Chemical and Biological Hazards Prevention

Studies and Research Projects

TECHNICAL GUIDE **T-15**

Sampling Guide for Air Contaminants in the Workplace

8th edition, version 8.1 updated

Daniel Drolet
Guylaine Beauchamp

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IRSST – Communications and Knowledge
Transfer Division
505 De Maisonneuve Blvd. West
Montréal, Québec
H3A 3C2
Phone: 514 288-1551
Fax: 514 288-7636
publications@irsst.qc.ca
www.irsst.qc.ca

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Daniel Drolet
Chemical and Biological Hazards Prevention, IRSST

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Laboratory Division, IRSST

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This publication is a translation of the French original; only the original version (T-06) is authoritative.

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English translation

Helen Fleischauer

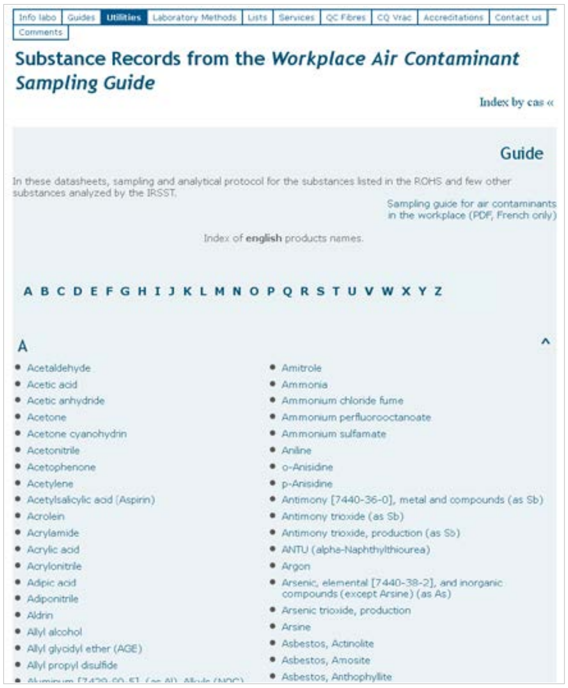
IRSST Web site

This document is available at the following address:

http://www.irsst.qc.ca/files/documents/PubIRSST/T-15.pdf

The content of the tables in Part 3 is also available in the form of individual substance data sheets with a search tool:

- By substance:
  http://www.irsst.qc.ca/en/-rsstlist.html
- By CAS number:
  http://www.irsst.qc.ca/en/-rsstclist.html



Substance Records from the *Workplace Air Contaminant Sampling Guide*

Guide

In these datasheets, sampling and analytical protocol for the substances listed in the ROHS and few other substances analyzed by the IRSST.

Sampling guide for air contaminants in the workplace (PDF, French only)

Index of **english** products names.

A

- Acetaldehyde
- Acetic acid
- Acetic anhydride
- Acetone
- Acetone cyanohydrin
- Acetonitrile
- Acetophenone
- Acetylene
- Acetylsalicylic acid (Aspirin)
- Acrolein
- Acrylamide
- Acrylic acid
- Acrylonitrile
- Adipic acid
- Adiponitrile
- Aldrin
- Allyl alcohol
- Allyl glycidyl ether (AGE)
- Allyl propyl disulfide
- Amitrole
- Ammonia
- Ammonium chloride fume
- Ammonium perfluorooctanoate
- Ammonium sulfamate
- Aniline
- o-Anisidine
- p-Anisidine
- Antimony [7440-36-0], metal and compounds (as Sb)
- Antimony trioxide (as Sb)
- Antimony trioxide, production (as Sb)
- ANTU (alpha-Naphthylthiourea)
- Argon
- Arsenic, elemental [7440-38-2], and inorganic compounds (except Arsine) (as As)
- Arsenic trioxide, production
- Arsine
- Asbestos, Actinolite
- Asbestos, Amosite
- Asbestos, Anthophyllite

Note

Version 8.1 of this guide is essentially an update of certain technical aspects that may have changed since its publication in 2005. In the same way, the *Regulation respecting occupational health and safety in mines* and documents now available on the Internet have been added to the "reference" section. Since this guide is used daily by many occupational hygiene practitioners in Québec, an update became necessary for reasons related to the nature of the operations of the IRSST's Laboratory Division.

Use of the data included in this publication as well as the application of these methods and techniques is at the user's own risk: the IRSST is not responsible for any errors or damage resulting from such use or application. The hyperlinks found in this document were validated at the time of its publication.

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Preamble

This IRSST technical guide assumes that the user is free to choose the objectives of his interventions and the means of achieving these objectives. The guide helps the user to obtain scientific and technical data whose accuracy (exactness) and reliability (precision) are known in relation to a reference value. The quality required in achieving an intervention's objectives must be determined by the people in charge of the intervention.

Content[1] of the document

Regulated guides

- Part 1: Sampling strategy
- Table entitled "*Table of substances in the ROHS*" in Part 3 Contaminant Sampling (pages 41 to 132, printed on green paper).

Non-regulated guides

- Part 2: Sampling instruments and techniques
- Table entitled "*Non-regulated substances analyzed by the IRSST*" in Part 3 Contaminant Sampling (pages 133 to 136, printed on yellow paper).

Introduction

The purpose of the *Act respecting occupational health and safety* (1) is to eliminate at source, dangers to the health, safety and physical well-being of workers. To meet these objectives, this guide describes the methods for quantifying the degree of exposure of workers in order to implement appropriate means of control. Permissible exposure values (PEVs) for chemical substances have been included in Schedule I of the *Regulation respecting occupational health and safety* (2) (ROHS) and also in the *Regulation respecting occupational health and safety in mines* (3) (ROHSM). Section 44 of the ROHS entitled "Methods" specifies that:

> "*These dusts, gases, fumes, vapours and mists found in the workplace environment shall be sampled and analyzed to obtain an accuracy equivalent to that obtained by applying the methods described in the Sampling Guide for Air Contaminants in the Workplace published by the Institut de recherche Robert-Sauvé en santé et sécurité du travail du Québec.*"

Section 44 of the ROHS and section 103.1 of the ROHSM specify that:

> *"The sampling strategy for these contaminants shall be carried out in accordance with common practices in industrial hygiene as summarized in this guide."*

To help occupational health and safety practitioners, the IRSST publishes, periodically revises, and disseminates the *Sampling Guide for Air Contaminants in the Workplace*. This guide includes a first section on the sampling strategy. The second part describes concisely the different evaluation techniques that can be used in an occupational hygiene procedure based on the nature of the substances: gases and vapours or aerosols. It is important to note that some of these techniques are exploratory and are not standard IRSST methods. Also, evaluation techniques are given for microorganisms even though they are not regulated in Québec. This part also contains information on the analysis of bulk samples and on the calibration of the sampling system. The third part specifies the sampling and analytical methods for each of the substances listed in Schedule I of the ROHS. It also contains information on the sampling and analysis of a limited

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[1] Consult the IRSST's Web site for the most recent update of the sampling guide

number of *non-regulated substances*, but still offered in the framework of the analytical services of the IRSST's laboratories.

Other guides available and published by the IRSST

- *Guide for the Adjustment of Permissible Exposure Values (PEVs) for Unusual Work Schedules* (4). This guide describes the process for reducing time-weighted average exposure values (TWAEV) according to the substances in Schedule I and the type of work schedule. This guide must be used together with the present document.
- *Guide de surveillance biologique-Prélèvement et interprétation des résultats* (5) (in French only). Biological monitoring is used to document workers' exposure by measuring the contaminant, metabolites or any other parameter in a biological matrix. It is used in a preventive context and may constitute a procedure complementary to the environmental monitoring described in this guide.

Part 1: Sampling strategy

Introduction

This section on sampling strategy is based on American (6) and European (7) procedures, condensed and adapted to the context of the Québec occupational health and safety network. It reminds users that a representative result is obtained by using a realistic strategy, adapted to the objectives of an intervention and backed up by appropriate statistical treatment. All of the steps must be subject to a quality assurance program, and certain steps to a quality control program.

Whether the objectives are preventive ones, such as those pursued by most occupational health professionals, or compliance with the ROHS or ROHSM as formulated by the inspection network of the Commission de la santé et de la sécurité du travail (CSST, Quebec occupational health and safety board), the objective of the proposed strategy is to verify contaminant concentration levels in relation to reference values. These values are either time-weighted average exposure values (TWAEVs), adjusted mean exposure values (AMEVs), short-term exposure values (STEVs), ceiling values and excursion limits established by the ROHS, or simply reference values adopted as guidelines for preventive or corrective action. For example, professional organizations such as the ACGIH® (American Conference of Governmental Industrial Hygienists), governmental agencies, or other different sources propose reference values. In this chapter, we will use the term "reference value" to cover all of these target values.

This strategy does not apply directly to epidemiological or toxicological studies. It applies to actions such as preventive reassignment, work refusal, complaints, and the setting up of a health program specific to the establishments only if one of the intervention's objectives can be linked to the verification of the concentration levels of one or more contaminants in relation to a reference value.

1.1 Description of the sampling strategy

Before beginning to evaluate a work environment, it is important that the objectives of the intervention be properly defined and that a rational procedure be followed. The decision flowchart in Figure 1 presents the logical sequence of an intervention whose objective is to measure the exposure of workers to contaminants present in their workplace. In the context of this Sampling Guide, exposure evaluation consists of comparing the concentrations of the contaminant or contaminants to which the worker may be exposed to reference values.

1.1.1 Potential exposure to contaminants

The first step ① in evaluating a workplace is to identify potential exposures to contaminants. This identification is done through consultation or by preparing a list of all contaminants, substances and reagents that could contribute to the worker's exposure. This list includes, depending on the case, the starting materials, the impurities, the intermediates, the final products, and the by-products. In the Québec context, the consulting of safety data sheets, made mandatory by the implementation of the *Workplace Hazardous Materials Information System* (WHMIS), can make the documentation work easier up to a certain point. PEVs, or in their absence, reference values, are collected for each of the contaminants. As in several subsequent steps, the decision leading to the end of the specific intervention process initiates a series of actions that depends on the organizational context of the occupational health practitioner, such as the preparation of a report.

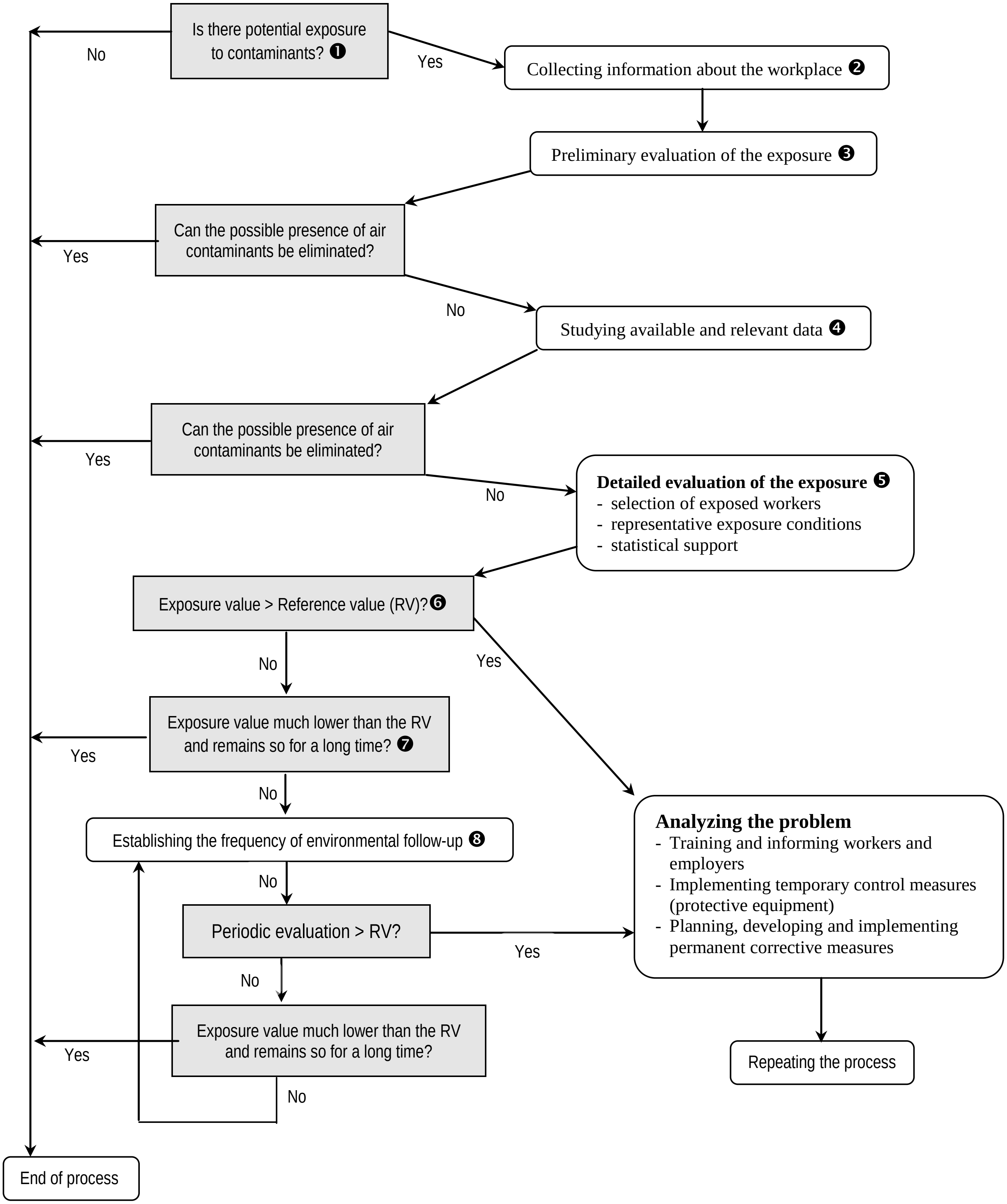

Figure 1- Decision flowchart for exposure evaluation

1.1.2 Collecting information about the workplace

The second step ② involves collecting information about the processes and procedures in order to evaluate the potential exposure to the identified contaminants. The purpose of this step is to generally describe the following aspects:

- the tasks;
- the work organization;
- the process(es);
- the workplace layout;
- the safety methods and procedures;
- the emission sources;
- the ventilation and other means of control at source;
- the duration of exposure.

