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Guidelines for personal exposure monitoring of chemicals: Part V

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Expert Division of Occupational Hygiene & Ergonomics, the Japan Society for Occupational Health, “The Committee for Personal Exposure Monitoring”

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Supplementary materials (Appendices) are available in the online version of this article.
Abstract

This Document, "Guidelines for personal exposure monitoring of chemicals" ("this Guideline"), has been prepared by "The Committee for Personal Exposure Monitoring" ("the Committee") of the Expert Division of Occupational Hygiene & Ergonomics, Japan Society for Occupational Health. Considering the background of the growing importance of personal exposure monitoring in risk assessment and the need to prepare for the introduction of monitoring using personal samplers from an administrative perspective in recent years, the Committee was organized in November 2012. The Committee has prepared this Guideline as a "practical guideline" for personal exposure monitoring, so as to offer proposals and recommendations to the members of the Japan Society for Occupational Health and to society in general. The scope of this Guideline covers all chemical substances and all related workplaces regarded as targets for general assessment and the management of risk. It thus is not to be considered to comment on legal regulations and methodology. The main text provides the basic methods and concepts of personal exposure monitoring, while 31 "Appendices" are provided in this Guideline throughout the series; technical descriptions, statistical bases, and actual workplace examples are provided in these appendices, to assist better understanding. The personal exposure monitoring described as per this Guideline is equivalent to an "expert-centered basic method to reasonably proceed with the assessment and management of risk at workplaces." It is considered that practicing and expanding on this method will significantly contribute in reforming the overall framework of occupational hygiene management in Japan.

Key words : Chemicals, Control, Exposure monitoring, Occupational hygiene, Risk assessment, Workplace
Chapter 2: Method for Personal Exposure Monitoring

7. Reporting

In general, a monitoring report shall be submitted by a risk assessment supervisor to the manager of the workplace. The contents of such a report include the purpose and method of monitoring, the measurement results, the assessment and evaluation of the results, a recommendation for control measures, and a proposal for control measures. While it is true that in neither Europe nor the USA is a report format specifically formulated or in circulation, each enterprise or consultant does sometimes prepare a basic format for practical purposes. In the case of Working Environment Measurement, in many instances a sketch of the workplace is attached. It is sometimes considered that preparation of such sketches takes a considerable amount of time. In response to this it can be mentioned that personal exposure monitoring does not absolutely require them unless specifically needed. Photographs of the workplace or copies of the layout drawings may be used as needed. In short, all a writer of such a report is required to do is to prepare, with due consideration, a simple report that focuses on things of practical use. The report with precise details is not necessarily required. Unnecessarily detailed report would take too much time in entering data. A report format that requires automatic filling in of the columns without thinking should also be avoided.

It is recommended that the results of personal exposure monitoring be reported to the individual workers monitored. Many workers would like to know the actual situation of his/her own exposure. Knowledge on these results would bring significant rewards in terms of improvement of awareness—such as compliance with the work rules and positive participation in the health management of the workplace—as well as it would lead to establishing trust between a risk assessment supervisor and an employer. When a high exposure level is detected in the personal exposure monitoring, it becomes necessary to disseminate and then explain the results along with their control measures.

Additional explanations concerning the reporting of personal exposure monitoring are indicated in the appendix (please refer to Appendix 22).

8. Follow-up (implementation of control measures, reassessment, and monitoring)

8-1 Execution and verification of control measures, and management of change

The responsibility of implementation of the control measures lies with the manager. In order to ensure the implementation of the planned control measures, it is effective to incorporate the recommendations from the risk assessment supervisor into the existing mechanisms of a business establishment (such as
the safety and health committee and the occupational and health management system [if operated]),
and to observe until the control measures are completed.

**Table 2.9. Control classes and frequency of reassessment and monitoring (eight-hour exposure)**

(Exposure values in the parentheses indicate the range of permissible changes)

| Reassessment and re-monitoring | Control class (previous rating) |
|-------------------------------|--------------------------------|
|                               | 3 | 2B | 2A | 1C | 1B | 1A |
| Reassessment                  | 6 months * | 6 months * | 6 months (6 months to 1 year) | 6 months (6 months to 2 years) | 1 year (1 to 3 years) | 2 years (2 to 3 years) |
| Re-monitoring                 | 6 months * (6 months to 1 year) | 6 months * (6 months to 1 year) | 6 months (6 months to 2 years) | 1 year (1 to 3 years) | 2 years (1 to 3 years) | 3 years (1 to 5 years) |

* Risk reduction measures shall be implemented with priority. Reassessment and monitoring at this frequency is limited to special cases. Please refer to the main text.

