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Indoor air—Sampling strategy for volatile organic compounds (VOCs)

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Land, Infrastructure and Transport through deliberations at the Japanese Industrial Standards Committee.

This Standard has been made based on **ISO/CD 16000-5** : 2002 *Indoor air—Part 5: Sampling strategy for volatile organic compounds (VOCs)* for the purpose of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard. Attention is drawn to the possibility that some parts of this Standard may conflict with a patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have technical properties. The relevant Minister and the Japanese Industrial Standards Committee are not responsible for identifying the patent right, application for a patent after opening to the public, utility model right or application for registration of utility model after opening to the public which have the said technical properties.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

NH/HN

Contents

Indoor air—Sampling strategy for volatile organic compounds (VOCs)

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO/CD 16000-5** *Indoor air—Part 5: Sampling strategy for volatile organic compounds (VOCs)* published in 2002 with some modifications of the technical contents.

The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex 1 (informative).

1 Scope This Standard is intended as an aid to the measurement plan of volatile organic compounds (hereafter referred to as "VOCs" indoor pollution.

Remarks: The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and **JIS** are IDT (identical), MOD (modified), and NEQ (not equivalent) according to **ISO/IEC Guide 21**.

ISO/CD 16000-5:2002 *Indoor air—Part 5: Sampling strategy for volatile organic compounds (VOCs)* (MOD)

2 Normative references The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) indicated below shall be applied.

JIS A 1960 *Indoor air—General aspects of sampling strategy*

Remarks : **ISO/DIS 16000-1** *Indoor air—Part 1: General aspects of sampling strategy* is equivalent to the said standard.

JIS A 1966 *Indoor air—Sampling and analysis of volatile organic compounds by sorbent tube/thermal desorption/capillary gas chromatography—Pumped sampling*

Remarks : **ISO/DIS 16017-1** *Indoor, ambient and workplace air—Sampling and analysis of volatile organic compounds by surbent tube/thermal desorption/capillary gas chromatography—Part 1: Pumped sampling* is equivalent to the said standard.

3 Definitions of volatile organic compounds (VOCs) Numerous volatile organic compounds (VOCs) are present in indoor environments. Depending on their boiling points, they are present in the gas phase, bound to suspended particle matter or deposited dusts. A working group of the World Health Organization (WHO) classified volatile organic compounds based on the boiling points as shown in table 1 [1]. In this Standard, VVOC, SVOC and POM are excluded.

Table 1 Classification of organic pollutants of indoor air [WHO 1989] [1]

Designation	Abbreviation (1)	Boiling point range		Examples of sampling method(2)
		Lower limit of temperature	Upper limit of temperature	
Very volatile organic compounds	VVOC	< 0	50 to 100	Activated carbon, cooled sampling method, molecular sieves, canister method
Volatile organic compounds	VOC	50 to 100	240 to 260	Tenax, graphitized carbon, activated carbon
Semi-volatile organic compounds	SVOC	240 to 260	380 to 400	PUF (3), XAD-2(4)
Particulate organic matter	POM	> 380		Filter

Notes (1) These abbreviations are used.
VVOC : Very Volatile Organic Compounds
VOC : Volatile Organic Compounds
SVOC : Semi-volatile Organic Compounds
POM : Particulate Organic Matter

(2) The WHO information has been supplemented.

(3) Polyurethane foam

(4) XAD-2 resin : Amberlite It is the resin of copolymer of XAD-2, styrene and divinylbenzene, with macro network structure. It well adsorbs substances such as polycyclic aromatic compounds.

This classification is based primarily on the boiling point and also takes into account aspects of the analysis, especially sampling. Since the state transition of substances is not steady, it is not practical to specify sharp limits for the boiling point ranges and the sampling methods according to temperature.

4 Sources and occurrence conditions Several hundred VOCs have been detected in indoor air hitherto. The sources are various and the most important sources are building materials, interior materials, human activities (for example, the activities related to smoking, repairing working and hobby work). The surrounding air (outdoor air) is also important depending on circumstances.

Recently, care shall be taken about the fact that the emission patterns continue to vary due to rapid development of products.