The health and safety records available in the establishment or at the government's OHS point of service should be consulted to orient the intervention and to avoid unnecessary duplication.

1.1.3 Preliminary evaluation of the exposure

The third step ③, the preliminary evaluation of the exposure, tries to find a link between potential exposures and the information about the workplace in order to attempt to establish the likelihood of an exposure. This step takes into account the process parameters or the work methods that may result in the contaminant being emitted into the worker's environment. For the process, these parameters are:

- the location and characteristics of each source;
- the number of emission sources;
- the emission rates for each source;
- the dispersion of the contaminant by air currents;
- the nature and effectiveness of the control measures (ventilation or elimination at source).

Most of the time, the parameters to consider in task execution are:

- The proximity of the worker to the emission sources;
- The time that the worker spends near the emission sources;
- The methods that may cause or increase the emissions.

Rapid qualitative evaluation methods can detect the presence or absence of a contaminant. Detector tubes, even though they are not very selective or precise, provide interesting information about the presence and relative concentrations of several contaminants. Direct-reading instruments are very useful tools at this step.

1.1.4 Studying available and relevant data

If the preliminary evaluation concludes that a contaminant is possibly present in the air, quantitative information about potential exposures must be collected.

This quantitative information is obtained in the fourth step ④ by studying the available and relevant data originating from results collected previously in the worker's environment, in similar facilities and processes, or calculated from satisfactory data, hypotheses or assumptions. If, in studying this data, it is impossible to compare the exposure to reference values, a detailed evaluation of the exposure must be carried out.

1.1.5 Detailed evaluation of the exposure

A detailed evaluation of the exposure ⑤ requires a statistically-supported rigorous approach to ensure that the sampling is representative and that the results are correctly interpreted. However, with a concern for efficiency and optimization of resource use, but without sacrificing scientific objectivity, the requirements of the detailed exposure evaluation can be adapted to the results of the comparison of the concentration measurements to the reference values. In fact, when objective data indicate that an exposure is clearly above or below reference values, the analytical and statistical requirements may become less restrictive and allow the use of techniques that are easy to apply, even though a statistically acceptable degree of precision and accuracy is lost. Measurement strategies (maximum exposure scenario) can also be adopted, namely at a workstation where a worker seems more likely to be exposed than his coworkers, or sampling near the emission sources, or other relative exposure evaluation techniques. In these cases, exposure evaluation does not require additional efforts because the exposure is clearly above or below the reference values. Priority must then be given, depending on the case, to correcting or evaluating exposures that are more likely to involve a risk to worker health. However, the interpretation and dissemination of these extreme results in relation to a reference value requires particular effort.

In other cases, where the exposure evaluation is of the same order of magnitude as the reference value, where the objective of the evaluation (complaints, compensation file, etc.) requires the maximum possible scientific rigour, it is then imperative that all the refinement of the scientific process be applied in selecting the workers, in selecting representative exposure conditions, and in the use of the statistical support.

1.1.5.1 Statistical support

All exposure evaluation measurements involve a certain variability that depends on the fluctuations in the concentration in the workplace and the errors related to the sampling and analytical techniques. Evaluations of the exposure of a worker or a group of workers are, as a result, experimental values that must be described in statistical terms. Quality assurance programs are implemented to improve the quality of the exposure evaluation processes and to characterize the statistical limits of the results in order to properly establish the significance of the comparison to a reference value. As needed, confirmation that the reference value has been exceeded, using the results of the evaluations of the exposure to a given contaminant is based on a determination of the confidence limits.

1.1.5.2 Basic elements of the statistical treatment

■ *Variations*

The main sources of variation that affect the estimation of worker exposure are of two types: random errors and systematic errors. Random errors are sometimes called statistical errors because they can be quantified by statistical analysis. They can be due to the imprecision of the analytical and sampling methods as well as the unexpected variations in the concentrations from hour to hour or from day to day. Systematic errors can be corrected when they are detected using stringent quality assurance programs. They are due to instrumental factors as well as to human error. They cannot be statistically quantified. To better understand the subtle differences between these two types of errors, here are a few examples.

Random errors include:

- fluctuation in pump flow rates;
- certain analytical method errors;
- daily fluctuations in contaminant concentrations;
- fluctuations in contaminant concentrations from one day to the next.

Some examples of **systematic errors** are:

- incorrect calibration or use of the instruments;
- errors in the recording of measurement results due to instrument disadjustment;
- sudden reductions in efficiency or breakdown in the ventilation equipment;
- changes in ambient conditions due to defects or to operating conditions different from usual conditions.

Random errors cannot be foreseen but may be quantified and controlled to a certain extent by applying stringent quality assurance programs.

A series of environmental measurements used to characterize an ambient exposure or concentration can generally be represented in two ways, either as a **normal** distribution (Figure 2) or a **lognormal** distribution

(Figure 3). It is important to determine the type of distribution that exists in the workplaces in question.

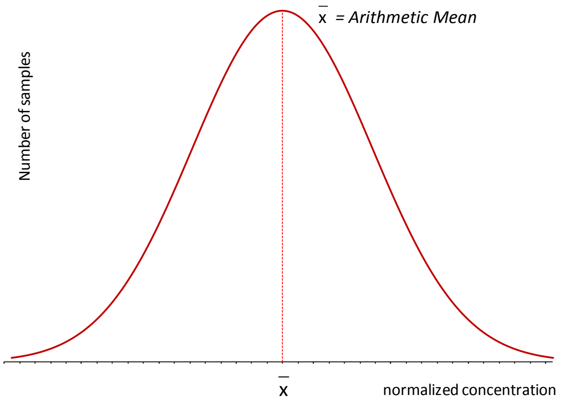

Figure 2- Normal distribution

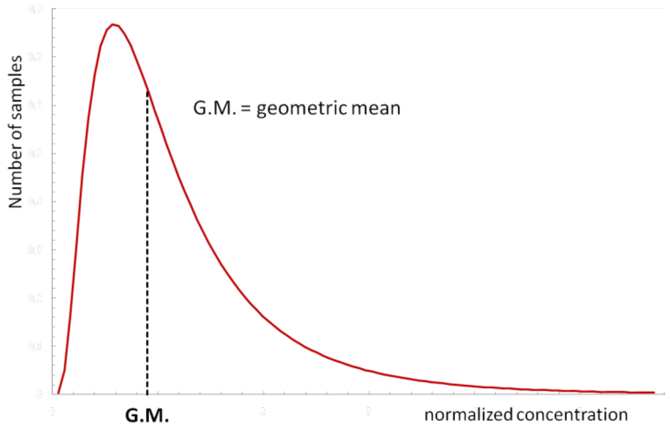

Figure 3- Lognormal distribution

The fluctuating nature of concentrations and the length of the measurement period p(long or short) for a sample are some factors that will affect the type of distribution of a series of measurements.

The results of grab samples (short duration), the 8-hour exposure of a worker from one day to the next, and the 8-hour exposure of a group of workers performing the same task generally have a lognormal distribution.

However, a series of analytical measurements carried out on the same sample and a series of calibration results using the same standard will tend to have a normal distribution.

■ *Parameters of a normal distribution*

The parameters describing a normal distribution are presented below. For easier result interpretation and comparison, normalized concentration values are regularly used. They are obtained by dividing the measured value by the reference value, which is based on the substance analyzed and the objective of the evaluation:

Equation 1*: Normalized concentration (ratio of the measured concentration and the reference value)*

$$\boxed{x = \frac{X}{RV}}$$

X = *Measured normalized concentration*
RV = *Reference value*

Equation 2: *Arithmetic mean*

$$\boxed{\bar{x} = \frac{1}{n} * \sum_{i=1}^{n} x_i}$$

x_i = *Normalized concentration*
n = *Number of samples*

Equation 3: *Standard deviation (s)*

$$s = \sqrt{\frac{1}{n-1} * \sum_{i=1}^{n} (x_i - \bar{x})^2}$$

Equation 4: *The coefficient of variation (represents the standard deviation relating to the mean of a series of measurements)*

$$CV = \frac{s}{\bar{x}}$$

CV = Coefficient of variation

The coefficient of variation is defined as the standard deviation relating to the mean of a series of measurements. The coefficients of variation generally reported are related to the sampling instruments and analytical methods. They can also be expressed as percentages.

■ *Parameters of a lognormal distribution*

Equation 5: *Geometric mean (G.M.)*

$$\log G.M. = \frac{1}{n} * \sum_{i=1}^{n} \log x_i$$

Equation 6: *Geometric standard deviation (s)*

$$\log s = \sqrt{\frac{1}{n-1} * \sum_{i=1}^{n} (\log x_i - \log G.M.)^2}$$

■ *Sampling precision*

The sampling precision due only to the pumps is generally estimated at 0.05 (5%). Furthermore, this is the precision that sampling pump manufacturers guarantee in their specifications. The coefficient of variation for sampling (CVs) is a function of all of the steps leading to collection of the sample and can be quantified by the occupational health practitioner in relation to the quality assurance procedures.

■ *Analytical precision*

For analytical methods, the coefficients of variation are determined using series of generated samples and by comparing them to standards. Analytical coefficients of variation (CV_A) are included in the description of most of the analytical methods available at the IRSST.

■ *Total coefficient of variation*

The total coefficient of variation (CV_T) should take into account the errors related to sampling CV_S) and to the analytical procedures (CV_A). The total coefficient of variation is calculated by taking the square root of the sum of the squares of the errors:

Equation 7: *Total coefficient of variation*

$$CV_T = \sqrt{(CV_S)^2 + (CV_A)^2}$$

Since we do not have the true CV_S, we use a CV_S estimated at 0.05 (5%) in the calculation of the CV_T in the publication of our analytical methods.

1.1.5.3 Confidence limits

A series of measurements generally has a normal or a lognormal distribution. The graphical representation of a normal distribution is a bell curve (Figure 4). A lognormal distribution mainly occurs when short-term samples are collected or major fluctuations can be attributed to the processes. It is represented by a bell skewed to the right. For a lognormal distribution, the logarithm of the concentration values is used, and the graphical representation then takes the form of a normal distribution. The standard deviation (σ) characterizes the region of the bell curve whose mean (μ) is located at the mid-point of the distribution. The area under the bell between the mean and ± 1.96 σ contains 95% of the measurements. The region to ± 1 σ contains 68% of the values.

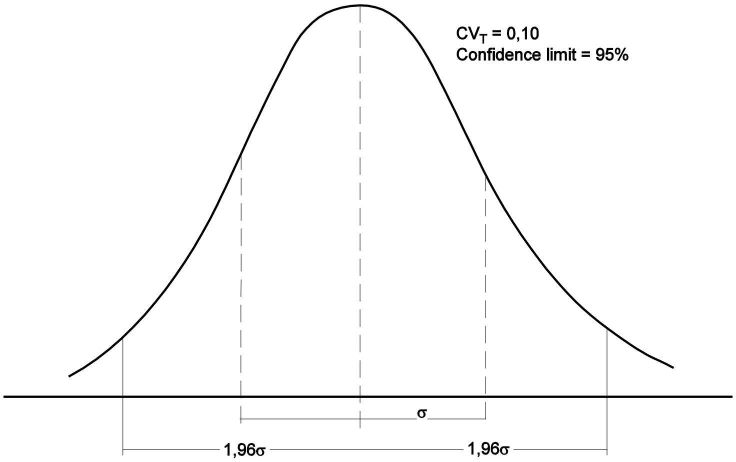

Figure 4- Normal distribution of a series of 8-hour samples

To determine whether the chosen reference value is exceeded with a 95% confidence limit, 95% of the results under the bell curve must exceed this reference value (Figure 5). This is the lower confidence limit (LCL), where the lowest 5% of the results are not considered. Mathematically, this cutoff (LCL) includes all the results under the curve between the values -1.645σ and ∞.

In the same way, to determine whether the chosen reference value has not been exceeded with a 95% confidence limit, 95% of the results under the bell curve must be smaller than the reference value. This is the upper confidence limit (UCL), where the highest 5% of the results are not considered. This cutoff (UCL) includes all the results under the curve between the values +1.645 σ and - ∞.

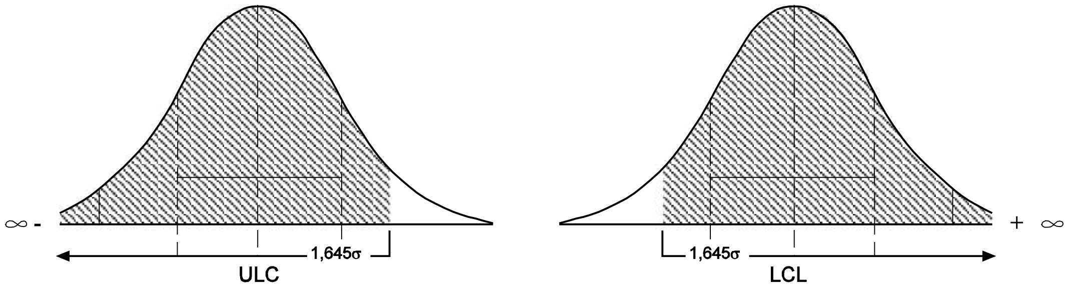

Figure 5- Illustration of the lower and upper confidence limits

1.1.5.4 *Decision whether the reference value has been exceeded or not*

The value of the total coefficient of variation of the normalized concentration is used to calculate the upper and lower confidence limits using the following equations:

Equation 8: *Lower confidence limit*

$$\boxed{LCL_{(95\%)} = x - (1.645 * CV_T)}$$

Equation 9: *Upper confidence limit*

$$\boxed{UCL_{(95\%)} = x + (1.645 * CV_T)}$$

For example, for a single sample over the entire duration of the work shift, three situations may occur: the reference value is exceeded, is not exceeded, or is possibly exceeded. The three situations are illustrated in

Figure 6.

