FORM FOR SUBMITTAL OF PROPOSED CHANGE TO ASHRAE STANDARD UNDER CONTINUOUS MAINTENANCE

NOTE: Use separate form for each comment. Submittals (MS Word 2000 preferred) may be attached to e-mail (preferred), submitted on diskettes or CD, or submitted in paper by mail or fax to ASHRAE, Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: *change.proposal@ashrae.org*. Fax +1-404/321-5478.

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Submitter's signature: Stanton A. Glantz Date: July 9, 2003

2. **Number and year of standard**: 62-2001

3. **Clause (section), sub-clause or paragraph number; and page number**: Appendix I

4. **I propose to**: (*check one*)
   [ ] Change to read as follows
   [ ] Add new text as follows
   [ ] Delete and substitute as follows
   [X] Delete without substitution

Use underscores to show material to be added (<u>added</u>) and strike through material to be deleted (~~deleted~~). Use additional pages if needed.

5. **Proposed change**: Delete Appendix I in its entirely.

6. **Reason and substantiation**: See attached pages.

[X] Check if additional pages are attached. Number of additional pages: 4 (5 pages total)

[ ] Check if attachments or referenced materials cited in this proposal accompany this proposed change. Please verify that all attachments and references are relevant, current, and clearly labeled to avoid processing and review delays. *Please list your attachments here:*

The ventilation rates specified in Appendix I are based on faulty assumptions and outdated information.

- The assumed smoking prevalence (proportion of smokers) is low in several cases. Appendix I assumes that only 25% of occupants are smokers in a "bar cocktail lounge" and "Gambling Casino 1." There are no data presented to support this assumption, despite the fact that these environments are often considered places where many people smoke. Several of the other environments (Dining room 1, Gambling casino 2, Conference room, Game arcade, Bowling alley, and Office) assume that only 20% of people smoke, less than the prevalence of smoking in the adult population (23%[1]).
- The assumed smoking rates are low (Table I-3). For example, they assume only one cigarette smoked per hour per smokers in a bar or cocktail lounge, 1.5 cigarettes per hour in casinos. These are environments where smokers would be expected to smoke more heavily than average, yet no objective data are presented to support this assumption. The assumed level of 0.6 cigarettes/hour in workplaces also seems low.
- The required ventilation rates are based on a 22 year old 1983 paper[2] (reference 13* in Appendix I). One third of the experimental subjects were smokers, much higher than the 23% of the adult population than smokes today.[1] The fact that there was a high proportion of smokers in the test group biases the levels of ventilation necessary for "acceptable" air quality down. Indeed, this paper[2] also reported that "None of the conditions in the present investigation [including the level of ventilation used in Appendix I] would satisfy even 2/3 of nonsmokers."[2, p. 1191]
- Appendix I ignores a much newer (2001) carefully done study[6] which concludes that "Odor thresholds of sets obtained from the olfactory experiments showed that a median odor sensation was perceived at very low concentrations equivalent to an ETS-$PM_{2.25}$ concentration of approximately 0.6-1.4 $\mu g/m^3$."[6, p. 1050] At about 4.4 $\mu g/m^3$ only one-third of subjects found the quality of the air acceptable.[6, p. 1049] All the experimental subjects were healthy nonsmokers.
- Acceptable ventilation levels in smoking lounges and heavy smoking bars are based on "adapted" people only, who have acclimatized to the pollution due to the secondhand smoke, which hides the higher ventilation quantities that would be required in these places even if one accepts the other assumptions in Appendix I.
- None of the calculations in Appendix I allow for particularly sensitive people, such as people with asthma, allergies, lung or heart disease, or children, even though such people are likely to be in rooms with secondhand smoke designed according to the recommendations in Appendix I.

All these assumptions bias the results to lower the ventilation rates (and higher levels of secondhand smoke pollution) that will be deemed "acceptable." This procedure is not consistent with good engineering design principles; normally any assumed values are selected to represent "high end" inputs to ensure that the system will respond effectively in real world conditions and be suitable for sensitive people. Even as a minimum ventilation recommendation, it is not good practice to bias all of the assumptions towards the lower end.

The ventilation rates specified in Appendix I will lead to levels of RSP that are well above levels that produce substantial discomfort and also that exceed those established by the US EPA National Ambient Air Quality Standards.

It is possible to estimate the RSP levels that will occur in each of the scenarios in Table I-3 using the relationship $RSP = C_0(P/V)sr/C_v$ where RSP = respirable suspended particulates from secondhand smoke, C_0 = RSP emissions per cigarette, (P/V) = occupancy in people / volume, s = percentage of occupants who are smokers, r = rate of smoking (cig/smoker-time), and C_v= ventilation rate (air changes/time). (This equation is the

* The lead author of this paper, W. Cain, has served as a consultant for tobacco companies.[3-5]

same steady state mass balance proposed and validated by Repace and Lowry[7] and Ott et. al[8, 9] written in terms of the variables in Table I-3 of Appendix I.) The table below summarizes the results of these calculations based on the information in Table I-3 of Appendix I (Occupancy, Proportion of Smokers, Smoking Rate, and Total Ventilation Rate). C_0 = 11.4 mg/cig.[9, 10] The ceiling heights are assumed.

