Discussion of Methyl Bromide AEGL Acute Inhalation Levels

The National Research Council releases acute exposure guideline levels (AEGLs) for “high-priority, acutely toxic chemicals” identified as “extremely hazardous substances” (EHS). The AEGLs are intended for the protection of “workers and residents in communities surrounding industrial facilities where EHSs are manufactured, used, or stored.” Three levels of AEGLs may be developed. The level one AEGLs (AEGL-1) are the most health-protective of the three levels, and are referenced as “non-disabling” exposure levels. AEGL-2 and AEGL-3 levels are identified as “disabling” and “lethal”, respectively. The expanded definition of an AEGL-1 value is an air concentration “above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic, non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure” (NRC 2012). Persons exposed at AEGL-2 concentrations “above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape”, and persons exposed at exposures above the AEGL-3 levels “could experience life-threatening health effects or death”.

The NRC chose to not establish AEGL-1 levels for methyl bromide, reasoning that methyl bromide has no odor or irritation properties at concentrations below those that define the AEGL-2 values. Additionally, the NRC noted the dose-response curve for methyl bromide lethality is steep and the margin of safety between no-effect and lethal values is small. See Table 5 on the following page taken from the NRC 2012 document that lists the AEGL values derived for methyl bromide.

Reference:

### TABLE 5-1 Summary of AEGL Values for Methyl Bromide

<table>
<thead>
<tr>
<th>Classification</th>
<th>10 min</th>
<th>30 min</th>
<th>1 h</th>
<th>4 h</th>
<th>8 h</th>
<th>End Point (Reference)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AEGL-2 (disabling)</td>
<td>940 ppm (3,657 mg/m³)</td>
<td>380 ppm (1,478 mg/m³)</td>
<td>210 ppm (817 mg/m³)</td>
<td>67 ppm (261 mg/m³)</td>
<td>67 ppm (261 mg/m³)</td>
<td></td>
</tr>
<tr>
<td>AEGL-3 (lethal)</td>
<td>3,300 ppm (12,837 mg/m³)</td>
<td>1,300 ppm (5,057 mg/m³)</td>
<td>740 ppm (2,879 mg/m³)</td>
<td>230 ppm (895 mg/m³)</td>
<td>130 ppm (506 mg/m³)</td>
<td>BMCL_{0.05} in rats (Kato et al. 1986)</td>
</tr>
</tbody>
</table>

*aNumerical values are not recommended because the data indicate that toxic effects might occur below the odor threshold for methyl bromide. Absence of an AEGL-1 value does not imply that exposure below the AEGL-2 value is without adverse effects. Abbreviations: BMCL_{0.05}, benchmark concentration, 95% lower confidence limit with 5% response; NOAEL, no-observed-adverse-effect level; NR, not recommended.*

Reference:

Discussion of Commonly Referenced 3.9 mg/m³ Occupational Acute Inhalation Value for Methyl Bromide

A low-level acute occupational exposure level commonly referenced for methyl bromide is 3.9 mg/m³ (1 ppm), the level found in the 1999 California OEHHA Acute RELs. The OEHHA acute inhalation value is identified as a 1-hour REL (reference exposure level). This acute REL value references a 1942 study by Watrous, and the data is from a 1940 inhalation exposure to 90 “worker” subjects, and is based “symptoms developed during the workshift”, that assumed a 2-hour exposure was sufficient to cause the symptoms to occur. A 2-hour LOAEL of 59 ppm was noted, with no indication of the method of quantitation of the exposure concentrations identified in the 1940 observations. Using the Haber’s Law equation, they extrapolated the 2-hour exposure concentration that induced the noted adverse effects to a 1-hour exposure LOAEL of 35 ppm. The critical effects noted for the LOAEL were “anorexia, nausea, headache”. No additional information of the adverse effects or the proportion of subjects exhibiting the critical effects was indicated. An uncertainty factor (UF) of 6 was applied to extrapolate the LOAEL to a NOAEL for “mild adverse effects”. An additional UF of 10 was applied to human population sensitivity variability. The resulting acute REL = 1 ppm (3.9 mg/m³).

Because of the uncertainty of the exposure concentration measurement, the small number of subjects, the adverse effects utilized as the critical effects for the LOAEL, the age of the study and the lack of documentation available, the DAQ does not judge this as an appropriate reference for an acute inhalation level protective of public health. Additionally, DAQ does not judge this LOAEL as an appropriate value to calculate an acute exposure level protective of public health using current extrapolation methods and applying the current default UFs.

Reference:

Appendix D.2 Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999)

"slm/discussion of MeBr acute inhalation values"