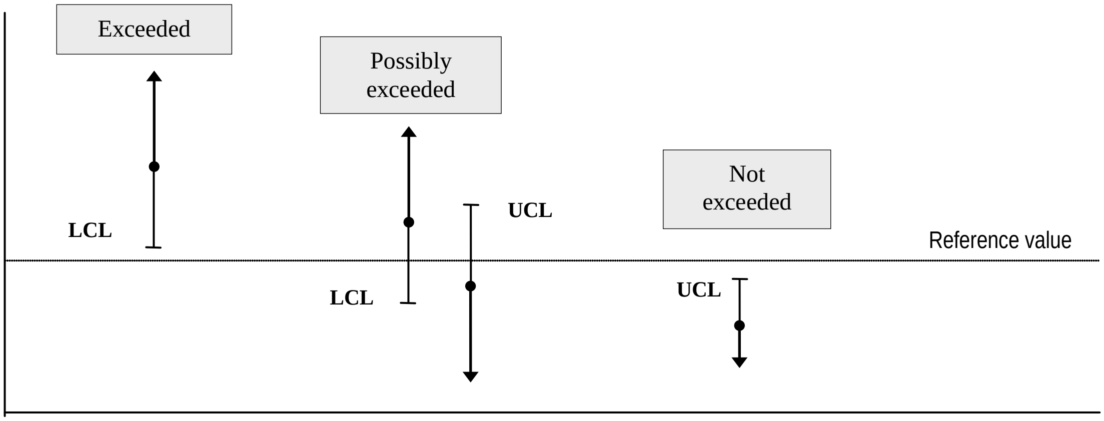

Figure 6- Classification using one-sided confidence limits

For other cases, a more detailed mathematical and statistical interpretation may be necessary. We suggest that reference (6) at the end of this document or a book of statistics applied to data analysis be consulted.

A situation in which the reference value is exceeded (step ⑥) leads to action that is not within the scope of the sampling strategy. However, exposure values clearly below the reference value and that remain there for a long time may result in priority being given to interventions at other workstations. Unfortunately, there is no universal definition of an exposure clearly below the reference value (step ⑦). This concept must be defined by the occupational health practitioner based on his objectives and decision-making context. Some indexes can be used in different cases. Europeans (7) use an empirical value of 0.1 times the reference value. The great majority of the IRSST reference methods cover at least a concentration range from 0.1 to 2–5 times the TWAEV and STEV. However, the ROHS stipulates in section 42 that:

> *"When a worker is exposed to a substance identified in Schedule I as having a known or suspected carcinogenic effect on humans or being diisocyanate or isocyanate oligomers, such exposure shall be reduced to a minimum, even when it remains within the standards in that Schedule."*

1.1.5.5 Selecting exposed workers

For some intervention objectives whose purpose is often to establish a causal relationship between a health problem and an exposure (for example, for such things as complaints, work refusals or claim investigations), the question of selecting workers does not arise because one or more specific workers are involved.

In other cases, when the exposure of a group of workers has to be documented in order to implement a health or environmental-monitoring program, it is generally impossible to measure the exposure of all workers at any moment. Different approaches lead to the selection of representative exposed workers that meets the objective of the intervention, namely, of only measuring the exposure of a small number of workers while obtaining a statistically acceptable evaluation for the entire group.

The ideal approach consists of separating the population of workers into similar exposure groups (SEGs) and of randomly choosing from these groups of exposed workers, those whose exposure will be evaluated. These SEGs can be established either by observing the work activity or by using a "sampling approach" that consists of creating the SEGs on the basis of a statistical analysis of the exposure data (8). Thus, from a population of workers with similar exposure, individuals are randomly chosen using random number tables (6). Tables A1 to A4 in Table 1 give the number of workers to be sampled in a homogeneous population exposed to a given risk. The content of these tables is based on statistical parameters and attempts to anticipate the different statistical scenarios of these groups in relation to the probability of including at least one of the workers most at risk.

Sometimes the situation lends itself poorly to the use of these tables because the number of workers with similar jobs is too small. It then becomes necessary to measure the exposure of all workers whose exposure is similar.

The validity of these groupings based on exposure risk can be established during critical studies on worker organization and from preliminary exposure data. The group homogeneity acceptability criterion suggested by the European community (7) is an individual exposure value greater than half and smaller than twice the arithmetic mean of the group. For example, a group of 20 workers whose arithmetic mean of their exposure to a contaminant is 1 mg/m^3 is considered as being homogeneous if the exposure value of each individual in the group to this contaminant is between 0.5 and 2.0 mg/m^3.

Table 1- Selection tables for workers in a similar exposure group

Table A1 – At least one worker among the 10% most exposed, probability of 90%

Size of group	8	9	10	11-12	13-14	15-17	18-20	21-24	25-29	30-37	38-40	40-50	51-∞
Employees evaluated	7	8	9	10	11	12	13	14	15	16	17	18	22

Table A2 – At least one worker among the 10% most exposed, probability of 95%

Size of group	12	13-14	15-16	17-18	19-21	22-24	25-27	28-31	32-35	35-41	42-50	51-∞
Employees evaluated	11	12	13	14	15	16	17	18	19	20	21	29

Table A3 – At least one worker among the 20% most exposed, probability of 90%

Size of group	6	7-9	10-14	15-26	27-50	51-∞
Employees evaluated	5	6	7	8	9	11

Table A4 – At least one worker among the 20% most exposed, probability of 95%

Size of group	7-8	9-11	12-14	15-18	19-26	27-43	44-50	51-∞
Employees evaluated	6	7	8	9	10	11	12	14

1.1.5.6 Selecting representative exposure conditions

Exposure evaluation conditions must be chosen so that the results provide an objective evaluation of the exposure in the worker's actual task performance situation. In the specific case of comparing the results of the evaluation to a reference value, the conditions will also take into account the nature of this value, namely whether it is a TWAEV, an STEV, a ceiling value or an excursion limit. In addition, if the workers' work schedule differs from the typical schedule (8 hours a day, 5 days a week), the TWAEV will in some cases have to be adjusted to give an adjusted mean exposure value (AMEV). The information applicable to the adjustment of the TWAEV and the resulting interpretation rules are described in the *Guide for the Adjustment of Permissible Exposure Values (PEVs) for Unusual Work Schedules* published by the IRSST (4).

The exposure must be evaluated from samples collected in the breathing zone of the worker for the entire work period or the period provided in the appropriate reference value, namely 8 hours for a TWAEV, the entire work shift for an AMEV, and 15 minutes for an STEV. The breathing zone is defined in section 1 of the ROHS as:

> *"a hemisphere having a 300-mm radius extending in front of the face and measured from the midpoint of*

> *an imaginary line joining the ears."*

In the case of groups of workers, if the preliminary evaluation did not produce data on homogeneous exposure, samples must be used to establish the variability of this exposure over time (day, night, seasons, climatic conditions, during certain operations, etc.) and in space (different workstations or emission sources).

The result of a single sample that covers the complete 8-hour period can be compared directly to the TWAEV, or if it covers a 15-minute period, to the STEV. In the case of unusual schedules, the single sample must cover the total duration of the work shift and the result compared to the AMEV.

Consecutive samples covering the entire work period offer the same advantage as single samples regarding comparison with the appropriate reference value. This strategy can also provide information on the variation in the concentration of a contaminant during the work period and allows a sample contaminated voluntarily or accidentally to be identified.

Multiple partial-period samples may be satisfactory, depending on the information on the homogeneity of the exposure results. In general, with homogeneous exposure, the mean daily exposure (MDE) can be calculated from multiple samples of a total duration of at least two hours or from 5 samples for the duration prescribed in the reference method, and where these samples are distributed uniformly within an eight-hour time period in a workday or for the duration of the work shift in the case of an unusual schedule. Several examples of calculations of the TWAEV, one example of a calculation of the R_m (sum of the fractions of the mixture during daily exposure to several substances), and one example of an application of the excursion limit are presented in *section 1.2.1*.

In certain cases, due to limitations in the methods or measuring instruments that require short-term samples, a series of grab samples can be collected at random intervals during the entire work period or the period of application of the standard. Grab samples are also used to compare the concentration of one contaminant to a ceiling value. In this case, the minimum sampling period must take into account the analytical limitations of response time, instrument stability, or others that are described in the IRSST's analytical and calibration methods. Even in the case of ceiling values, result interpretation must take into account the precision and accuracy of the technique, and establish the reliability of the comparison of the results and the limit value using normal statistics.

Figure 7 summarizes the time characteristics of the different types of sampling in characterizing a TWAEV. Several factors have an impact on the choice of one strategy over another. The availability and cost of the sampling equipment, access to the workplace, variability in the processes, the precision and accuracy of the methods, and the number of samples, are all factors to be considered in choosing a strategy. Of the four types of samples described, the results most representative of the actual situation involve collecting several consecutive samples over the entire work period. The second choice would be to collect a single sample over the entire period. The interpretation of the results of partial-period samples, and the grab sample applied to the TWAEV, AMEV or to the STEV, require a good knowledge about the homogeneity of the exposure and an appropriate statistical analysis.

1.1.6 Frequency of environmental monitoring

Pursuing long-term objectives in the evaluation and effectiveness of means of control and elimination at source, or obtaining exposure value results that are close to the reference value, raise the question of the frequency of environmental monitoring (step ⑧). In certain cases, a minimum frequency is provided in the Québec regulation. For example, for asbestos, the ROHS specifies in section 43 that:

> *"In any establishment where workers are exposed to asbestos, the employer must at least once a year measure the concentration of airborne asbestos dust and the concentration of respirable asbestos fibres in the workers' breathing area. A sampling strategy may provide for more frequent measuring, depending on the extent of the risk to the health, safety or physical well-being of the workers."* The same regulation sets the same frequency requirement for any establishment that employs 50 workers or more, *"… where the concentration of gases, dusts, fumes, vapours or mists at a work location exceeds or could exceed the standards prescribed in Schedule 1…"*

In the other cases, the interval between the exposure evaluations should take into account the following factors:

- cycles in the process, including normal operating cycles and maintenance or repair cycles;
- consequences of breakdowns in the facilities for control or elimination at source;
- ambient concentrations close to the reference values;
- efficiency of means of control;
- variability of results over time.

Reference 6 gives an example of how to determine the frequency of an exposure evaluation.

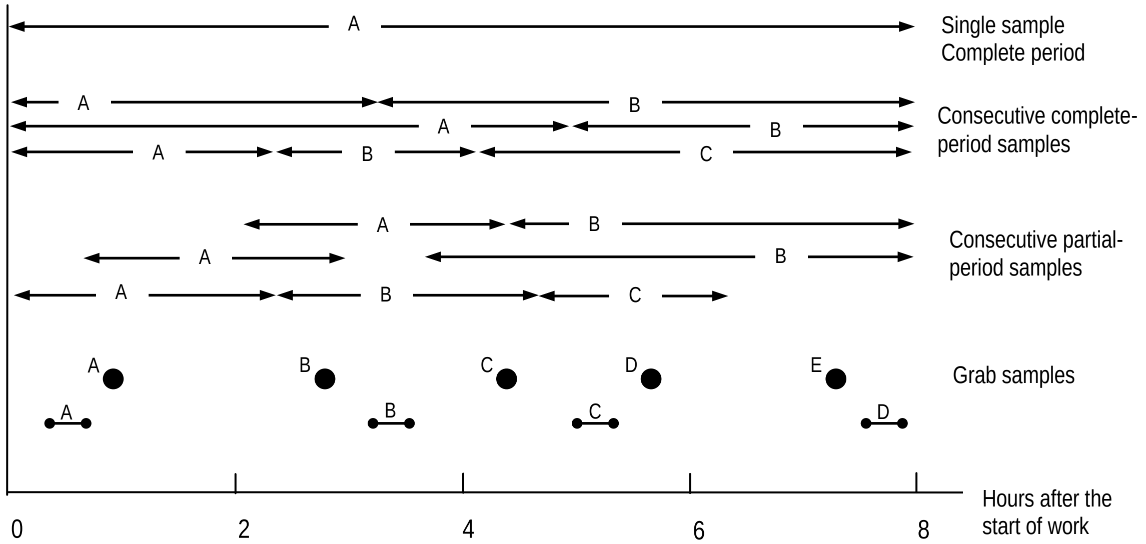

Figure 7- Types of samples for characterizing an 8-hour exposure (TWAEV)

1.2 Examples of calculation of the mean daily exposure (MDE), the R_m, and the excursion limit

1.2.1 Weighting of the exposure by work shift

The exposure dose for a series of measurements covering the complete 8-hour work period is calculated using the following formula for the purpose of applying a TWAEV (2):

Equation 10: *Calculating the MDE (mg/m^3 or ppm)*

MDE = Weighted 8-hour concentration (mean daily exposure)
C = Concentration measured at a workstation
t = Sampling time in hours for a total of 8 hours
1,2,...n = Indication of the sampling period

$$MDE = \frac{C_1 t_1 + C_2 t_2 + ... + C_n t_n}{t_1 + t_2 + ... + t_n}$$

To apply an AMEV, the sum of the sampling times in the denominator must equal the total duration of the work shift.

For a mixture of substances with similar effects on the same organs of the human body, the effects are considered as additive unless otherwise established (2), and the coefficient of the sum of the fractions of a mixture (R_m) is used. This calculation is done using the TWAEV for each of the substances and the value of the measurement for 8 hours of exposure for each substance (MDE).

Equation 11: *Calculating the R_m (sum of the fractions of the mixture)*

$$R_m = \frac{C_1}{T_1} + \frac{C_2}{T_2} + ... + \frac{C_n}{T_n}$$

C = Weighted concentration of each of the substances in the air (MDE)
T = TWAEV
1,2,...n = Indication of each of the substances

When R_m exceeds unity, the permissible concentration of the mixture is exceeded and the exposure does not comply. In the case of an unusual schedule, the TWAEV (T, 8 hours) must be replaced by the AMEV (T_a, work period).

■ ***Example 1***

An operator works for 7 hours and 20 minutes at a task in which he is exposed to a substance listed in Schedule I of the ROHS. The concentration measured during this period is 0.12 mg/m^3. What is his mean daily exposure (MDE)?

7.33 hours at 0.12 mg/m^3
0.67 hours at 0 mg/m^3 (no exposure) namely: MDE = ((0.12 x 7.33) + (0 x 0.67)) / 8 = **0.11 mg/m^3**

■ ***Example 2***

An operator works for 8 hours on a process in which he is exposed to a contaminant for which the ROHS gives a TWAEV. During this period, he is exposed to a concentration of 0.15 mg/m^3. What is his mean daily exposure?

MDE = (0.15 x 8) / 8 = **0.15 mg/m^3**

■ ***Example 3***

An operator works for 8 hours during the night on a process that exposes him intermittently to a regulated substance. Knowing his work schedule and his exposure during these different tasks (Table 2), what is his mean daily exposure?

Table 2- Evaluation of the exposure of worker Y

Work schedule	Task	Exposure values (mg/m^3)	Sampling time in hours
22:00 - 24:00	Shop assistant	0.1 (from exposure values of a group of full-time workers performing this task)	2
24:00 - 01:00	Office work	0	1
01:00 - 04:00	Cafeteria work	0	3
04:00 - 06:00	Cleaning in shop	0.21 (measured)	2

The exposure was established to be zero for the office and cafeteria work, and consequently his mean daily exposure will be:

MDE = ((0.10 x 2) + (0.21 x 2) + (0 x 4)) / 8 = 0.078 mg/m^3

■ ***Example 4***

Workers are exposed to solvents under the conditions described in Table 3. Are the workers overexposed to these solvents, which all have effects on the central nervous system?

Table 3- Exposure of a worker to a mixture of solvents

Solvent	Concentration (ppm)	Exposure time (hours)	TWAEV (ppm)
Toluene	25 33 12	4,0 1.5 2.5	50
Acetone	225 560	6,0 2.0	500
Trichloroethylene	20 40 60	5.0 2.0 1.0	50

MDE $_{\text{toluene}}$ = [(25*4) + (33*1.5) + (12*2.5)] / 8 = **22.5**

MDE $_{\text{acetone}}$ = [(225*6) + (560*2)] / 8 = **309**

MDE $_{\text{trichloroethylene}}$ = [(20*5) + (40 * 2) + (60 * 1)] / 8 = **30**

$$R_m = \frac{22.5}{50} + \frac{309}{500} + \frac{30}{50} = 1.67$$

and unity (1) has been exceeded and the situation is noncompliant.

1.2.2 Application of the excursion limit

The ROHS defines the excursion limit for substances with no STEV as follows:

> "*Provided the time-weighted average exposure value is not exceeded, excursions in exposure levels may exceed 3 times that value for a cumulative period not exceeding a total of 30 minutes during a workday. Notwithstanding the foregoing, none of those excursions in exposure levels may exceed 5 times the time-weighted average exposure value during any length of time whatsoever*."

In the case of an unusual schedule, the excursion limits are calculated as a function of the AMEV rather than the TWAEV. Example 5 presents an idealized application of the excursion limit for each of the cases.

■ ***Example 5***

Figures 8 and 9 give examples of the two possibilities of the excursion limit being exceeded in the case of exposure of a worker to a solvent for which the ROHS gives a TWAEV of 100 mg/m³ without specifying the STEV. A direct-reading instrument sampling in the worker's breathing zone records the concentrations over a period of slightly less than two hours. On each of the graphs, an arrow indicates the point when the excursion limit is exceeded. Note that the weighted average exposure of this worker was measured and that it was below the TWAEV.

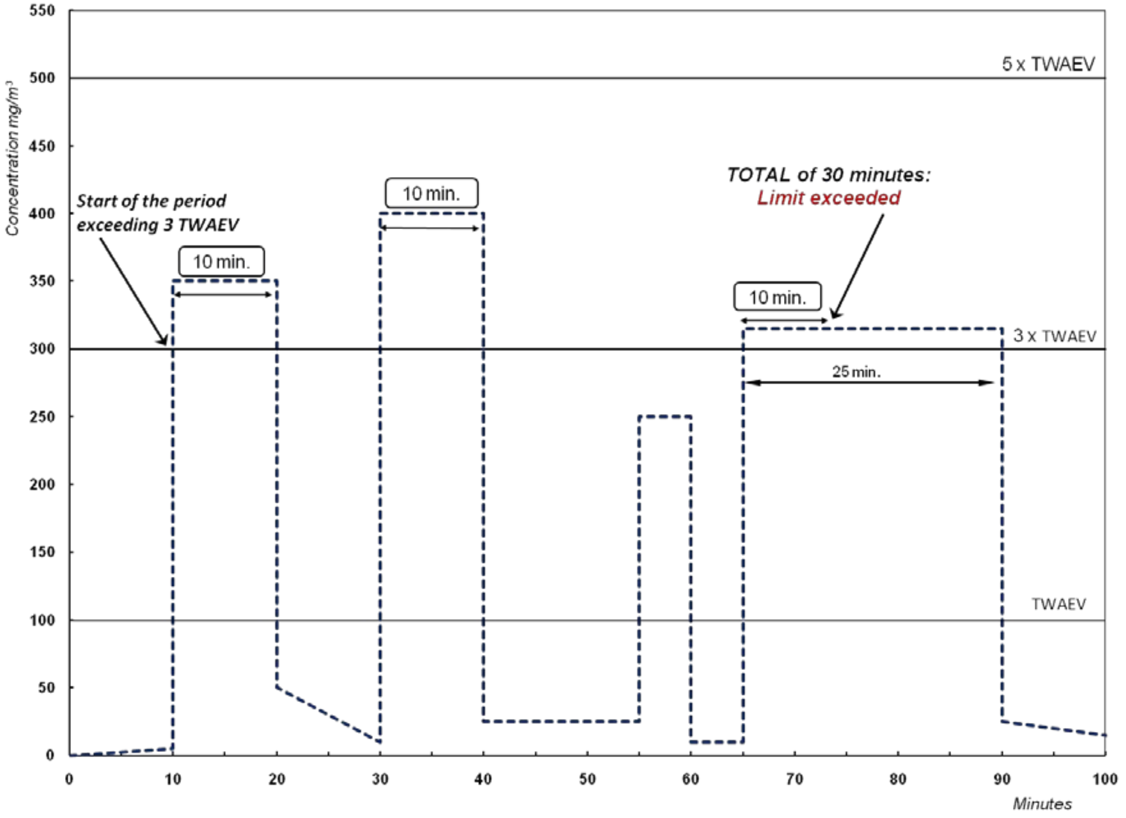

Figure 8- Example of excursion limit being exceeded with total time

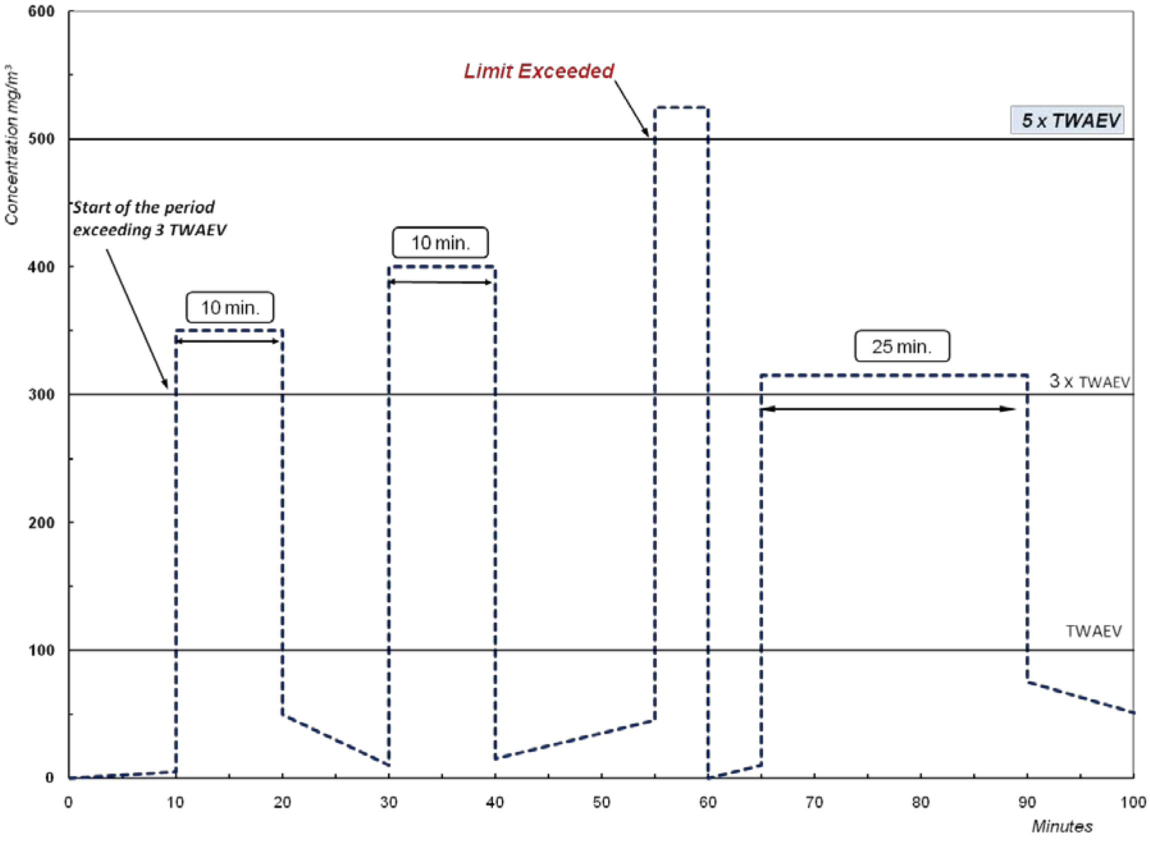

Figure 9- Example of excursion limit being exceeded by increase in concentration

Part 2: Sampling equipment and techniques

Introduction

Once the measurement strategy for the chemical substances or biological agents in the workplace has been chosen, measuring equipment, techniques and methods for meeting the objective must be selected. Measurements can be direct, using portable instruments, or indirect, by sampling on a collecting medium and subsequent laboratory analysis. These direct or indirect techniques are described briefly in relation to the type of contaminant: gases and vapours, aerosols (liquids, dusts and fumes), and microorganisms. The list of equipment required for sampling or analysis is presented in *Part 3*. Other sections complete this part of the guide by providing information about process samples and sampling using pumps.

2.1 Concentration units for PEVs in the ROHS (ppm and mg/m³)

The objective in using sampling equipment and techniques is to compare the concentration measurement results for an air contaminant to a reference value, mainly the PEVs in the ROHS. It is therefore important that the result of a measurement, whether expressed in ppm, mg/m^3 or in $fibre/cm^3$, be comparable to the value of the PEV in the ROHS and be consistent with the definition of the units. For this, the definitions in the *Definitions and Notes* section of Schedule I of the ROHS are:

> *"mg/m³: milligram per cubic meter (milligram of substance per cubic meter of air)*
> *ppm: parts per million (parts of gas or vapour per million parts of airborne contaminants per volume measured at 25°C and 101.3 kPa)."*

Consequently, one must conclude that the PEV *values* expressed in *ppm* are established for specific conditions of temperature and pressure while the PEV values when expressed in mg/m³ or in fibres/cm³ in the ROHS are *invariable* in relation to environmental conditions. This reasoning is based on two premises described in greater detail by Stephenson *et al.* (9), and by the ACGIH® in 2012 (10):

- The volume of air breathed in by a worker during his work day is not significantly different in relation to moderate variations in the ambient conditions of temperature and pressure;
- Absorption of a gas or vapour is related to the partial pressure of the substance involved (11).

This approach is also used by other organizations proposing reference values, such as OSHA's *Permissible Exposure Limits* (PELs) (12), the ACGIH's® Threshold Limit Values (TLVs®) (10), and NIOSH's *Recommended Exposure Limits* (RELs) (13). The aim of this approach is to limit the *quantity* of contaminant that can be inhaled by a worker, and is therefore similar to a *permissible dose approach*. It is important to emphasize that some countries such as *Belgium* (14) and *Australia* (15) have PEVs based on a *permissible concentration approach*. The reader must therefore be careful when comparing the literature from different countries because the manner in which compliance with a standard is verified may be different and lead to different conclusions.

To expose a worker, inhaling a certain volume of air for a certain period of time at a given dose and under different conditions, the PEVs in ppm must be adjusted in relation to the molar volume under the conditions of the site where the worker is located, or as a corollary, the concentrations in ppm for conditions other than NTP (normal temperature and pressure) must be corrected to "ppm at NTP" units before comparing them to the PEV expressed in ppm.

In Québec, for the very great majority of workplaces, the molar fraction that compares the molar volume under certain conditions to the molar volume at NTP (24.45 L) is close to unity. In this case, the permitted ppm concentrations will be practically equivalent to those at NTP. However, for extreme and rather rare conditions (for example for depth work in mines), the molar fraction can differ significantly from unity.

The following guidelines must be applied to verify compliance with PEVs:

- Calculate the exposure concentration expressed as mass per volume (at the sampling site and not adjusted for conditions at NTP). This concentration must be directly compared to the PEV in the ROHS expressed as mg/m³ or as fibres/cm³;
- If the exposure concentration is expressed in ppm (vol/vol) for *conditions other than NTP* (PT), this concentration must then be adjusted to bring it to NTP before comparing it to the PEV in the ROHS. A *computer-based tool* available on the IRSST's Web site easily performs this conversion for comparison to a PEV in the ROHS (16).

Equation 12: *Conversion of* ppm_{PT} *to* ppm_{NTP}

$$ppm_{NTP} = ppm_{PT} * \left(\frac{P}{760}\right) * \left(\frac{298}{T}\right)$$

P: pressure at the sampling site (mm of Hg)
T: temperature at the sampling site (°K)

It is important to emphasize the fact that *the concentration in mg/m³ or in fibres/cm³ must calculated with the sampling volume under site conditions and this concentration compared directly to the value of the PEV*. Care must be taken to know the volume sampled when using a flow measuring instrument and to ensure that the flow rate displayed by the instrument corresponds to the flow rate under site conditions. If an instrument displays an equivalent flow rate under certain calibration conditions, as is the case for hot-wire flow meters, this flow must be converted to the site conditions (see *section 2.6.2*). A reader who wants to investigate the subject in more detail can consult the *Mémento sur l'utilisation des pompes et des débitmètres* (17).

2.2 Gases and vapours

The term *gas* is reserved for substances that are effectively in the gaseous state at 25°C and 101.3 kPa. Gases have no shape; they occupy the space available to them. *Vapours* are compounds in the gaseous state, which, under normal conditions of temperature and pressure, are in the liquid state in equilibrium with the gaseous state. Several portable direct-reading instruments are available on the market for sampling gases and vapours. The most commonly used collecting mediums are sorbent tubes. Impingers, filters impregnated with reagents, and bags are also used for some compounds. (18)

2.2.1 Electronic direct-reading instruments

Technological improvements, the miniaturization of electronic devices, and developments in computer science have resulted in high-performing and portable direct-reading instruments (DRI). Computerized data acquisition and processing systems are integrated into the instruments, allowing the exposure doses to be displayed for variable periods. Detection techniques that have been used only in the laboratory can now be used in the field as a result of miniaturization. Table 4 gives the list of DRI available at the IRSST for evaluating gases and vapours. The interferences specific to each instrument are mentioned in their user's manual. These instruments can be affected by electromagnetic fields. However, some of them are intrinsically shielded against radiofrequencies. Other instruments can also be shielded against radiofrequencies if an exterior casing is used. Below is the list of the five operating principles for these DRI, with a brief description.

