

Committee on Sick House Syndrome: Indoor Air Pollution
Progress Report No. 3
- Summary on the discussions at the 6th and 7th meetings -

5 July 2001

1. Guideline values of individual Volatile Organic Compounds (VOCs)

Scientific discussion leading to establishment of the guideline values for indoor air concentration of *tetradecane*, *nonanal*, *di-(2-ethylhexyl) phthalate* and *diazinone* is summarized. The guideline values of all the chemicals determined so far at this committee are tabled. The objectives and anticipated effects of providing the guideline values together with the criteria for selecting chemicals are described as well.

2. Outline of guideline values for indoor air concentrations

The objective of establishing the guideline values is to mitigate indoor air pollution or to ensure healthy and comfortable indoor air quality. As most of our daily activities take place indoors, we should have right to require healthy and comfortable indoor air quality to ourselves. All indoor air chemicals need to be subject to providing the guideline values. All indoor environments should be subject to application of the guideline unless there are particular chemical sources.

The guideline values for indoor air concentration mean that, given the current available scientific knowledge, no adverse health effects would be caused in humans with the lifetime exposure of the chemical at the level of no more than the value. The values may be revised in the future, as necessary, depending on further available knowledge and/or progress in international assessment works based on such scientific knowledge.

However, it becomes increasingly aware that some people suffering from sick-house syndrome can be sensitive to a very small quantity of certain air chemicals. Therefore, even if indoor air quality met the guideline, the indoor would not necessarily be considered safe to all people. But, it is considered that the establishment and proper application of the guideline values is effective to promote the improvement of residential environment, eventually resulting in prevention of people for health hazards due to indoor air pollution.

Therefore, it is anticipated that building materials, design and construction, housing and ways of living will be improved so as to meet the guideline. Furthermore,

all stakeholders including general public, constructors and related industry, and building management should have a correct understanding for the guideline values not indicate that, under any circumstances, a chemical subject to the guideline be harmful to human health.

According to the Committee Progress Report No.1, June 2000, under the subheading “Priorities for setting up guideline values”, the following six criteria have been being used for selecting chemicals subject to the guideline: 1) chemicals for which guidelines have been given by foreign governments or international organizations; 2) chemicals for which investigations demonstrated that the indoor air concentration has been found high because of apparent indoor chemical emission sources; 3) Chemicals for which public comments have particularly claimed; 4) Chemicals for which foreign governments have provided a new regulation and the like; 5) Chemicals to be selected so as to comprehend indoor chemical sources; and 6) Chemicals to be selected so as to comprehend chemical structural categories. Establishment of the Guideline values will be preceded consistently in accordance with these criteria.

3. Guideline values for indoor air concentration of individual chemicals

The guideline values for indoor air concentration of these chemicals have been provided based mainly on chronic toxicity via a long-term exposure, except that of formaldehyde has been given as a 30-minute average value based on toxicity via a short-term exposure. However, the advisable value of Total Volatile Organic Compounds (TVOCs) has been gained not based on scientific knowledge, but as low as reasonably achievable from the results of investigations on indoor VOC concentration in our country. Therefore, the TVOC advisable value is used as an indicator for indoor air quality, independently of individual VOC guideline values.

The proposal of guideline value of *nonanal* still remains interim because of no additional information available for data gap. With regard to work on the guideline value for *tetradecane* or *nonanal*, it was agreed that further exploration would be pursued into the feasibility of guideline value for the cluster of compounds such as *C₈-C₁₆ aliphatic hydrocarbons* and *C₈-C₁₂ aliphatic aldehydes*.

Table 1. Chemicals newly added to the guideline

VOCs*	Toxicity endpoint	Guideline value for indoor air concentration**
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<i>Tetradecan</i> 2), 6)	Effects on liver in rat orally exposed to C_8 - C_{16} mixture	330 $\mu\text{g}/\text{m}^3$ (0.04 ppm)
<i>Di-(2-ethylhexyl) phthalate</i> 3), 5)	Histopathological effects on testicle in rat orally exposed	120 $\mu\text{g}/\text{m}^3$ (7.6 ppb)
<i>Diazinone</i> 4), 5)	Effects on blood plasma and erythrocyte choline esterase in rat exposed by inhalation	0.29 $\mu\text{g}/\text{m}^3$ (0.02 ppb)