Following the issuance of the report, after a correct interval, the risk assessment supervisor shall verify whether or not the control measures recommended have been implemented. If they have not been implemented, the supervisor would urge or assist the personnel responsible to implement them.

If any “changes” occur in a workplace after the control measures have been carried out, necessary action shall be taken based upon the changes. This is referred to as “management of change.”

Management of change is a procedure in which the risks (here exposure) associated with changes, such as changes in the chemical substances used, introduction of new substances, modification of equipment, or changes in the process or procedure, are reassessed and the necessary actions are taken. The overall responsibility for the management of change, that is the supervision of changes as well as the execution and completion of the assessment and management of risks associated with the changes, lies with the manager (eventually an employer). A risk assessment supervisor should always receive information on changes from the manager, and, in the case of any changes occurring, the supervisor shall perform reassessment and monitoring as well as additional control measures from an expert point of view. Such repetition of the personal exposure monitoring process (steps 1 to 9 in Fig. 2.1) would enhance workplace management. The management of change allows warranty of good safety even when the interval of reassessment and monitoring is not kept constant but is rather extended (please refer to the next section). On the other hand, in the case of statutory Working Environment Measurement, if management of change is not actively considered, it can be interpreted that periodic measurement (for example every six months) is required without exception.

The concept of this “management of change” has also now become widespread in Japan. The “Guidelines for investigating dangerousness or toxicity due to chemical substances (Guideline No. 2, March 30, 2006)” also specifies “when changing equipment, raw materials, work methods, and work
procedures” as one of the implementation timing involved in “investigating dangerousness or toxicity.”

8-2 Reassessment and monitoring

After proceeding with the overall process of personal exposure monitoring and implementation of the control measures (steps 1 to 8, and the first half of step 9 of Fig. 2.1), after a certain interval, a risk assessment supervisor shall reassess the workplace in order to verify whether or not any changes have arisen in the exposure condition and also whether the control measures recommended are effectively maintained.

Here, “reassessment” and “re-monitoring” are defined separately. The definition of reassessment is that a risk assessment supervisor would inspect a workplace, conduct a hearing with the manager, and re-estimate the exposure of SEGs and compare with the previous results. The inspection and hearing shall be similar to the (initial) “basic characterization of workplace.” The definition of re-monitoring, on the other hand, is to perform additional measurements as necessary. Reassessment is performed initially, and the necessity for re-monitoring is determined based on the results. If performed, the results of reassessment and monitoring respectively are to be recorded.

In general, reassessment and re-monitoring shall be performed periodically. Their frequency would vary according to the control class determined at the time of the previous assessment based upon the results of exposure monitoring as well as other factors. Specific examples of this approach are shown in Table 2.9. For the control classes 3, 2B, or 2A, the basic frequency for reassessment and re-monitoring shall be six months. For the control classes 1C, 1B, or 1A, the basic frequency for reassessment shall be six months to two years according to the control class, while that for re-monitoring shall be one to three years, again according to the control class. In this manner, the better the control class, the longer the interval for reassessment and re-monitoring becomes. This enables reasonable management according to risks, and, for the employer, leads to motivation for improving the control level.

Table 2.9 also shows basic intervals, while the ranges of modifiable frequency according to conditions are given in parentheses. When the frequency changes for any reason, it shall be documented in a clear manner. Depending on the particular situations, new intervals (longer or shorter) may be set as exceptions. With the above mechanism, undesirable situations, such as if a specified monitoring is continuously performed even when the “first control class” has continued for many years, which occurs frequently in Working Environment Measurement, can be avoided.

In the case of control classes 3 or 2B, in which risk reduction measures are required (Table 2.3), control measures shall be implemented as soon as possible. In this case, reassessment or re-monitoring
Reassessment and re-monitoring have a range of modifiable frequency (the frequencies provided in parentheses in Table 2.9). For the control classes 1B or 1A, the range for reassessment can be extended up to three years, re-monitoring for up to three to five years. These ranges may be set as follows: to set “the next reassessment after 'a' years, and re-monitoring after 'b' years” at the time of initial (or previous) assessment and monitoring; to set “the next reassessment after 'a' years” and to determine the necessity for monitoring depending on the result of reassessment after 'a' years.

Such “decision of frequency” shall be determined by a risk assessment supervisor through overall consideration of the future exposure risk of an SEG on the basis of the following factors 1) and 2) (Table 2.10):

1) Initial (previous) control class
2) Factors related to exposure risk
   (i) Degree of toxicity of substances
   (ii) Reliability of control class.