- amalgamation
- combustion
- electrochemistry
- infrared spectrophotometry
- photoionization

■ *Amalgamation*

Amalgamation is the phenomenon by which mercury forms an alloy with another metal. Even at very low concentrations in the air, mercury amalgamates with metals such as gold and silver. In the detector, the mercury vapours present in the air come in contact with a gold filament, and an amalgam forms, the effect being to increase the resistance of the filament. This increase in resistance is proportional to the amount of mercury amalgamated. By knowing the sampling volume, it is then possible to calculate the average concentration of mercury present as vapour in the air.

■ ***Combustion***

This principle is used to detect gases and vapours that burn in the presence of oxygen in the air. Combustible gases such as methane and ethane, vapours of organic solvents, and a few gases such as carbon monoxide (CO), hydrogen (H_2) and hydrogen sulfide (H_2S) can be detected using this principle. Air containing the gas circulates on a filament heated to a temperature above the mixture's ignition temperature. The heat emitted by combustion changes the electrical resistance of the wire, and this change is proportional to the concentration of the combustible gas/air mixture. Measuring instruments for combustible gases are calibrated in percentages of the lower explosive limit of a reference substance. This represents the lowest concentration of a mixture that can explode when it is exposed to an ignition source. Propane and ethane are the most commonly used calibration gases. Instruments operating on this principle are not very specific.

■ ***Electrochemistry***

Measuring instruments using the electrochemistry principle are used to analyze gases or vapours that can be oxidized or reduced by means of an electrical potential. An oxidation or reduction reaction is initiated at an electrode, by a controlled voltage. When the electrochemical detector is in contact with the substance, it measures a difference in current whose amplitude is proportional to the concentration of the contaminant in the air. However, other compounds with oxidation-reduction potentials below that of the targeted substance will interfere. Interference filters inside or outside the electrochemical cell can be used to eliminate undesirable substances.

■ ***Infrared spectrophotometry***

Instruments operating according to this principle can detect and measure the concentration of gases and vapours that absorb infrared radiation. Gas molecules absorb energy at wavelengths corresponding to changes in their energy state. The difference between the energy emitted by a source and the energy received by the detector is proportional to the concentration of the gas in the air. By establishing the source emission parameters, one obtains a specific measurement of the concentration of the compound to be determined in the air. It is important to note the strong absorption of water vapour molecules during infrared analysis. B&K 1302 monitors detect organic compounds by photoacoustics, meaning by measuring the pressure exerted on a microphone by a compound exposed to a wavelength in the infrared range. This wavelength is selected in relation to the compound to be determined. A compensation system eliminates certain interferences such as water vapour.

■ ***Photoionization***

This principle consists of ionizing an organic compound by the absorption of light energy. Photons emitted by an ultraviolet lamp ionize the compounds whose required energy is equal to or greater than their ionization potential. The ions produced are directed to a collector electrode, thus giving a measurement of the current which is compared to a reference concentration. These non-specific instruments are useful for detecting emission sources and as an exploration tool.

Table 4- Direct-reading instruments available at the IRSST

Contaminant	Formula	CAS	Phase	Instrument model	Principle	Measurement range	Accuracy	Response time** (sec)
Acetone	C_3H_6O	67-64-1	Vapour	B&K 1302	Infrared + Photoacoustic cell	> 0.4 ppm	± 3%	60
Ammonia	NH_3	7664-41-7	Gas	B&K 1302	Infrared + Photoacoustic cell	> 0.8 ppm	± 3%	60
				PAC III	Electrochemistry	0-200 ppm	± 3%	60
Nitrogen dioxide	NO_2	10102-44-0	Gas	PAC III	Electrochemistry	0-50 ppm	± 5%	15
Nitric oxide	NO	10102-43-9	Gas	PAC III	Electrochemistry	0-200 ppm	± 5%	30
Nitrous oxide	N_2O	10024-97-2	Gas	B&K 1302	Infrared + Photoacoustic cell	> 0.05 ppm	± 3%	60
Carbon dioxide	CO_2	124-38-9	Gas	GasAlert micro 5/IR	Infrared	0-50000 ppm	± 500 ppm (reproducibility)	30
				Q–TRAK Plus	Infrared	0-5000 ppm	± 3% + 50 ppm	60
				IAQ Probe	Infrared	0-5000 ppm	± 3% + 40 ppm	60
Carbon monoxide	CO	630-08-0	Gas	PAC III	Electrochemistry	0-2000 ppm	± 5%	35
				X-am 2000	Electrochemistry	0-2000 ppm	± 5%	25
				Q-TRAQ Plus	Electrochemistry	0-500 ppm	± 3% or*** 3 ppm	60
				IAQ Probe	Electrochemistry	0-250 ppm	± 3%	30
Formaldehyde	HCHO	50-00-0	Gas	Formaldemeter htV-m	Electrochemistry	0.05-10 ppm	± 10%	10 to 60
Combustible gases			Gas	Multi-RAE Plus	Combustion	0-100% LEL*	± 10% or*** 3% LEL	30
				X-am 2000	Combustion	0-100% LEL*	± 5%	15
Mercury	Hg	7439-97-6	Gas	Jerome	Amalgamation	0-1 mg/m^3	± 5%	12
Total organics			Vapour	Multi-RAE Plus	Photoionization	0-2000 ppm	± 10% or*** 2 ppm	10
				TOXI-RAE PID				5
Ethylene oxide	C_2H_4O	75-21-8	Gas	B&K 1302	Infrared + Photoacoustic cell	> 0.24 ppm	± 3	60
Oxygen	O_2	7782-44-7	Gas	Multi-RAE Plus	Electrochemistry	0-30 %	± 2% or *** 0.4 Vol%	15
				X-am 2000	Electrochemistry	0-25 %	± 1%	10
Ozone	O_3	10028-15-6	Gas	AeroQual, Series 500	Gas-sensitive semiconductor	0-0.5 ppm	± 10%	60
				Gas Alert Extreme	Electrochemistry	0-1 ppm	± 10%	60
Sulfur dioxide	SO_2	7446-09-5	Gas	PAC III	Electrochemistry	0-100 ppm	± 5%	20
Styrene	C_8H_8	100-42-5	Vapour	B&K 1302	Infrared + Photoacoustic cell	>0.12 ppm	± 3%	60
Hydrogen sulfide	H_2S	7783-06-4	Gas	PAC III	Electrochemistry	0-100 ppm	± 5%	25
				X-am 2000	Electrochemistry	0-200 ppm	± 5%	15

*: Lower explosive limit
**: T_{90}: time necessary to reach 90% of the final reading
***: The largest value of the two data

2.2.2 Colorimetric direct-reading devices

Colorimetric methods are among the simplest, fastest, and least costly methods. Their operating principle is based on the fact that the intensity of the developing colour is proportional to the concentration of a contaminant or a family of contaminants. Three types of devices are used, namely:

- Tubes connected to a manual or automatic pump;
- Long-duration tubes operating by passive diffusion;
- Chips containing capillary tubes requiring the use of an optical reader.

In the case of tubes connected to a pump, the concentration is a function of the sampled air volume. It is therefore important, after having broken the ends of the tube and connecting it to the pump, to comply with the time period necessary for the desired volume of air to pass through and the reaction to develop. Low concentrations can be evaluated by several strokes of the pump, according to the manufacturer's instructions.

Long-duration colorimetric tubes are designed in the same way as conventional colorimetric tubes. However, the quantity of the reactive substance in the support may differ, to allow long-term sampling without exceeding the reaction capacity of the impregnated substances. Long-duration tubes are generally graduated in ppm-hours. To obtain a weighted concentration, the change in colour reading is divided by the sampling time in hours.

The most recent system consists of a chip containing capillary tubes filled with a reactive substance. As with the above-mentioned devices, a colorimetric reaction occurs on contact with the contaminant, whose intensity is not read by the user but by an optical reader. The reaction time and the mass flow rate are also taken into consideration in calculating the concentration. Information about the contaminant, the mass flow rate and the measurement range are included in the bar code located on the chip. The interaction between the optical reader and the different chips is done using the instructions included in this bar code. Chips are available for some fifty compounds. An optical reader is available for loan from the IRSST.

The main limitations of these devices are their non-specificity and low accuracy. They are useful as source-detection devices, or to see variations in concentrations in space or time, or for following a single known contaminant. They cannot be used for evaluating a worker's exposure (19).

2.2.3 Sampling media

2.2.3.1 *Adsorbent tubes*

Adsorbent tubes are used to collect samples in the gaseous and vapour states such as solvent vapours, some gases, and acids. They are glass tubes containing two sections of adsorbent. These tubes may contain activated charcoal, silica gel, or certain polymers. By analyzing each of the sections individually, the efficiency of adsorption of the collecting medium can be verified. Sampling is considered as acceptable if less than 10% of the chemical is found in the second section. If more than 25% of the chemical is found in it, a loss has probably occurred and the results express a minimum concentration. However, this rule may vary when more than one substance enters the tube, thus promoting competition for the adsorption sites.

The ends of the tube are broken on the sampling site and connected to the pump by means of special devices. *The tube must be placed with the arrow in the direction of air flow. The tube must be vertical to prevent any channeling, which would reduce the adsorption efficiency.* The flow rate and sampling volume must be selected in relation to the indications given in the tables in Part 3 of this Guide and the sampling strategy chosen.

All the information collected during sampling must be noted. The tubes are sealed using plastic plugs and are stored *in a freezer at -4°C until shipment to the laboratory*. *The storage location must be solvent-free* (without bulk samples or sampling equipment such as *jars containing toluene*). Shipment to the laboratory in ice must take place as soon as possible to avoid a loss of adsorbed product.

2.2.3.2 Passive dosimeters

Sampling with a passive dosimeter involves the diffusion process. It is a phenomenon by which a solute in a fluid (for example toluene in air) goes from a concentrated region to a less concentrated region. The concentration gradient is ensured by the collection of molecules of the substance by an adsorbent located at the bottom of the dosimeter.

The *sampling rate* for a solvent is expressed in mL/min. This parameter is both a function of the substance and the geometric characteristics of the dosimeter. Each solvent therefore has its own specific sampling rate. Contrary to the use of a pump, contaminants are not collected at the same rate. A constant is used to calculate the results and it represents the time necessary for the dosimeter to sample a substance contained in one litre of air. Similar to adsorbent tubes, passive dosimeters can be affected by environmental conditions such as humidity, temperature and the co-adsorption of different molecules present in a work environment. For example, a temperature difference of 10°C results in a correction of 1.6%.

Two types of passive dosimeters are available at the IRSST: the 3M monitor for collecting several solvents, and the SKC UMEX dosimeter for measuring formaldehyde.

The 3M monitor can collect certain solvents. For a list of them, consult the user's guide[2] (in French only). Furthermore, a computer-based tool[3] (in French only) is available for calculating the concentration in mg/m^3 equivalent to a non-detected result for these 31 substances.

After sampling, it is important that the dosimeter be hermetically sealed once the diffusion membrane has been removed. For 3M monitors, the two openings must be tightly sealed. UMEX samplers have a sliding cover that must be placed over the sampling zone. Subsequently, the plastic end supplied with the 3M monitor will be used during the analysis; it must be included in the dosimeter box.

Similar to adsorbent tubes, dosimeters are kept *in a freezer at -4°C until shipment to the laboratory*. *The storage location must be solvent-free* (without bulk samples or sampling equipment such as *jars containing toluene*). Shipment to the laboratory in ice must take place as soon as possible to avoid a loss of adsorbed product.

2.2.3.3 Impingers

Impingers are used for sampling a few inorganic acids and organic compounds. The collecting solution in the impinger is then analyzed to quantify directly the chemical being sampled, or to quantify a substance resulting from a chemical reaction between the substance and the collecting solution. Impingers are made of glass or polyethylene; spill-resistant impingers, inserted into holsters, are also available for personal sampling.

Two types of impingers are used: the midget impinger and the glass fritted tip impinger. The midget impinger is used to collect contaminants that are very soluble in the collecting solution or that react very rapidly in it. The glass fritted tip impinger is used for more efficient collection of compounds that are not very soluble in the collecting solution. In fact, since fritted glass forms currents of fine and dispersed bubbles, it increases the contact surface

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[2] http://www.irsst.qc.ca/files/documents/PubIRSST/guide3M.pdf

[3] http://www.irsst.qc.ca/files/documents/fr/Utilitaires/VMR-DOS.xls

between the air flow and the absorbing medium, thus improving the absorption efficiency.

If the sampled air contains particles that could plug the pores of the fritted glass or interfere with the analysis, a nonreactive and nonabsorbent prefilter must be used. For all sampling, a trap must be placed between the sampling impinger(s) and the pump in order to protect the latter from any accidentally aspirated collecting solution. An empty midget impinger is then used as the trap.

The calibration system includes a prefilter (if necessary), the sampling impinger containing the appropriate volume of solution, the trap, and flexible tubing of the same dimensions as that used during sampling. Since the flow rate can be affected by the water vapour pressure, it is suggested that a drying tube be inserted between the impinger and the flowmeter (18).

On the sampling site, the waxed wrapping film or plastic plugs used to seal the impinger are removed, and the outlet of the impinger (side arm) is connected to the trap, which is itself connected to the pump by means of flexible tubing.

For sampling with impingers, too large a sampling volume may lead to saturation and significant evaporation of the solution, while too small a volume may reduce the precision and sensitivity of the analysis. At the end of sampling, the impinger's openings are sealed with waxed wrapping film. The samples must be returned to the laboratory for analysis as soon as possible in the shipping boxes supplied. If they cannot be shipped immediately to the laboratory, they must be stored in a refrigerator.

2.2.3.4 Sampling bags

Sampling bags are used to collect certain gases. The phenomena of diffusion across the walls and adsorption on the walls of the bag affect the choice of materials for a given compound and the time that the sample can be kept (20). Bags are made of different polymeric materials and are available in different volumes.

