCLG of 0.3 mg/L that

was calculated using an RSC of 80 percent, based on the assumption that most exposure to chloroform is likely to come from ingestion of drinking water. In the final Stage 1 DBPR, EPA reconsidered this assumption in response to comments and in the light of data which indicate that exposure to chloroform by inhalation and dermal exposure may potentially contribute a substantial percentage of the overall exposure to chloroform depending on the activity patterns of individuals (USEPA 1998e) e.g., during showering, bathing, swimming, boiling water, clothes washing, and dishwashing. There is also potential exposure to chloroform by the dietary route. There are uncertainties regarding other possible highly exposed sub-populations, e.g., swimmers, those who use humidifiers, hot-tubs, and outdoor misters, persons living near industrial sources, people working in laundromats, and persons working with pesticides employing chloroform as a solvent (USEPA 1998b).

A 1998 International Life Sciences Institute (ILSI) report evaluated the uptake of drinking water contaminants through the skin and by inhalation. The report noted that "(i)n the case of chloroform, its high volatility leads to its rapid movement from liquid to air. Large water-use sources, such as showers, become dominant sources with respect to exposure" and "(t)he inhalation route is demonstrated to be the primary route for higher-volatility compounds (e.g., chloroform)" (ILSI 1998). Weisel and Jo (1996) found that "approximately equivalent amounts of chloroform from water can enter the body by three different exposure routes, inhalation, dermal absorption, and ingestion, for typical daily activities of drinking and bathing."

Chloroform has been found in beverages, especially soft drinks, and food, particularly dairy products (Wallace, 1997). Wallace states that "ingestion (drinking tap water and soft drinks and eating certain dairy foods), inhalation (breathing peak amounts of chloroform emitted during showers or baths, and lower levels in indoor air from other indoor sources), and dermal absorption (during showers, baths, and swimming)" each "appear to be potentially substantial contributors to total exposure".

EPA estimates that for the median individual, ingestion of total tap water (assuming certain activity patterns, habits, and home characteristics) can

contribute roughly 28 percent of the total dose of chloroform (USEPA 2001a). With assumptions as described, tap water ingestion is a portion of exposure through fluid intake which contributes about 34 percent of the total dose, inhalation accounts for about 31 percent of the total dose, ingestion of foods contributes another 27 percent of the overall dose, and dermal absorption (primarily during showering) adds slightly less than 8 percent of the total dose. These exposure percentages are based on average daily doses (mean chloroform intake for adults) for each source and route of exposure under specific conditions. They do not take into account the considerable variability in several factors across the population. For instance, intake of drinking water or particular foods and length of shower varies from day-to-day, as do home air turnover rates and ventilation. Different areas in the United States vary with respect to these factors and chloroform concentrations in food. Thus, although the 28 percent for the median individual is based on reasonable assumptions, uncertainty remains.

Given the uncertainties of estimation, EPA believes available analyses point to the RSC of 20 percent as the appropriate default (i.e., 20 percent of exposure to chloroform comes from drinking tap water alone). EPA also believes that this default is protective of public health and is a more reasonable choice than choosing any particular estimate because of the assumptions and uncertainties involved with each estimation. Hence, EPA is proposing the MCLG based on the RSC default of 20 percent which supports the adequacy of the margin of safety associated with the MCLG.

iii. *Water ingestion and body weight assumptions.* In MCLG calculations, EPA assumes the 90th percentile water ingestion of 2 liters (roughly equivalent to a half gallon) per day (USEPA 2000a). The use of a conservative consumption estimate is consistent with the objective of setting an MCLG that is protective. EPA also uses a default adult body weight of 70 kg (equal to 154 pounds) for the RfD since dose is calculated from lifetime studies of animals and compared to lifetime exposure for humans.

iv. *MCLG calculation.* The MCLG is calculated to be 0.07 mg/L using the following assumptions: an adult tap water consumption of 2 L per day for a 70 kg adult, and a relative source contribution of 20%: