

## 7. DATA ANALYSIS FOR AEGL-3

### 7.1. Human Data Relevant to AEGL-3

A large number of deaths occur annually due to acute poisonings in fires and in closed locations (e.g., in private homes and workplaces). In the latter instance, poisoning usually occurs because gas-, oil- or coal-fired furnaces or stoves are operated without sufficient ventilation. In apparently healthy people who died from CO poisoning, usually COHb concentrations of 60% or higher are found (Stewart 1975; Winter and Miller 1976; Balraj 1984; Holmes 1985; AIHA 1999). In early experimental studies, healthy subjects were exposed to sufficient concentration–time combinations to reach levels of about 40% to 55% COHb (Haldane 1895; Chiodi et al. 1941). Effects described at this level of CO exposure included hyperpnea, confusion of mind, dim vision, and unsteadiness or inability to walk (Haldane 1895). Henderson et al. (1921) exposed subjects for 1 h to 34-38% COHb. Subjects showed a marked loss of equilibrium in the Romberg test, irritability, and throbbing frontal headache, and at times Cheyne-Stokes breathing was observed.

Nelson (2006a) reported on human deaths related to CO poisoning from unvented space heaters. Sixteen of 22 lethal cases had COHb levels at more than 40%. Six of 22 victims had COHb levels at  $\leq 40\%$  and two of six had pre-existing conditions, such as arteriosclerotic disease and cardiorespiratory failure. A 1942 fatality study reported by Nelson (2006a) summarized COHb data for 68 victims that were found dead in a gas-filled room or in a garage containing exhaust gases at high concentrations. CO concentrations were not provided. Sixty-seven percent of the 68 cases died with 40-88% COHb levels. Three-percent of the cases died with 30-40% COHb levels. Summary of another fatality study from Poland showed a similar trend of COHb levels (Nelson 2006a). Individual data were not provided, and the CO source was not discussed. However, the Polish study considered 321 lethal CO poisonings from 1975 to 1976 and provided COHb levels for 220 survivors and 101 fatal cases. The survivors had a mean COHb level of 28.1% (SD = 14.1), whereas the lethal cases showed an average COHb level of 62.3% (SD = 10.1). Over 80% of the survivors had COHb levels below 40%. In contrast, about 90% of the deceased had COHb levels above 50%. Similar percentages of survivors and deceased were observed at COHb levels of 40-50% with a slight increase in the number of survivors when compared with that of the lethal cases. These three studies showed a trend that most lethal cases occurred at COHb levels higher than 40% and that survivorship was likely to be seen at levels below 40%.

Another study from the Center of Forensic Sciences in Canada evaluated 304 fatal cases from 1965 to 1968 (Nelson 2006a). The mean lethal COHb level was  $51\% \pm 12\%$  with a majority range of 40-59% and the highest single frequency range of 45-59%. A report on CO exposure from exhaust fumes in the