Samples are collected in 2-litre or 5-litre 5-ply aluminized bags. However, due to the diffusion or stability of some reactive gases, this type of sampling bag is not recommended mainly for hydrogen sulfide (H_2S), sulfur dioxide (SO_2) and nitrogen dioxide (NO_2) (21).

When the workplace contains a significant concentration of airborne dust, a prefilter may be necessary at the bag opening to eliminate this dust. On the sampling site, the bag is connected to the pump's air outlet by means of flexible plastic tubing (Tygon®). Flexible polyester tubing and rubber tubing absorb certain gases and are therefore not recommended.

The sampling volumes recommended for gases correspond to minimum volumes, which allow a precise determination. The flow rates are chosen by the user in relation to the sampling time (application of the TWAEV or STEV).

Sampling is carried out at atmospheric pressure, and the final pressure inside the bag must be equal to the atmospheric pressure. Once sampling has been completed, the valve is closed and sealed.

Humidity is a very important factor due to the phenomenon of dissolution of gases in water; temperature variations must therefore be avoided, since these would lead to condensation inside the bag. The samples must be sent to the laboratory within 48 hours of sampling to maintain their integrity.

2.2.3.5 Special cases of reactive substances

Some particularly unstable substances such as aldehydes, chlorine dioxide and isocyanates must be stabilized during sampling. To do this, a judiciously selected chemical reagent that will react with the substance to be determined will be used in order to form a stable nonvolatile compound for sensitive and specific analysis in the laboratory. This reagent may be present on the tube's adsorbent, on impregnated filters, or be part of the desorbing solution. In this latter case, the filter must be immediately transferred to a jar containing the reagent in solution. It should be emphasized that this process applies to aerosols as well as to gases and vapours.

2.2.3.6 Blank sample

For each sampling series, a blank must be provided. The recommended number of blanks is 10% of the total number of samples. However, in the case of asbestos sampling, a minimum of two blanks must be provided or 10% of the total samples, whichever is greater. The blank undergoes the same procedures as the samples (opening, sealing and transport) except that it is not used for sampling. It must be from the same lot as the samples.

2.3 Aerosols

2.3.1 General definitions

An aerosol can be defined as a suspension of solid or liquid particles in a gaseous medium. These particles can be formed by the mechanical fractionation of a starting material (wood, ore, etc.), by condensation, or by chemical reaction between gaseous pollutants. Fumes are aerosols that result from the condensation of metal vapours or the incomplete combustion of organic compounds (welding fumes, soot, etc.).

The substances making up the particles of an aerosol can enter the body directly by inhalation, but also indirectly by ingestion or skin absorption by means of several mechanisms, such as dissolution. In addition, these particles can act on the body in many ways, producing allergenic or irritant effects. The potential health risks of aerosols therefore depend on the toxicity of their particles, their size, their concentration, as well as their mechanical, chemical or biological properties.

2.3.1.1 Solid aerosols (dusts and fumes)

Dusts can be classified into two general groups: dusts with adverse health effects and dusts with no known toxic effects (nuisance dusts or particulates not otherwise classified). The latter are not biologically inert. They can interfere with the mechanisms of clearing of airways (10). According to the ROHS, a TWAEV of 10 mg/m³ (total dust) applies to these "nuisance dusts." The ACGIH® recommends two values for these dusts: 3 mg/m³ (respirable fraction) and 10 mg/m³ (inhalable fraction) to prevent these pulmonary effects.

Dusts with adverse effects are divided into fibrogenic, toxic and carcinogenic dusts. These dusts undergo specific sampling and analysis due to the nature of the standards governing them.

Welding fumes cannot be easily classified. Their composition depends on the materials to be welded, the electrodes, and the processes used. According to the ROHS, a TWAEV of 5 mg/m³ applies if there are no toxic components present in the welding rod, in the metals to be welded, or in their coatings. When welding fumes contain components with a toxicity greater than that of iron oxide (in terms of TWAEV), a complete analysis must be done on the toxic components likely to be present, applying the standards specific to each of these products individually.

2.3.1.2 Liquid aerosols

Aerosols whose particles are liquid rather than solid can be present in a work environment. For example, oils or acids that are not very volatile can be found suspended in the air, forming a mist. They are collected on a filtering membrane by means of a sampling pump. Occasionally, this filter must be placed as quickly as possible in a stabilizing solution, as is the case for isocyanate oligomers.

2.3.2 Experimental definitions

The locations in the respiratory tract where aerosol particles are deposited generally depend on the aerosol's aerodynamic diameter. The health effects of particles that enter the body by inhalation therefore depend mainly on this parameter, but also on the material of which they are made, the amount of this material, and the characteristics of the respiratory tract where they are deposited. After several years of debate, different committees and institutions have agreed about the quantification of an aerosol's potential health risks by establishing three fractions for evaluating the quantity of material likely to be deposited in specific regions of the respiratory tract. Each of these fractions is based on the cause/effect principle so that the mass concentration likely to be deposited in a region of the respiratory tract can be associated with the generally observed occupational diseases.

The *inhalable fraction* targets the entire respiratory tract and is applicable to particles presenting health risks independent of their deposition site. The *thoracic fraction* applies to the particles presenting a hazard to the intermediate pulmonary pathways and the gas exchange region. Finally, the *respirable fraction* includes particles that present a danger when they are deposited in the gas exchange region. These three fractions, which can theoretically be related to specific zones in the respiratory system, have experimental definitions (10).

For aerosols, the permissible exposure values of the ACGIH® and Europe are expressed in relation to these three fractions: inhalable, thoracic and respirable. In Québec, they refer to two categories of dusts, namely total dusts and respirable dusts. Schedule I of the ROHS refers to these categories to which the PEVs apply. For each of the regulated substances, the sampling method specifies a sampling device and suggests, as needed, a selection device that allows certain sampling requirements to be met.

2.3.2.1 Inhalable fraction

The inhalable fraction corresponds to the mass of particles whose aerodynamic diameter (d_a) is between 0 and 100 µm and that are collected by a sampler whose collection efficiency (E_i) curve, regardless of wind velocity and direction, is the following:

Equation 13: *Collection efficiency of inhalable dust sampler* $\boldsymbol{E_i}$

$$\boxed{E_i = 50\% * (1 + \mathrm{E}^{-0.06 d_a})}$$

d_a = *aerodynamic diameter*

A sampling device exists for evaluating this fraction (*section 2.3.3.1.2*) but its use is limited to a preventive context since no universal conversion factor allows a new permissible exposure limit to be calculated for the inhalable fraction from the actual exposure limits expressed as total dusts. Schedule I of the ROHS gives PEVs only for *total* dusts (*section 2.3.2.4*) and not for the inhalable fraction.

2.3.2.2 Thoracic fraction

The thoracic fraction corresponds to the mass of particles that would be collected by a sampling device whose collection efficiency curve (E_t) would be:

Equation 14: *Collection efficiency of a thoracic dust sampler* $\boldsymbol{E_t}$

$$\boxed{E_t(d_a) = E_i * (1 - F(x))}$$

d_a = *aerodynamic diameter*
x = *Ln (da/Γ)Ln (Σ)*
Γ = *11.64 µm (median diameter of the cumulative lognormal distribution)*
Σ = *1.5*
$F(x)$ = *cumulative probability function of the standardized normal variable x*

2.3.2.3 Respirable fraction (respirable dusts)

The respirable fraction corresponds to the mass of particles that are collected by a sampler whose collection efficiency curve (E_r) in relation to the aerodynamic diameter of the particles is described by a cumulative lognormal function with a median diameter of 4 µm and a standard deviation of 1.5. This definition is represented by the following equation:

Equation 15**:** *Collection efficiency of a respirable dust sampler* $\boldsymbol{E_r}$

$$\boxed{E_r(d_a) = E_i * (1 - F(x))}$$

d_a = *aerodynamic diameter*
x = $Ln\,(da/\Gamma)Ln\,(\Sigma)$
Γ = *4.25 µm (median diameter of the cumulative lognormal distribution)*
Σ = *1.5*
$F(x)$ = *cumulative probability function of the standardized normal variable x*

2.3.2.4 Total dust

The term "total dust" has an experimental definition based on a sampling technique that refers to the quantity of dusts collected on a 37-mm diameter filter placed in a closed cassette with a 4-mm opening. There is no international consensus on this experimental definition of total dust. The choice of this sampling device is based on practical considerations such as the preservation of the integrity of the sample, the ease of handling, etc. A cassette with a 4-mm opening results in an underestimation of dusts whose aerodynamic diameter exceeds approximately 20 µm. This way of sampling therefore does not provide an effective evaluation of the health risks of an aerosol for the upper airways, namely the nose, mouth, pharynx and larynx. Theoretically, these risks would be better evaluated by sampling the inhalable fraction as defined above. Total dust corresponds historically to a cleanliness index rather than to a fraction that can be associated with a target zone in the respiratory tract. For solid or liquid particles, the PEVs in the ROHS are expressed in terms of total dusts.

2.3.3 Evaluation methods

Aerosol particles are generally sampled in the breathing zone or by stationary sampling using a personal pump placed in series with a sampling device. The pump aspirates the aerosol through the sampling device, which will collect the particles reaching it. When desired, a particle selector can be placed in series upstream from the sampling device so that it collects only a specific fraction of the ambient aerosol. Despite the fact that stationary sampling allows an easy comparison of various equipment or collectors, it is important to remember that the PEVs in the ROHS apply to the worker's breathing zone.

The pump flow rate must be checked before and after sampling. All information relating to sampling and necessary for the analysis, such as flow rate, sampling time, temperature, pressure, humidity and the substances present in the workplace likely to interfere with the analytical method must be noted. Samples are shipped to the laboratory as soon as possible for analysis. Although available, direct-reading instruments for aerosols are not considered as a reference method.

2.3.3.1 Sampling devices

2.3.3.1.1 Cassettes for sampling total or respirable dust

Aerosols are generally collected by filtration on a membrane. The most common sampling device consists of a 2- or 3-section cassette made of plastic material, and a porous support on which a filter or membrane is placed. The cassette sections are pressed together and a cellulose strip seals the joints between the two or three sections. It is important that the cassette be tightly sealed. If the different sections of a cassette can move, the seal is not total. Such a cassette should not be used. Two diameters of cassettes are available, namely 25-mm and 37-mm, with a 4-mm inlet orifice. Cassettes with a 25-mm diameter are used mainly for asbestos sampling or inside a mask during welding. Membranes or filters with different porosities and compositions are available. Membrane selection is based on the nature of the substance to be sampled and the analytical method used.

On the sampling site, the plugs are removed and the cassette is connected to the sampling pump by means of flexible tubing. At the end of the sampling, the cassette is resealed and placed in the shipping box, with the filter upwards to avoid as much as possible any loss of dust.

To sample organic dusts or dusts causing deposition problems (for example: wood, starch and peat dust, electrostatic dusts), it is recommended that Accu-Cap™ filters be used for sampling. This filter consists of a capsule that is used to collect the dusts, in order to eliminate the loss of dust on the inside walls of the cassette during laboratory handling. Since the filter and its enclosure undergo gravimetric measurement, underestimation due to lost dust is practically eliminated.

The previously described cassettes are used for total dust sampling as defined in *section 2.3.2.4*.

2.3.3.1.2 Cassettes for sampling inhalable dusts

The inhalable fraction of an aerosol can be sampled using a sampling device with a 15-mm diameter inlet orifice such as an IOM cassette. This type of collector allows more effective sampling of particles of larger aerodynamic diameters than the conventional closed cassette. However, the concentrations obtained have no legal significance since the PEVs in the ROHS are established for total dusts. Nevertheless, the measurement of inhalable dusts should be encouraged in the context of a prevention process. For the time being, the IRSST does not provide occupational health practitioners with this type of cassette for sampling the inhalable fraction.

2.3.3.1.3 Cascade impactors

Impactors classify an aerosol's particles into multiple portions, with each portion being between two precise aerodynamic diameters, and determine the mass concentration of each of the portions. Cascade impactors are the type most commonly used and consist, in general, of several impaction stages of different thicknesses placed in series, thus explaining the name cascade. Each stage has a series of orifices on its surface whose geometry increases the velocity of the air and the particles in it. The thickness of a stage and the velocity of the particles through the orifices of a stage are such that only particles whose aerodynamic diameter is sufficiently small can follow the air flow and reach the orifices of the following stage. The particles that cannot reach the orifices of the next stage will impact on the top of the following stage. The tops of the impaction stages must be coated with a substance such as silicone, whose purpose is to make the particles adhere to the surface. Sometimes, to facilitate analysis, filters can be placed on the stages and specially cut for this purpose. Cascade impactors are not available at the IRSST.

2.3.3.2 Selective devices

For reasons related to the physical and toxicological properties of aerosols and their capacity to penetrate to different levels of the respiratory system, it is important in certain cases to eliminate some of the aerosol in order to sample specific portions. Different types of selectors exist, which are placed in series with the sampling head.

2.3.3.2.1 Cyclone

During sampling, cyclones eliminate aerosol particles whose aerodynamic diameters exceed the cut point diameter according to a certain efficiency curve. Particles that enter the cyclone and that cannot follow the rapid circular flow to which they are subjected are projected onto its walls and are collected in its grit pot. Any cyclone whose efficiency is recognized by the scientific community for sampling respirable dusts and that meets the desired performance criteria can be used. Based on our current knowledge, the nylon cyclone, which is most frequently used, allows the segregation of respirable dusts as defined by the ISO[4]/ACGIH®/CEN[5] criterion and given by Equation 15. When this cyclone is used, the flow rate must be set at 1.7 L/min *under the actual sampling conditions* so that the respirable fraction of an aerosol is sampled. It must be placed in

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[4] International Organization for Standardization

[5] European Committee for Standardization

series before the filter holder.

2.3.3.2.2 Cotton elutriator

The cotton elutriator, which is placed in a vertical position during sampling, consists of a cylinder whose two ends are conical. The air enters the elutriator from its lower end and comes out through a filter that is placed at the end of the upper cone. The recommended air flow of 7.4 L/min generates an upward air flow in the cylindrical section of the elutriator that is equal to the sedimentation rate of particles with an aerodynamic diameter of 15 µm which are carried downwards. All particles smaller than this diameter will be carried upwards and collected by the filter provided for this purpose. The parameters of this device and its cut point diameter were planned for use with cotton fibres. It should be noted that this cotton sampling is not carried out in the worker's breathing zone.