When the measurement method is considered, the emission characteristics of sources are especially important. The concentrations of VOCs in indoor air vary depending on rooms and vary especially as time elapses even in the same room. The following class of compounds can be frequently detected in indoor air.

- Alkanes, cycloalkanes
- Aromatic hydrocarbons
- Halogenated hydrocarbons
- Terpenes
- Aldehydes
- Ketones
- Alcohols, alkoxyalcohols
- Esters

This list does not include a number of groups of compounds such as carboxylic acids, isocyanates or amines. This is because these compounds generate in indoor air but can not be detected or can be only unsufficiently detected by the analytical methods applied usually for VOCs analysis.

For the analysis of these special VOCs including a number of polar compounds, not the above-mentioned method but the comparatively complicated techniques are required. Therefore, analysis for VOCs in scarcely carried out except that it is certainly necessary.

5 Measurement methods The methods for determining VOCs in indoor air may be divided into short-term and long-term measurement methods, herewith assuming that the determination of individual VOC is considered. However, the information of VOCs existing in indoor air can be determined in some case depending on a preliminary testing way even if VOCs are individually not separated.

The sampling and analytical methods to be used for analysis are described in **JIS A 1960** and **JIS A 1966**.

Information : The contents in this clause are equivalent to **ISO/DIS 16000-1**: 2001 and **ISO 16017-1**:2000.

5.1 Short-term measurements Short-term measurements are generally understood as a sampling period of less than one hour.

The VOCs are concentrated in the sampling medium by being drawn through the sorbent using suction pumps (active sampling).

5.2 Long-term measurements Although it is possible to perform long-term measurement according to the active sampling with low air flow rate, the passive sampling is chosen for the long-term measurement.

The passive sampling predominantly works according to the diffusion principle and gives an integrated measurement value as a mean value over the selected exposure period (usually from several hours to several weeks). In this method, the short term peak concentrations contribute to raise slightly the mean value.

The passive sampler for VOCs is described in the bibliography [2]. The performance evaluation method for these passive samplers is also described in the bibliography [2].

When the passive sampling is adopted, the applied method should be described including the performance characteristics and uncertainty of measurement.

The information related to the use of passive sampler is as shown is Annex C.

5.3 Screening test The characteristics of screening test is to be capable of indicating the present air pollution quickly beforehand without a large-scale apparatus in spite of being unsufficient at measurement place.

In the screening test, direct indicators are often used. These meters are generally possible to record continuously. This type of meter is provided with various detectors, such as flame ionization detector = FID, photo ionization detector = PID, photo acoustic sensor = PAS, and is much effective for searching the sources of indoor VOCs in some case.

In this type of instruments, some are not reacted with VOCs but reacted with VVOCs and SVOCs.

The preliminary test for VOCs requires to use a measurable detector as considering that the level of concentration is in the range of $\mu g/m^3$ being in common indoors. The one capable of measuring is commercially available on the market in Japan.

The detector on the market using oxidization reagent system is not capable of detecting VOCs until the range of concentration has reached to the unit of mg/m^3. In addition, various compounds (such as aliphatic compounds, aromatic compounds, alcohols, ketones, esters) have different relative sensitivity. When these preliminary test methods are utilized, care shall be taken also of the principle of measurement plan as described in detail in the following.

6 Sampling plan The procedure when carrying out indoor air analysis depends on the measurement purpose and the emission characteristics of possible sources. Since sources that emit continuously and over long periods are typically the most important, the following specially target these types of sources.

For making the monitoring of continuous sources to be a purpose, the influence of intermittent sources shall be eliminated (see table 2). For the purpose, the VOCs caused by the intermittent sources shall be eliminated from the room as much as possible by ventilating sufficiently before measurement.

6.1 Measurement objectives and environmental conditions Before indoor air measurements are carried out, objectives of such measurements shall be clearly defined.

Basically, the following objectives for measurements are considered.

A Confirmation of conformity to the guideline value in Japan

B Confirmation of conformity to the guideline value in WHO

C Determination of the average concentration over a relatively long period

D Determination of the concentration occurring under the special condition

E Identification of sources

F Checking the success of remedial activities

Also, independently of the objectives A to F, it shall be made clear in advance whether it is wished to determine the concentration of single VOC, a relatively small number of predetermined VOCs, or VOCs as many as possible. If necessary, the measurement strategy shall be orientated accordingly.

