**(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)**

## INFORMATIVE APPENDIX C SUMMARY OF SELECTED AIR QUALITY GUIDELINES

If particular contaminants are of concern, or if the IAQ Procedure is to be used, acceptable indoor concentrations and exposures are needed for the particular contaminants. When using this procedure, these concentration and exposure values need to be documented and justified by reference to a cognizant authority as defined in the standard. Such guidelines or other limiting values can also be useful for diagnostic purposes. At present, no single organization develops acceptable concentrations or exposures for all indoor air contaminants, nor are values available for all contaminants of potential concern. A number of organizations offer guideline values for selected indoor air contaminants. These values have been developed primarily for ambient air, occupational settings, and, in some cases, for residential settings. They should be applied with an understanding of their basis and applicability to the indoor environment of concern. If an acceptable concentration or exposure has not been published for a contaminant of concern, a value may be derived through review of the toxicological and epidemiological evidence using appropriate consultation. However, the evidence with respect to health effects is likely to be insufficient for many contaminants. At present, there is no quantitative definition of acceptable IAQ that can necessarily be met by measuring one or more contaminants.

Table C-1 presents selected standards and guidelines used in Canada, Germany, Europe, and the United States for acceptable concentrations of substances in ambient air, indoor air, and industrial workplace environments. These values are issued by cognizant authorities and have not been developed or endorsed by ASHRAE. The table is presented only as background information when using the IAQ Procedure. Specialized expertise should be sought before selecting a value for use in estimating outdoor airflow rates using the IAQ Procedure or for building design or diagnostics purposes. Meeting one, some, or all of the listed values does not ensure that acceptable IAQ (as defined in this standard) will be achieved.

Tables C-2 and C-3 list concentration values of interest for selected contaminants as general guidance for building design, diagnostics, and ventilation system design using the IAQ Procedure. The values in the table are based on cognizant authorities and studies reported in peer-reviewed scientific publications; ASHRAE does not recommend their adoption as regulatory values, standards, or guidelines. The tables are presented as further background when using the IAQ Procedure. Consultation should be sought before selecting a particular value for use in calculating ventilation using the IAQ Procedure. Meeting one, some, or all of the listed values does not ensure that acceptable IAQ will be achieved.

Selection of a specific target concentration and exposure is best made by a team with wide experience in toxicology, industrial hygiene, and exposure assessment. As they review the specific concentrations listed in Tables C-1, C-2, and C-3, or others taken from other sources, designers should be mindful of the following:

- Standards and guidelines are developed for different purposes and should be interpreted with reference to the setting and purpose for which they were developed compared to that to which they are being applied.
- Not all standards and guideline values recognize the presence of susceptible groups or address typical populations found in occupancies listed in this standard.
- Most standards and guidelines do not consider interactions between and among various contaminants of concern.
- The assumptions and conditions set forth by the standard or guideline may not be met in the space or for the occupants being considered (such as an 8-hour day, 40-hour work week).

When many chemicals are present in the air, as they almost always are in indoor air, then some way of addressing potential additive effects is warranted. The ACGIH guidance on the subject instructs that when two or more substances acting on the "…same organ system are present, their combined effect, rather than that of either individually, should be given primary consideration." [C-1] Information on affected organs is readily available on the websites of the cited references for ACGIH, OEHHA, and ATSDR. If no contradictory information is available, the effects of the different substances "should be considered as additive." A formula is given wherein the ratios of the concentrations of each substance with the same health-related endpoint to the threshold-limit value for each substance are added. If the sum of all these ratios exceeds unity, then it is considered that the concentration value has been exceeded.

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \ldots + \frac{C_n}{T_n}$$

where

$C_i$ = airborne concentration of the substance

$T_i$ = threshold-limit value of that substance

### C1. GUIDELINE VALUES FOR INDUSTRIAL ENVIRONMENTS

ACGIH threshold limit values, or TLVs®, have been applied to industrial workplace air contaminants [C-1] (Reference C-2 is the German counterpart). The ACGIH TLVs represent the maximum acceptable 8-hour, time-weighted average (TWA); 15-minute short-term exposure limit (STEL); and instantaneous (ceiling) case limits. It is a source of concentration limits for many chemical substances and physical agents for industrial use. In light of the constantly changing state of knowledge, the document is updated annually. It cautions the user, "The values listed in this book are intended for use in the practice of industrial hygiene as guidelines or recommenda-