Smoking-Permitted Application	Occupancy (people/100m^3)	Ceiling Height (m)	Proportion of Smokers, SM	Smoking Rate, SR (cig/smoker-h)	Total Ventilation Rate (L/s-adapted person)	RSP ($\mu g/m^3$)
Smoking lounge	70	3	1.0	3.0	33	288
Heavy smoking lounge	70	3	1.0	6.0	58	328
Bar, cocktail lounge	100	3	0.3	1.0	16	59
Heavy smoking bar, cocktail lounge	100	3	0.5	2.0	29	109
Dining Room 1	70	3	0.2	0.6	13	29
Dining Room 2	70	3	0.5	0.6	16	59
Gambling Casino 1	120	4	0.2	1.5	19	50
Gambling Casino 2	120	4	0.2	1.5	18	53
Conference Room	50	3	0.2	1.1	14	50
Game Arcade	70	2.5	0.2	1.1	19	37
Bowling Alley (seating area)	70	4	0.2	1.5	21	45
Office	7	2.5	0.2	0.6	13	29

These levels of RSP are well above the 4.4 $\mu g/m^3$ levels two-thirds of the healthy subjects Junker, et. al[6] found considered unacceptable air quality.

These levels of RSP are all above the 15 $\mu g/m^3$ annual arithmetic mean level of $PM_{2.5}$ specified by the US EPA National Ambient Air Quality Standard.[11] These levels are also well above levels that would be considered to pose an acceptable risk for lung cancer based on federal standards.[12]

These results are strongly dependent on the assumptions that are made. For example, using an average smoking prevalence of 23%[1] (rather than the low 20% assumed in Appendix I) and a smoking rate of 2 cigarettes/hour per smoker[2, 7] (rather than the very low rate of 0.6 cigarettes/hour assumed in Appendix I) raises the RSP levels for Dining Room 1 and Office from 29 $\mu g/m^3$ to 112 $\mu g/m^3$.

The levels of RSP defined by the procedures in Appendix I can produce immediate adverse effects on the cardiovascular system that increase the short-term risk of heart attack.

While most attention on secondhand smoke has been devoted to lung cancer, secondhand smoke also increases the risk of heart disease. Some of these changes, in particular effects on blood platelets and vascular endothelial function (which affects the ability of the arteries in the heart to expand and increase blood flow when the heart needs more blood) occur within less than 30 minutes of secondhand smoke exposure in realistic environments.[13-15] These changes both increase the immediate risk of a heart attack and do long term damage to the heart and blood vessels.

In addition, short term exposure to RSP in secondhand smoke reduces heart rate variability[16] (small random fluctuations in heart rate around the basic rate). While the precise mechanisms have not been elucidated, a reduction in heart rate variability increases the risk of a heart attack. One experiment involved having volunteers sit in the smoking lounge (RSP = 78 $\mu g/m^3$) for two hours at the Salt Lake City airport. This exposure to

secondhand smoke RSP was associated with a consistent and significant reduction in heart rate variability that was associated with about a 10% increase in risk of a heart attack. No one has yet determined how quickly this effect occurs or how low a concentration of secondhand smoke is required to trigger this effect, but it will clearly occur at some of the levels of RSP present in spaces designed in accordance with the guidelines in Appendix I, even under the assumptions that bias the results to low levels of RSP.

Appendix I is inconsistent with ASHRAE principles and stated Board Policy.

There are at least two relevant Board Policies:

- "The Board of Directors affirms the implied policy that ASHRAE standards shall consider health impacts where appropriate" (100-117-006 & 520-166-013). Adopted by Board of Directors June 9, 2002.
- "Change the scope [of Standard 62] to indicate that the standard applies only to non-smoking spaces in buildings." Adopted by Board of Directors June 27, 2002.

The June 27, 2002 policy was adopted based on the following background statements by the Board Policy Committee for Standards:

1. The title of Standard 62.1 is "Ventilation for Acceptable Air Quality." If supplemental guidance for spaces where smoking is permitted was included in the standard, such inclusion would be contrary to the title of the standard. There is evidence that acceptable air quality cannot be achieved where smoking is permitted.

The Board Policy Committee also included the background statement:

4. The ETS informative material in the proposed Appendix 62-O could possibly be used in the special publication or handbook suggested above. (Note: Appendix 62-O [Appendix I in the Standard] will be considered by the BOD at the 2002 Annual Meeting. If adopted, the appendix should remain part of standard 62.1 until such time that recommendations by the BPC on Standards regarding 62.1 are approved by the BOD.)

Given that the Board adopted the recommendation of the BPC to change the scope of Standard 62 to indicate that it applies only to nonsmoking spaces on June 27, 2002, it would appear that Appendix I is no longer relevant and should be deleted.

Appendix I is inconsistent with the ASHRAE Code of Ethics.

The Code of Ethics states in part: "Our efforts shall be directed at all times to the enhancement of the public health, safety and welfare."[17] As noted above, spaces designed in accordance with the guidelines in Appendix I can lead to levels of RSP that are not consistent with "public health, safety, and welfare."

Summary

The guidance in Appendix I allows for levels of RSP exposure that violate standards set by cognizant health authorities, are not based on reasonable engineering design principles, can lead to exposure levels that produce immediate and dangerous adverse cardiovascular effects, are inconsistent with stated ASHRAE Board policy and

the ASHRAE Code of Ethics, and does not even meet its stated goal of providing comfort to a reasonable fraction of the population.

References

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