2.3.3.3 Direct-reading instruments

The conventional sampling methods for aerosols described above remain the most reliable, despite the fact that instruments for instantaneous reading of the concentration are now available on the market. Most of these devices, which use different measuring principles such as gravimetric analysis, and optical aerodynamic and mechanical properties, and mobility in force fields (17) must be used with discernment in the context of an exploratory approach or for very specific studies. In fact, most of these direct-reading instruments for aerosols require calibration with the dusts present in the workplace in order to obtain reliable results. As well, they must be maintained, which can be painstaking and costly.

"DustTrak" direct-reading instruments are available at the IRSST. They can be used for exploratory studies. Due to their sensitivity to particle size, and to the nature and concentration of the dusts present in an environment, these devices cannot replace reference sampling methods.

2.4 Compressed breathing air

Section 48 (Air supply) of the ROHS stipulates that:

> *"Compressed breathing air for supplied-air respirators or self-contained respiratory protective apparatuses referred to in section 45 must comply with CSA Standard CAN/CSA-Z180.1-00, Compressed Breathing Air and Systems, and compressed breathing air that supplies diving equipment must comply with CSA Standard CAN3 Z180.1-M85, Compressed Breathing Air and Systems"*

Section 12.1 of the ROHSM indicates that the quality of the compressed air supplied to any breathing apparatus shall comply with CAN3-Z180.1-M85, which specifies, among other things, purity criteria and frequency of analysis.

A sampling device is available at the IRSST for all samples in the distribution network in accordance with CAN/CSA-Z180.1-00. An instruction guide and the required sampling equipment are included. An overall analysis report specific to the compressor is issued by the IRSST.

2.5 Microorganisms (bioaerosols)

2.5.1 Introduction

Microorganisms are microscopic living things. They are present in all environments: water, soil, air, plants, animals, humans. In sufficient concentration, some may cause health problems. However, for the majority of them, dose/effect relationships have not been established. In Québec, there are no PEVs for microorganisms. They are therefore evaluated in a preventive context. It must however be noted that no visible growth of moulds is acceptable in a work environment.

For an industrial hygiene study, the approach favoured by the IRSST is the one established by the ACGIH's® American Committee on Bioaerosols, namely the evaluation of viable bioaerosols, meaning living microorganisms present in the air (22). The bioaerosols analyzed at the IRSST are heterotrophic aerobic bacteria, Gram negative bacteria and their endotoxins, and total moulds. Some species or some genera can be specifically investigated. Comparison of species and concentrations at the measuring stations in relation to those in the upwind outdoor air is the basic parameter used for determining whether there is proliferation. This comparison is particularly useful for moulds. For heterotrophic aerobic bacteria, Gram negative bacteria and endotoxins, threshold limit values are proposed in the literature for some work environments.

2.5.2 Air sampling

Two air sampling methods are available for bacteria and moulds based on the microorganism concentrations expected in the work environment. For high concentration environments, meaning greater than 10,000 CFU/m³ (colony forming units), sampling on polycarbonate filters is recommended at a flow rate of 2 L/min for 20 minutes.

For other situations, the standard method based on the use of the Andersen impactor must be used (Figure 10). The modified N-6 version of the impactor, consisting of a single impaction stage, is normally used. Microorganism sampling requires a collecting medium capable of keeping the microorganisms alive.

Microorganism impaction is on a nutrient medium containing agar. The composition of this agar varies with the group of microorganisms investigated. In general, malt extract is used to isolate moulds; bacteria are collected on trypticase soy or nutrient agar. Several other differential or selective media can be used, depending on the microorganisms investigated.

At the start of sampling, the instrument's flow rate is adjusted to 28 L/min using a flow meter or a rotameter. It will be checked at the end of sampling in order to calculate the average flow rate necessary for quantitative analysis (*section 2.7.1.2*). In general, in rather uncontaminated environments such as office buildings, sampling is done over a two- to five-minute period. This period is shorter for more contaminated environments. Preliminary sampling can be done to determine the necessary sampling times.

The Andersen instrument is disinfected with 70% ethanol prior to sampling. The alcohol must be completely evaporated.

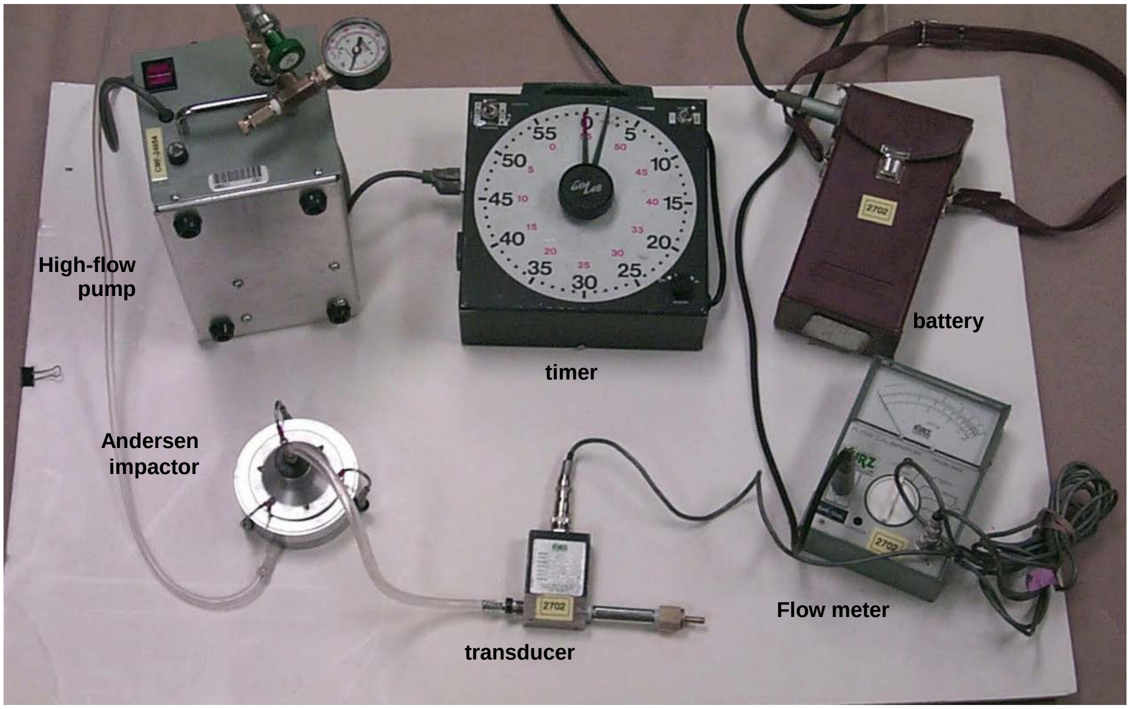


Figure 10- Sampling train for microorganisms

It is ***important*** to minimize the time the petri dishes are open. Once sampling has been completed, the petri dishes are hermetically sealed with a strip of parafilm and placed upside down to avoid the sample being contaminated should condensation occur. All petri dishes must be identified with their place and time of sampling. A self-adhesive label is placed on the side of the petri dishes. A blank must be produced for every 10 samples, or for each location if less than 10 samples are collected.

Warning

- The agar must never come in contact with anything.
- The inside of the head of the Andersen instrument must *not be touched*.
- Movements around the instruments must be kept to a minimum during sampling.
- Petri dishes must be kept closed for as long as possible.
- Sampling must begin immediately once the agar has been exposed to air.
- Sampling must be restarted if there is coughing or sneezing near the sampler.
- It is recommended that two samples be collected simultaneously.

Endotoxins are sampled on a glass fibre filter at 2 L/min for 4 hours.

2.5.3 Surface sampling

Occasionally, surface sampling by means of swabs, Bio-tape, sponges or samples of materials (bulk samples) can be done on surfaces to locate sites of proliferation, but the interpretation of such results is complex and can only be qualitative.

An initial approach suggests microscopic characterization of the mycological structures, which can help in the rapid confirmation of the presence of a site of proliferation. This does not require growth; however, it does not identify the strains present. It is important to note that characterization by mycological structure is not achievable using swab samples.

A second approach proposes characterization following the growth of the viable microorganisms present in the sample. This method is used to detect lower levels than mycological structure characterization because a single viable cell can be detected if conditions favourable to its growth are met. This approach allows bacteria and moulds to be analyzed. It is used for sponge or wipe samples and/or samples of various materials that can provide information on the workers' probable exposure. It should be noted that identification by growth cannot be done on Bio-tape.

Sterile swab sampling is done by rotating the swab on the surface to be sampled. A 100-cm² surface to be sampled must be completely wiped with the swab to collect this sample. The entire surface of the agar is then inoculated using the same principle of rotation. This method allows qualitative analysis only.

For microbial analyses on slides, sponges and bulk samples, refer to the sampling protocol (in French only) available at the IRSST (23). Bio-tape is used for sampling smooth surfaces that are not contaminated by a significant amount of material. The analyzed surface must not be made of friable material. After removing the protective tape, apply the adhesive part of the slide to the surface to be sampled. Only the presence or absence of mycological structures will be reported.

Sterile sponges are useful for sampling irregular dusty surfaces, or when large surfaces must be sampled. Use the gloves provided and rub the sponge on the surface to be sampled. Place the sponge in the section of the bag that was not previously opened. Sponge samples will be extracted and diluted before analysis. A too large amount of material causes less interference with this type of analysis; however, a too small amount of moulds will not be detected. It should be noted that contrary to the use of Bio-tape, sponge samples can subsequently be used to identify microorganisms by growth.

Characterization by mycological structure and identification by growth of the microorganisms can be done on a bulk sample when the material is suspected of being contaminated. Use alcohol for cleaning the tools that will be used for sampling. It is preferable to use gloves (e.g., latex) for sampling. Place the sample in a clean self-sealing bag or a sterile container (i.e., for a urine sample). The amount of material supplied must be sufficient to allow appropriate analysis in the laboratory (minimum of one tablespoon or 10 mL).

2.5.4 Specific considerations

The shipping times are 48 hours when growth characterization is requested, whereas there is no specific time frame for mycological structure analysis.

The samples must be shipped to the laboratory within 24 hours of their collection. Any delay must be noted in order to ensure the validity of the results.

2.5.5 Analytical methods

Two methods are available for evaluating viable bacteria and moulds. The basic method consists of counting the colonies formed following an incubation period specific to the investigated microorganisms. Counting is done by optical microscopy. Subsequently, if the situation justifies it, identification can be done. To do this, each of the different colonies found on the initial agar must be reinoculated on a specific agar, incubated again, and identified by different techniques. Bacteria are identified by a series of biochemical tests or by analysis of their fatty acid profile, while moulds are identified by morphological observation.

Transmitted light microscopy is used for mycological structure characterization analysis. Observation is done directly on the slide or on an aliquot of the suspension collected after extraction of the supplied materials (sponge, bulk) placed between the slide and cover slip.

Endotoxins are analyzed using the limulus amebocyte lysate (LAL) method and the determination is done by kinetic chromogenic analysis using a spectrometer at a wavelength of 405 nm.

The technical guide *Bioaerosols in the Workplace: Evaluation, Control and Prevention Guide* (24) describes the process recommended by the IRSST for preventing, controlling and evaluating microorganisms in the workplace. It is recommended that this document be consulted when planning an intervention.

Due to the complexity and the time required for bioaerosol identification and endotoxin determination, a *prior agreement must be arrived at with the person in charge of the IRSST's microbiology laboratory***.** For these same reasons, when the count is below 250 CFU /m³, the species will not be identified.

2.6 Samples originating from a bulk

Samples originating from a process or starting materials (commonly called *bulk samples*) are sent to the laboratory in the three following cases.

2.6.1 As a reference product

The substance is used or can be used as a calibration solution. This is the case when analyzing mixtures of hydrocarbons such as VM & P naphtha, Stoddard solvent and rubber solvent (25). In these cases, the reference solutions are complex mixtures of hydrocarbons of variable composition. It may be necessary to use the mixture found in the workplace as the calibration solution, since it is the source of exposure.

2.6.2 Composition analysis

A starting material or a deposited dust is sent for analysis when all other means of obtaining information have proven ineffective; this includes reviews of the literature, and consulting the supplier, manufacturer and the CSST's *Répertoire toxicologique* (*Toxicological Index)*.

When a composition analysis is requested, the following information must be provided: the type of industry, the nature of the process, the type of exposure, the exposure-related health problems, the suspected chemicals, and particularly the safety data sheet when a commercial substance is involved.

2.6.2.1 Liquids

Organic

For organic solvents, analysis can be carried out using the solution, or preferably, saturated activated charcoal tubes, thus allowing the main volatile components of the mixture to be quantitatively determined by gas chromatography coupled with mass spectrometry. This analytical technique is also used to confirm the presence of a specific substance in a mixture (for example, the presence of benzene in paint naphtha). This determination is carried out using a saturated tube or the solution. When there is saturation of a tube (IRSST # 2120), a flow of 0.2 L/min for a minimum of 4 hours is recommended.

Inorganic

For ion or pH determinations, the liquid solution is shipped.

Liquid organic and inorganic samples must not be shipped in the same box as other samples to avoid contamination, and must be properly identified with the corresponding requisition number.

2.6.2.2 Bulk samples, sedimented dusts or materials

For these dusts, the following analyses are possible:

- Mineralogical and morphological characterization;
- Identification of the crystalline forms of silica:
  quartz, cristobalite and tridymite. Tridymite cannot be identified when quartz and cristobalite are present. Furthermore, this polymorph of crystalline silica is not extensively documented in the literature.
- Metal identification;
- Identification of fibrous substances and estimation of the fibre content, used mainly in the application of the *Safety Code for the construction industry* (26) (polarized light microscopy, method 244-2). All the fibres mentioned in the ROHS can be analyzed.

The necessary quantity of dust is approximately 3 grams; it must be collected in 60-mL bottles available from the IRSST, or in self-sealing bags.

2.6.3 Surface test

To orient the sampling strategy, preliminary tests can be performed. The IRSST has mainly developed several surface tests that are grouped into two categories.

1. With colorimetric development for:
   - Chromates
   - Cyanides
   - Aliphatic isocyanate (HDI)
   - Aromatic isocyanates (MDI and TDI)
2. With subsequent laboratory analysis for:
   - Metals (on filter)
   - Beryllium (on wet wipe)
   - Mycological structure (on Bio-tape)
   - Mycological structure and/or identification of moulds by growth (on a sponge)

The contents of these surface identification kits are described in Appendix 1 of this guide.