Table 2. Chemicals so far included in the guideline

VOCs*	Toxicity endpoint	Guideline value for indoor air concentration**
<i>Formaldehyde</i>	Nose, throat irritation in humans exposed by inhalation	100 $\mu\text{g}/\text{m}^3$ (0.08ppm)
<i>Toluene</i> 1), 2)	Effects on central nervous system (CNS) behavior functions and development and reproduction in humans exposed by inhalation	260 $\mu\text{g}/\text{m}^3$ (0.07ppm)
<i>Xylene</i> 1), 2)	Altered development of central nervous system in offspring whose mother rat exposed by inhalation during its pregnancy period	870 $\mu\text{g}/\text{m}^3$ (0.20ppm)
<i>p-Dichlorobenzene</i> 1), 2)	Liver/kidney effects in beagles dogs orally exposed	240 $\mu\text{g}/\text{m}^3$ (0.04ppm)
<i>Ethylbenzene</i> 1), 2), 3)	Liver/kidney effects in mice and rats exposed by inhalation	3800 $\mu\text{g}/\text{m}^3$ (0.88ppm)
<i>Styrene</i> 1), 2)	Brain/kidney effects in rats exposed by inhalation	220 $\mu\text{g}/\text{m}^3$ (0.05ppm)
<i>Chlorpyrifos</i> 4), 5)	Altered development of CNS and morphological effects on brain in offspring whose mother rat orally exposed	1 $\mu\text{g}/\text{m}^3$ (0.07ppb) For children: 0.1 $\mu\text{g}/\text{m}^3$ (0.007ppb)
<i>Di-n-butyl phthalate</i>	Abnormal genitals in offspring	220 $\mu\text{g}/\text{m}^3$ (0.02ppm)

1), 3), 5)	whose mother rat orally exposed	
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<i>Total Volatile Organic Compounds (TVOC)</i> 1), 3)	Gained as low as reasonably achievable from investigations on indoor air in our country.	Advisable value: 400 $\mu\text{g}/\text{m}^3$
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Table 3. Chemical for further investigations

VOCs*	Toxicity endpoint	Interim guideline value for indoor air concentration**
<i>Nonanal</i> 2), 6)	Toxicological effects in rat orally exposed to C_8 - C_{12} mixture	41 $\mu\text{g}/\text{m}^3$ (7.0 ppb) (Interim value because of data gap)

* Numbers indicate the above-mentioned criteria used for selection.

** At 25 degree Celsius

2. Sampling and analytical methods

The details of sampling and analytical methods of the newly added chemicals are given separately (available only in Japanese).

About *tetradecane*, the standard methods of VOCs, which are provided in the Progress Report No.1, should be followed. About *di-(2-ethylhexyl) phthalate* and *diazinone*, refer to the description of *chlorpyrifos* and *di-n-butyl phthalate*, respectively, in the Progress Report No.2.

3. Manual for analysis of indoor air chemicals

It is anticipated that indoor air concentration of chemicals will vary according to sampling and analytical methods and conditions. Therefore, in order to assess whether to meet the guideline values, it was necessary to provide standard conditions for sampling and analysis. The standard methods were first published for *formaldehyde*, *toluene*, *xylene* and *p-dichlorobenzene* with the Progress Report No.1. Further conditions for sampling and analysis have since been added with the Progress Report No.2 and this report.

The manual provides the published standard methods with additional issues of concern, terminology, guide of implementation, and supplementary explanation. The analysis of *chlorpyrifos*, *diazinone*, *di-n-butyl phthalate*, *di-(2-ethylhexyl) phthalate* and

TVOC is still beyond the manual, but it is hoped to refer to where applicable.

4. Guide for preparation of manual for consulting

As awareness has recently been raised of indoor air pollution, it is apparent that consultation about this issue tends to increase. The guide provides not only up-to-date knowledge and information about but also guidance for action to be taken against indoor air pollution, based on reported cases of consultation, treatises and other scientific information and up-to-date investigational reports. It is, therefore, anticipated that it will be used as a reference guide for the preparation of guidance and action manual on residential environment. Needless to say, in order to ensure healthy residential environment, it is also necessary to take actions against ticks, mold, harmful-to-health insects, mice, etc. and further to provide guidance for water supply and drainage, lighting and illumination, noise and vibration, refuse disposition and stench. It is hoped that these will be referred to "*Guidelines for Houses with Healthy and Comfortable Environment*", which was published in 1999 (available only in Japanese).

Networking relevant medical institutions and repair technique also remain important for the solution of indoor air pollution. Investigations and researches on these issues are underway in co-operation with relevant ministries or departments. Awareness will be raised of the outcomes as well once available.

5. Subjects expected for and after the next

According to the criteria for the selection of chemicals subject to the guideline, Progress Report No.1, the following chemicals have been selected*:

- *Acetaldehyde*^{1), 2)}
- *Fenobucarb*^{3), 5)}.

*Shoulder numbers indicate criteria used for selection.

Furthermore, the following clusters of chemical compounds will be studied:

- *C₈-C₁₆ aliphatic hydrocarbons*
- *C₈-C₁₂ aliphatic aldehydes.*

Appendix

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