Depending on the objective, different environmental conditions shall be maintained or recorded before and during measurements, which principally relate to the ventilation condition, the room temperature and the relative humidity.

A Confirmation of conformity to the guideline value in Japan

In the measurement of newly-build housing, the objective room in hermetically closed at least for 5 h after ventilated for 30 min, and then the air is sampled approximately for 30 min. The sampling time should be around 2 o'clock to 3 o'clock in the afternoon. During the hermetical period after ventilated, all the openings facing to outside air shall be shut, and all other fittings and doors, and doors of built-in furniture and fixtures in the room shall be opened.

When there is a normally ventilation system, the system may be operated during all the sampling period. At such a time, the opening related to the normally ventilation system need not to shut even during the hermetical period.

In the measurement of the housing in resident condition, sampling shall be carried out for 24 h under the condition of making daily life.

B Confirmation of conformity to the guideline value in WHO

In many cases, indoor air analyses are initiated by various types of complaints, which are expressed by the room occupants.

Complaints of this type can range from the perception of unknown and frequently unpleasant odours, to headaches, nausea or irritation of the nose, throat or eyes.

If VOC guideline values exist and these are time-related, the measuring or sampling period shall correspond to the specified time interval.

VOC measurement is carried out under the conditions described below.

After intensive ventilation for 30 minutes, doors and windows of naturally ventilated rooms are kept closed for about eight hours (optimally overnight). Prior to measurement, additional sealing measures such as taping over window and door gaps are not required.

Sampling is then performed for at most 60 min as doors and windows kept closed.

To obtain information on the effectiveness of ventilation, the room is ventilated intensively after sampling by opening doors and windows for five minutes. Doors and windows are reclosed and after one hour a further sample is taken.

When rooms are ventilated by mechanical ventilation or air conditioning systems the system shall be operated for three hours under the normal operating conditions prior to sampling.

If room occupants make complaints during unusual conditions, for clarification, measurement should also be performed under these conditions.

The VOC concentration level depends, if conditions are otherwise constant, on the indoor air temperature to a large extent, and possibly also on the relative humidity.

To obtain meaningful indoor air VOC concentrations, it is therefore essential to perform the measurement under the climate conditions under which the room being investigated is usually used.

C Determination of the average concentration over a relatively long time period

To carry out long-term measurements such as actual measurement surveys, diffusive samplers are generally used. In these cases, the room does not need to be prepared if the measurement period exceeds 24 h.

Usually, the sampling period does not exceed one month. In each case, the performance of the sampler used, the stability of the sampling medium, and the amount of chemical substances collected shall be the decisive factors.

In the case of long-term monitoring, the room occupants should continue their usual ventilation behaviour and other activities. The common activities shall be asked for and shall be documented before the examination. It is of particular importance here to obtain knowledge of the activity of intermittent sources. If deviations therefrom occur during the sampling period, these shall also be documented.

D Determination of the concentration occurring under special conditions

In some cases, it can also be of interest to obtain information on the level of VOC concentrations under special conditions. Such special conditions may occur, firstly, if a room is used under unfavourable climatic conditions, for example at temperatures outside in summer which the room occupants cannot alter this. Secondly, the emission of VOC from sources, which emit temporarily, for example when a solvent is used, can also be an unusual situation of this type. Accordingly a short-term measurement is performed under the conditions, which are expected to give rise to elevated VOC concentrations.

E Identification of sources

When an abnormally high level of VOC concentration is observed in indoor air, it is required to find what a method is suitable for the reduction of such concentration. For that purpose, the knowledge related to the VOCs sources is indispensable. For the first step to identify the source, the information obtained from the analytical results shall be carefully examined. And the general knowledge related to the emission characteristic and specific odour of material shall be considered.

The information related to the expected sources such as building materials, interior materials, office supplies, chemicals for cleaning are understood in more detail according to the following investigation.