Table 2.10. Factors for judgment in determining the frequency of reassessment and monitoring

| Factors for judgment | Typical contents |
|----------------------|-----------------|
| 1) Initial (previous) control class | — |

shall be performed soon after the implementation of the control measures. As mentioned above, the frequency for subsequent reassessment and re-monitoring shall be determined. In other words, for control classes 3 or 2B, it is considered inappropriate simply to conduct “reassessment and monitoring after six months.” The exception may include a special situation in which reassessment and monitoring after six months are performed in order to verify the appropriateness of the conditions, when large-scale, time-consuming equipment measures are planned, and the work is required to progress by the temporary wearing of respiratory protective equipment.

Although the interval of monitoring may be reduced for the relatively “bad” control classes (classes 3, 2B, 2A), frequent monitoring is not the primary purpose of control, or it is not a penalty for a bad work environment. If there are reasons for high exposure, the frequent monitoring would not improve the work area in any way. In other words, exposure reduction measures shall be implemented prior to spending energy for re-monitoring that leaves the bad control situation. In this sense, it is advisable to study the possibility of the introduction of new or additional control measures at the time of reassessment. At the same time, the current risk reduction measure shall be verified and thoroughly implemented. These include maintenance of the local exhaust ventilation equipment and proper control of the respiratory protective equipment if it is indispensable (appropriate protection factor for exposure, replacement frequency of absorption tubes, fit test of respirator, etc.).
### Factors related to exposure risk

| (i) | Degree of toxicity of substances to be handled |
|-----|------------------------------------------------|
|     | Toxicity (carcinogenicity), occupational exposure limit, etc. |

| (ii) | Reliability of control class (*) |
|------|----------------------------------|
|      | Level of skill and experience of risk assessment supervisor |
|      | Measurement accuracy (number of samples, monitoring duration) |
|      | Number of times of past monitoring (accumulation of data) |
|      | Quality and quantity of referred alternatives (results of similar SEG) |
|      | Effectiveness of equipment measures (local exhaust ventilation equipment, etc.) |
|      | Amount of substances to be handled (trace amounts) |
|      | Volatility of substances to be handled (very low), etc. |

* Includes the reliability of: the control class determined previously, the results of the current assessment and monitoring, and the fact that the control class will be continued in future.

As shown above, the range of modifiable frequency is determined by the initially (previously) determined control class (1)) (Table 2.9), but the factor 2) is added to finally set the frequency. The reliability of the control class (ii) includes the reliability of the control class determined previously, the results of the current assessment and monitoring, and the fact that the control class will be continued in the future. When a risk assessment supervisor has determined the frequencies of reassessment and monitoring, the basis for that decision shall be clarified and documented. The frequency to be determined is not always the longer one in Table 2.9. Depending on the situation, the frequency can be shorter than the previous frequency. For the initial control classes 3 or 2B, because risk reduction measures are essentially required, contribution of factor 2) is not significant, and it is necessary to perform reassessment and monitoring at the shortest interval (six months).

Only for the control classes 1B or 1A, instantaneous measurement (Section 4-2) can be treated as re-“monitoring.” This depends upon the situation. If there is any special reason (for example, the amount of the chemical is very small and the occupational exposure limit would not be exceeded even if all of the chemical was released in the workplace), the frequency (in the parentheses) in Table 2.9 may be exceeded. However, since there may be invisible deterioration in the equipment due to aging, it is not recommended that no monitoring (including instantaneous measurement) be conducted for a long period of time (e.g., five to ten years).
In order to ensure appropriate judgment, experienced and highly skilled risk assessment supervisors are particularly required. If, however, they have inadequate experience and skill levels, it is recommended that the basic frequency (outside the parentheses) in Table 2.9 be followed. The frequency can be flexibly determined once the supervisor gains experience. Additional explanations on the overall judgment for 1) and 2) above are provided in the appendix (please refer to Appendix 23).

Table 2.9 shows the frequencies of reassessment and monitoring for eight hours (one shift) exposure. It does not show the frequencies for exposure for a short duration task. In the case of a short duration task, it is difficult to determine the frequencies of reassessment and monitoring due to such additional factors such as work hours and the task frequency. It is based upon the principle that the lesser the control class, the higher the frequency becomes. A risk assessment supervisor shall make an appropriate judgment.

9. Actual Personal Exposure Monitoring

The following appendices indicate several model examples for personal exposure monitoring that have been performed in actual workplaces according to the procedure contained in this Guideline (please refer to Appendices 24 to 28):
Appendix 24: Eight-hour monitoring (test work, organic solvent)
Appendix 25: Eight-hour monitoring (painting work, organic solvent)
Appendix 26: Eight-hour monitoring (production of vinyl chloride compounds, lead particles)
Appendix 27: Short term monitoring (sampling work, chemical substances)
Appendix 28: Short term monitoring (tank truck loading work, gasoline, monitoring more than 15 minutes).