Concerning the measurement methods, in addition to sensory inspection, the techniques suitable for searching VOCs sources are as follows.

- Compare the measurement results of air at the centre in room with the measurement results of air in the neighbourhood of the expected sources. Use a direct indicator, if possible.
- Use a portable type emission test container capable of setting on flat surface.
- Carry out the sampling and analysis of material.

F Checking the success of remedial activities

Measurements are made before and after the remedial activities. The sampling conditions shall be compatible with the initial measurements.

Attention shall be paid as to whether new substances have been introduced into the interior.

6.2 Time of sampling The sampling time is determined by the measurement purpose. When the results of measurement are interpreted, it shall take into account the concentration differences that occur during relatively large time periods, for example, changes in concentration may occur due to seasonal variations, and short-term effects such as changes in source strength and ventilation.

In the case where cigarette smoking or the use of chemicals is not taken into account for the evaluation of the measurement results, eliminate these pollutants. Table 2 shows an overview of important VOC sources and their emission characteristics.

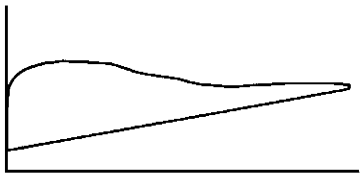
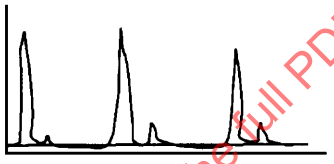
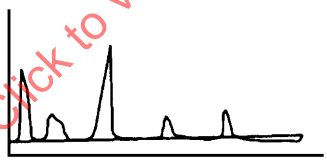
When the change in VOC concentration with time is being considered, two categories of sources may be differentiated: continuous sources which are active over relatively long time periods (months, years) and intermittent sources which are only active over shorter periods (days, hours). More detailed consideration of the emission profile results in further differentiation: each of the two main categories may be subdivided into two groups, those in which the pattern is constant and those in which it is variable with time.

6.3 Duration of sampling and frequency of measurement The sampling duration is determined first by the measurement purpose and second by the characteristics of the analytical method chosen, for example by the detection limit and the breakthrough volume expected in association with the sorbent chosen.

Particular attention shall be paid to the sampling duration in measurement planning if complaints are the reason for the measurements. Thus, for example, it shall be taken into account that short-term measurements only rarely permit conclusions to be drawn with respect to a mean value valid for longer time periods.

On the other hand, long-term sampling leads to a loss of information with respect to the variation with time of the VOC concentrations and particularly with respect to the frequency of the occurrence and the magnitude of peak concentrations. The frequency of measurements shall be incorporated into the measurement plan in accordance with the measurement purpose and should also be based on the measurement uncertainty.

Table 2 Emission characteristics of VOC sources

Emission characteristics	Indoor air concentration	Example of source
Continuous – active over a long period – uniform, short term changes in emission rates are low	Concentration  Time	Building products, furniture, flooring material
Continuous – irregular	Concentration  Time	Paints, coating material, adhesives (remedial work)
Intermittent – active in short term – uniform – periodic time pattern	Concentration  Time	Gas oven, smoking
Intermittent – irregular – variable time pattern	Concentration  Time	Cleaning agents, hobby products
Ambient sources	Indoor concentrations depend on ventilation, distance from the source, building characteristics and meteorological conditions.	Traffic, industrial sources, contaminated sites

6.4 Sample location It is generally not necessary to investigate every room in a large building or apartment complex from the beginning. Prior to initiating the monitoring program, appropriate rooms shall be identified for VOC sampling. The criteria for selection are typically the room usage or the occurrence of complaints. For example, rooms that are occupied for long periods such as living rooms and bedrooms, classrooms and kindergartens, and offices, may be of particular interest. The room can be selected based on the results of screening tests as a reference.

The sampling location within a room can also influence the result of the measurement. Frequently higher concentrations are observed in the immediate vicinity of an emission source than anywhere else in the room. The locate sources, it can also be useful to carry out measurements both close to the source and remote from the source within a room.

When the compliance with a guideline value is being checked, a procedure should be followed such that sampling is performed no closer than 1 m to the wall and 0.75 m to 1.5 m height as the sampling point in the room.

For particular purposes it can be useful to determine the ambient air concentration for comparison with the indoor air. The ambient air should, if possible, be measured a little distance away from the building wall at about the same height above ground as the sampling point in the room. In the case of buildings fitted with air-conditioning, the ambient air measurement shall be carried out in the vicinity of the ambient air supply inlet.

6.5 Presentation of results and measurement uncertainty

6.5.1 Presentation of results for individual VOC components and TVOC concentration During measurement planning, the relevant parameters for notification in the report and the measurement uncertainty shall be specified.

The results of a determination including gas chromatographic separation of VOC are reported in the form of the concentrations of the individual compounds. When passive samplers are used, the conversion formulae used to calculate the result, including the diffusion coefficients or absorption rates should be specified.

To assess the overall situation, a single concentration value is used as a basis, which is intended to characterise the total VOC concentration (TVOC). It shall be stated that not all of the VOC present in the indoor air are included in a TVOC concentration determined in this manner.

Low-molecular-weight aldehydes, amines and highly polar VOC, especially, may not be able to be analysed meaningfully using a method which is currently common for gas chromatographic determination of VOC in air and shall be determined separately using suitable methods.

6.5.2 Measurement uncertainties Measurement uncertainties are unavoidable. The degree of uncertainty is determined by the number of measurements and the uncertainty of sampling and analytical results. In addition, single measurement result is influenced by the concentration changes in time and space.

The measurement report shall include not only the analytical method used but also a description of the analysis system performance at the time of measurements. Especially, those related to lower limits of detection and lower limits determination are important.

In the measurement results, the numerical data are usually reported so that the last decimal place (significant place) represents the order of magnitude of the measurement uncertainty at the same time.

6.6 Quality assurance of measured values The sampling should be carried out multitimes. One of the sample can be used as the reference sample. And the recovery of sorbents shall be recorded.

The measurement plan shall specify what measures to be taken to meet the quality requirements specified by the client.

For the selection of the measures for quality assurances of measured values and the establishment of specification, the following questions shall be answered beforehand.

- Does the measurement organization have a documented assurance system?
- What calibration method will be carried out, with what frequency and to what extent?
- Which method will be used to identify the VOCs?
- Are comparative measurements (for example, with laboratories) to be carried?
- How will the measurement uncertainties be determined?
- Does the measurement organization participate in the joint comparison experiment?

Annex A (informative)
Examples of VOCs detected in indoor air

This Annex (informative) is to supplement the matters related to the text and not to constitute the provisions of this Standard.

The analysis of chemical compounds other than those in the table below may be required.

Chemical compound	CAS number	Boiling point (°C) (1)
Aromatic hydrocarbons		
Benzene	71-43-2	80
Toluene	108-88-3	110
Ethylbenzene	100-41-4	136
m-/*p*-Xylene	108-38-3 / 106-42-3	139 / 138
o-Xylene	95-47-6	144
n-Propylbenzene	103-65-1	159
1,2,4-Trimethylbenzene	95-63-6	169
1,3,5-Trimethylbenzene	108-67-8	165
2-Ethyltoluene	611-14-3	165
Styrene	100-42-5	145
Naphthalene	91-20-3	218
4-Phenylcyclohexene	31017-40-0	251 (1-Phenylcyclohexene)
Aliphatic hydrocarbons		
n-C_6 to *n*-C_{16}		
n-Hexane	110-54-3	69
n-Heptane	142-82-5	98
n-Octane	111-65-9	126
n-Nonane	111-84-2	151
n-Decane	124-18-5	174
n-Undecne	1120-21-4	196
n-Dodecane	112-40-3	216
n-Tridecane	629-50-5	235
n-Tetradecane	629-59-4	253
n-Pentadecane	629-62-9	270
n-Hexadecane	544-76-3	287
2-Methylpentane	107-83-5	60
3-Methylpentane	96-14-0	63
1-Octene	111-66-0	121
1-Decene	872-05-9	170
2-methyl-1-propen trimer	77-56-947	134

Chemical compound	CAS number	Boiling point (°C) (1)
Cycloalkanes		
Methylcyclopentane	96-37-7	72
Cyclohexane	110-82-7	81
Methylcyclohexane	108-87-2	101
Terpenes		
3-Carene	13466-78-9	167
α-Pinene	80-56-8	156
β-Pinene	18172-67-3	164
Limonene	138-86-3	170
Alcohols		
2-Propanol	67-63-0	82
1-Butanol	71-36-3	118
2-Ethyl-1-hexanol	104-76-7	182
Benzyl alcohol	100-51-6	205
Glycols, Glycolethers		
2-Methoxyethanol	109-86-4	124-125
2-Ethoxyethanol	110-80-5	135
2-Butoxyethanol	111-76-2	171
1-Methoxy-2-propanol	107-98-2	118
2-Butoxyethoxyethanol	112-34-5	231
2-Phenoxyethanol	122-99-6	245
Aldehydes		
Butanal	123-72-8	76
Pentanal	110-62-3	103
Hexanal	66-25-1	129
Nonanal	124-19-6	190-192
Benzaldehyde	100-52-7	179
Ketones		
Methylethyketone	78-93-3	80
Methylisobutylketone	108-10-1	117
Cyclohexanone	108-94-1	156
Acetophenone	98-86-2	202
Halogenated hydrocarbon		
Trichloroethene	79-01-6	87
Tetrachloroethene	127-18-4	121
1,1,1-Trichloroethane	71-55-6	74
p-Dichlorobenzene	106-46-7	173

Chemical compound	CAS number	Boiling point (°C) (1)
Esters		
Ethyl acetate	141-78-6	77
Butyl acetate	123-86-4	126
Isopropyl acetate	108-21-4	85
Methoxy propyl acetate	108-65-6	145-146
2-Ethoxy ethyl acetate	111-15-9	156
Dimethylphthalate	131-11-3	284
Texanol	25265-77-4	244
Texanol isobutyrate	6846-50-0	
Others		
2-Pentylfuran	3777-69-3	> 120 (2-tert-Butylfuran)
THF (Tetrahydrofuran)	109-99-9	67

Note (1) Depending on the literature used, the boiling points reported may vary by a few °C for some compounds.

Annex B (informative)
Sorbents for sampling of VOCs

This Annex (informative) is to supplement the matters related to the text and not to constitute the provisions of this Standard.

Sorbents available in the market for sampling of VOCs and frequently used, are as shown in Annex table B.1. The advantages, disadvantages and the corresponding desorption methods are shown.

Annex Table B.1 Sorbents for sampling of VOCs

Sorbent	Desorption method	Compounds to be adsorbed	Initial value in range of boiling point (°C)	Advantage and disadvantage of sorbent
Tenex TA	Heat	All VOCs in stable thermally	> 50	Advantage : Low background, Sufficient research has been carried out because it is frequently used. Disadvantage : Decomposition product (benzaldehyde, acetophenone)
Carbotrap	Heat	All VOCs in stable thermally	> 60	Advantage : Low background Disadvantage : High price
Activated carbon	Solvent	Almost non-polar VOCs Slightly polar VOCs	> 50	Advantage : Large capacity Disadvantage : Reaction with a certain compound
Porapak (Q, S, R, N)		Almost non-polar VOCs Slightly polar VOCs Polar VOCs	> 40	Disadvantage : High background Low thermal stability
Carbo Molecular sieve (for example, Carboxen 563, and Carboxen 564 Carbosieve S-III, Anasorb 747)	Heat, Solvent	Polar and non-polar VOCs	> –80	Disadvantage : Adsorption of water vapour
Silica gel	Solvent	Polar compound	> 50	Disadvantage : Adsorption of water vapour

Annex C (informative)
Passive sampler

This Annex (informative) is to supplement the matters related to the text and not to constitute the provisions of this Standard.

When passive samplers are used, not only the important parameters but also the sampling speed shall remain invariant in all measurement methods, and care shall be taken about the influence of humidity and air current of atmospheric air.

The specially important matter is the presence of the minimum indoor air current.

Because the contaminant is not concentrated by using a pump like pumped sampling but is adsorbed by diffusion.

When the investigation objective substance is sufficiently not supplied from the surrounding air due to insufficient air current, the objective substance in air just in the neighbourhood of the sampler is used up and results in the underestimation of concentration [2] [3] [4] [5].

The size of influence differs depending on the shape of the sampler [6].

In the case of usual measurement, the passive sampler is placed or hung at an optional position in room, if possible , in neighbourhood of the centre of room. It is recommended to keep away at least 1 m from the possible contamination sources such as floor, ceiling, wall.

Annex D (informative)

Protocol for recording activities during long-term sampling and boundary conditions

This Annex (informative) is to supplement the matters related to the text and not to constitute the provisions of this Standard.

During typical use of rooms, temporary emissions may occur owing to activities or behaviour of the occupants.

In order to interpret the analytical results, the activities of the occupants, the ventilation conditions and the climatic conditions during sampling shall be determined and documented.

During long-term measurements, in addition, the participation of the occupants is necessary.

The measurement institute should inform the occupants that activities deviating from customary use can affect the measurement result. For this reason, all activities deviating from customary use should be noted in a protocol.

Since many rooms are used either only at times or by different groups of people, in practice it has proved to be helpful if the activities and boundary conditions are recorded by occupants at the end of a period of use or at the end of a day.

The protocols shall be collected and made available to the measurement institute for evaluation at the end of the sampling period.

In case of long-term sampling, it is advisable, in addition to the information to be obtained in indoor air studies, to record other information as follows.

When passive samplers are used for long-term sampling, the way in which the samplers are attached and the position and height of attachment of the passive samplers in the room shall be documented, if necessary, using a sketch.

The final version of the protocol should be established during the appropriate measurement planning.

A Location and period to be used

A1 Designation of room :

A2 Beginning of use Date : Time :

Completion of use Date : Time :

A3 Case of using passive sampler

Does a change or hindrance occurs in passive sampler during the use of room ?

(for example, the temporary interception from the surrounding air of passive sampler)

☐ Yes ☐ No

B Activity during use

B1 Has the room be used as usual?

☐ Yes ☐ No

B2 How many persons have been present in average?

B3 Are there smokers in the room?

How many cigarettes are smoked?

B4 Has a candle and the like been burnt?

☐ Yes ☐ No

B5 Have office suppliers, chemicals for home use, cosmetics, leisure goods, handcraft works been used?

☐ Yes ☐ No

The following product has been used :

☐ Office suppliers or handcraft works containing solvent (for example, adhesives, correction fluid)

☐ Detergent or protective goods containing solvent (for example, disinfectant, furniture polish, screen cleaner for TV, etc., shoe polish)

☐ Cosmetics (for example, hair spray, manicure liquid)

☐ Indoor spray/Aromatizer

☐ Insecticide spray/Gardening spray

☐ .....

C Repair or exchange of interior or equipment

C1 Have maintenance or repair work been recently performed in the room?

☐ Yes ☐ No

The following product has been used for the purpose :

☐ Paints and coating material

☐ Floor adhesives or other adhesives

☐ Diluent or detergent containing solvent

☐ .....

C2 Have new furniture or other interior goods been provided in the room?

☐ Yes ☐ No

The following goods have been newly provided :

☐ Partition in room

☐ Furniture

☐ Computer/monitor

☐ Interior goods of fabric material

☐ .....

C3 Have new machine parts or dry-cleaners goods been unpacked, or been placed in the room for temporary storage?

☐ Yes ☐ No

The following goods have been placed :

☐ Dry-cleaned textile goods

☐ Newly printed matter

☐ .....

D Indoor heat environment

D1 Temperature

D2 Relative humidity

D3 In the indoor heat environment in the usual service condition?

☐ Yes ☐ No

D4 Has the equipment or apparatus for the change of indoor heat environment been used?

☐ Yes ☐ No

☐ Humidifier

☐ Cooling

☐ Heating

E Ventilation

E1 Ventilation form

☐ Ventilation period of window ventilation :

☐ Complete opening of window

☐ Partial opening of window

☐ Closing of window

☐ Mechanical ventilation system (for example, ventilating fan, ventilating and air conditioning system)

☐ Operation period :

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