2.6.4 Granulometric analysis of dusts

Particle size can be determined from the passage of a known mass of dust into a nest of sieves. This type of particle size analysis is flexible because the sieves can be easily inserted or removed, and the particle size distributions containing the size fractions most pertinent for a user's specific problems can be obtained. This technique consists of separating particles by fractions from 1000 µm to 1 µm in diameter. The amount of dust necessary for this type of analysis is important, since a minimum volume of 2 litres of dust must be supplied. The IRSST offers a granulometric analysis service. It is important to note that this technique cannot be used to evaluate inhalable, thoracic and respirable fractions.

2.7 Description of the sampling systems

Evaluation of an air contaminant requires a system for collecting a given volume of air, a collecting medium, and an analytical method. It generally includes the following components: pump, tube, cassette-filter unit, cyclone, etc. Calibration of a sampling system, meaning the adjustment of the air flow through it requires the use of a flow meter and will depend on the pump and ambient conditions on the sampling site and calibration site. The following sections describe the flow meters and pumps most commonly used in industrial hygiene and discuss the effects of temperature and pressure on their mechanism and on their calibration.

2.7.1 Sampling pumps

Pumps are the devices most commonly used in industrial hygiene for sampling a known volume of air for the purpose of determining the concentration of the contaminants present. The pumps most used are high flow, low flow, and very high flow pumps.

2.7.1.1 Personal pumps

Personal sampling pumps are classified in two categories: pumps with low flow rates which generally operate in the 1 to 500 mL/min range, and high-flow pumps which operate from 1.0 to 5.0 L/min. They operate independently due to rechargeable batteries, thus ensuring at least 8 consecutive hours of sampling during the work period.

Use of a pump assumes periodic verification of the flow rate in order to ensure that it remains constant. Generally, the flow control mechanisms on some pumps are designed to maintain this constant flow despite the drop in battery voltage and normal clogging of the collecting medium. Flow checks, at least at the start and end of sampling, are used to determine the average flow and, if need be, to detect poor functioning of the pump. The difference between these flow measurements must be less than 5% (21).

Utilization temperatures of the main pumps

Manufacturers generally mention a temperature range in which pumps can be used with complete confidence:

Table 5- Temperature range for the use of some personal pumps

Manufacturer and model	Interval
GilAir, GilAir 5	-20°C to 45°C
Gilian HFS 113	
SKC PCxr-7 SKC PCxr-8	

2.7.1.2 Very high flow pumps

Very high flow pumps are used for sampling in the general ambient environment when a large amount of material is to be collected for analysis or when a large sampling volume is needed to collect sufficient contaminant in a context in which the concentrations in the air are very low.

Microorganism samplers and cotton elutriators use pumps able to operate at high air flow rates. The necessary air flow rate is 28.3 L/min for the Andersen® sampler, and 7.4 L/min for the cotton elutriator. For the cotton elutriator, a critical orifice is used to maintain a constant flow.

2.7.2 Flow meters and flow measurement

The precise determination of the flow rate is a key aspect of occupational hygiene sampling. It is measured using a flow meter. There are several types of flow meters, which use different operating principles. Their precision, variable from one model to another, is found in the manufacturer's specifications. The four most common models are the following:

- Bubble flow meter (conventional burette or electronic version), e.g., Gilibrator;
- Piston flow meter, e.g., Drycal;

- Rotameter, e.g., Matheson;
- Mass flow meter, e.g., Kurz and MKS.

The flow circulating in a flow meter is not always the one displayed. To determine the actual flow circulating in a flow meter that is being used under conditions different from its calibration conditions, it is necessary to know:

- The temperature and pressure during the measurement;
- The flow meter's calibration conditions;
- The flow meter's operating principle.

The components found in a calibration train are preferably placed in line in this order: pump, collecting medium and flow meter.

Figure 11- Calibration of a sampling train

Ideally, the flow meter must not disrupt the flow to be measured. When the flow meter used or some component causes significant head loss during calibration of certain instruments, a flow compensated method must be used. In these cases, a source of air (a pump equipped with an air outlet, for example) in series with a flow meter, connected to a pressure gauge connected directly to the instrument's input, must be adjusted until the pressure on the pressure gauge is equal to that of the ambient environment. When this equilibrium is reached, the flow rate read on the flow meter corresponds exactly to what the instrument would aspirate in the open air.

Sometimes, it is impossible to connect a component such as a cyclone directly to a measuring system. In these cases, the component must be placed in a tightly sealed receptacle with two or three connection ports. If the flow meter is a bubble flow meter and causes no head loss, only two connection ports are needed: one to connect the flow meter, and the other to connect the pump. However, if the flow meter being used causes a significant head loss, the flow compensated method will have to be applied, and the recipient will have to have three connection ports: one to connect the flow meter, another to connect the pump or the instrument, and the third to connect the pressure gauge.

Figure 12- Calibration with a cyclone

Utilization temperatures of the main flow meters

Manufacturers generally mention a temperature range in which flow meters can be used:

Table 6- Utilization temperature intervals of some flow meters

Manufacturer	Interval
MKS	15°C to 40°C
Kurz	0°C to 50°C
Gilibrator	5°C to 35°C
DryCal	0°C to 40°C
Rotameter	-30°C to 120°C

Computer-based tool for flow correction

The following sections describe the necessary flow corrections for each type of flow meter by taking into account that the pump is calibrated **on the sampling site**. To make the calculation process easier, a *computer-based tool* (27) is available on the IRSST's Web site for applying the flow correction equations in relation to various types of flow meters.

2.7.2.1 *Bubble flow meter or piston flow meter*

The soap bubble flow meter, the electronic bubble flow meter, and the piston flow meter are effectively considered primary standards for flow measurement because their means of detection is based on measuring a space or a volume whose dimensions are fixed and invariable in relation to the temperature and pressure. A soap film flow meter or a burette can be used to directly obtain the volume or the flow rate.

When the flow meter is used under conditions in which the relative humidity is below 50%, the air volume circulating above the solution in the flow meter can be humidified (28). A correction must therefore be made for this volume of water that was not part of the original volume. This is done by assuming that the gas will become saturated with water vapour, and by subtracting the water vapour saturation pressure from the ambient pressure as shown in the following relationship:

Equation 16: *Flow correction in relation to the water vapour pressure*

$$\boxed{Q_s = \frac{(P_s - P_{vap})}{P_s} * Q_{flowm}}$$

Q_s: real sampling rate
P_s: absolute ambient pressure (mm of Hg)
P_{vap}: water vapour saturation pressure (mm of Hg)
Q_{flowm}: flow indicated on the flow meter (Q_{read})

The values for the water vapour saturation pressure in relation to the different temperatures are available in the literature (29). The *computer-based tool* described in the previous section takes these values into account in calculating the real flow rate.

The piston flow meter requires no correction.

2.7.2.2 *Rotameter*

A rotameter is a slightly tapered inverted vertical tube in which a float (metal or plastic bead, small cylinder, etc.) moves from top to bottom. It is in fact a variable section annular orifice in which the capsule moves until its weight is balanced by the pressure of the fluid circulating in it. In the case of a traditional orifice, the area of the orifice is constant and the pressure differential across varies with the flow rate. For a rotameter, the opposite occurs; the area of the orifice changes in relation to the flow rate, and the pressure differential across remains constant (18). The head loss caused by a rotameter is generally very low in the order of psi and remains constant.

Rotameters must be calibrated against primary standards and are affected by changes in pressure and temperature. A calibration curve supplied by the IRSST or the supplier accompanies each rotameter. It must be referred to in order to properly adjust the pump to the desired flow. The calibration curve is established at a reference pressure and temperature (variable depending on the source). The flow must be corrected in relation to the pressure and temperature on the sampling site using the following equation:

Equation 17: *Flow correction in relation to the pressure and temperature (rotameter)*

$$Q_s = Q_{flowm} * \sqrt{\frac{P_{flowm} * T_s}{P_s * T_{flowm}}}$$

Q_s: real sampling rate
P_s: absolute ambient pressure (mm of Hg)
T_s: absolute ambient temperature (°K)
Q_{flowm}: flow indicated on the flow meter (Q_{read})
P_{flowm}: flow meter calibration pressure (mm of Hg)
$T_{flowm:}$ flow meter calibration temperature (°K)

Table 7- Reference pressures and temperatures used by manufacturers for certain rotameters

Company	Reference pressure mm of Hg	Manufacturer's reference temperature	IRSST's reference temperature
Matheson	760	294°K (21°C)	298°K (25°C)
Allegro			
Gilmont			

2.7.2.3 Mass flow meter

A hot-wire flow meter uses the phenomenon of heat transfer between a hot body and a gas to quantify a flow rate. When a gas circulates above a hot surface, heat is transferred between the hot surface and the gas. The rate of heat transfer will depend on the mass of product circulating and the thermal properties of the gas and the surfaces. This rate of heat transfer will be proportional to the mass flow rate if the specific heat of the gas and ΔT remain constant.

Hot-wire flow meters are designed to display the same response for the same mass flow rate, even if the temperature and pressure conditions are different. They therefore have the advantage of displaying a flow rate at the instrument's standard conditions, regardless of the temperature and pressure conditions.

The flow rate displayed by a mass flow meter (Q_{flowm}) therefore does not always correspond to the actual flow circulating in it (Q_s). The latter can be calculated using the flow meter equation which depends on its calibration conditions described in the following table and the ambient conditions of use. For a given gas, the flow meter equation is simply that of mass flow conservation:

Equation 18: *Flow correction in relation to the pressure and temperature (mass flow meter)*

$$Q_s = \left(\frac{P_{flowm}}{P_s}\right) * \left(\frac{T_s}{T_{flowm}}\right) * Q_{flowm}$$

Q_s: sampling rate
P_s: absolute ambient pressure (mm of Hg)
T_s: absolute ambient temperature (°K)
Q_{flowm}: flow indicated on the flow meter (Q_{read})
P_{flowm}: flow meter calibration pressure (mm of Hg)
T_{flowm}: flow meter calibration temperature (°K)

Table 8- Reference pressures and temperatures used by manufacturers for some mass flow meters

Company	Reference pressure mm of Hg	Reference temperature
Hasting	760	293°K (20°C)
Kurz	760	298°K (25°C)

2.7.2.4 Corrections for variations in temperature and/or pressure

Depending on the situation, corrections can be applied to take into account variations in volume as a function of ambient temperature and pressure. A volume or flow rate evaluated under certain conditions of temperature and pressure can be converted to other conditions of temperature and pressure. These corrections are based on the conservation of the number of molecules in the sampled volume:

Equation 19: *Perfect gas equation*

$$\boxed{\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}}$$

P = Pressure
V = Volume
T = Temperature (°K)
1 = Conditions on site # 1
2 = Conditions on site # 2

For flow rate correction, the same equation applies by substituting the volumes by the flow rates, since the flow rate is a volume per unit of time (Q = V/t):

Equation 20: *Perfect gas equation with substitution of the volume by the flow rate*

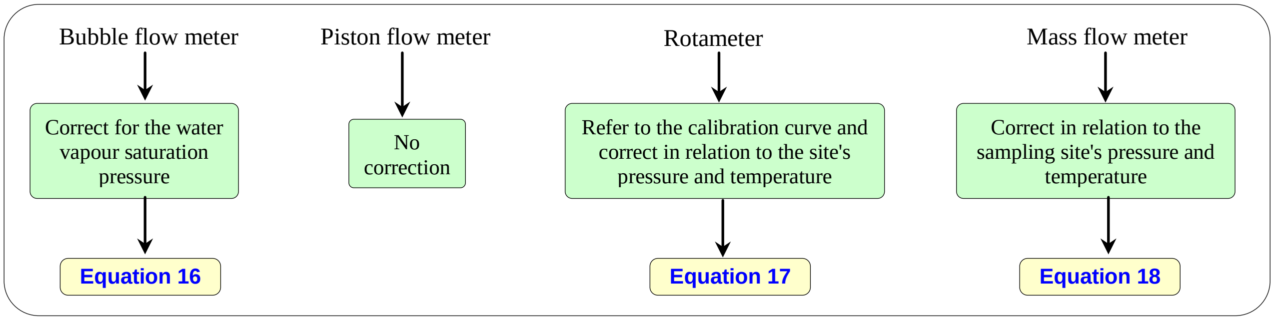
$$\boxed{Q_1 = Q_2 \frac{P_2}{T_2} \frac{T_1}{P_1}}$$

Q = Flow rate
P = Pressure
T = Temperature (°K)
1 = Conditions on site # 1
2 = Conditions on site # 2

2.7.3 Flow rate calibration on the sampling site

Considering the limited current knowledge about the behaviour of the different pumps and that their components have changed over the years, it is difficult to differentiate the type of pump actually used. This is why it is strongly recommended that pumps be calibrated on the sampling site. By doing so, the environmental conditions of temperature and atmospheric pressure that directly affect the sampling flow rate do not have to be taken into account, as recommended by NIOSH (30) and OSHA (31).

Figure 13- Summary of the flow rate correction process on the sampling site



2.7.4 Calibration outside the sampling site

This guide does not develop formulas to be applied, considering the problem with flow rate correction when the pump is calibrated outside the sampling site. In this case, refer to the *Mémento sur l'utilisation des pompes et des débitmètres* (17).

Part 3: Contaminant sampling and analysis

Introduction

The following section presents the sampling and analytical parameters used in evaluating occupational exposure. The PEVs in question are listed and defined in the ROHS. Information on the principles for using reference values is presented in *Part 1* of this document and in several publications including the ACGIH® *2012 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (10).

3.1 Specific considerations for the analytical laboratory

The quality of a result depends on the *entire evaluation process*, the establishment of the sampling strategy, the sampling itself, and the laboratory analysis. In this context, it is important to entrust the analysis of the samples to a recognized laboratory. An occupational hygiene analytical laboratory should be selected on the basis of its expertise, its accreditations, and its quality management system. The IRSST's laboratories possess several accreditations and certifications that ensure, to its partners and clients, the quality, integrity and recognition of its work.

The IRSST's analytical laboratories are accredited by the *American Industrial Hygiene Association* [6] (AIHA). To maintain this accreditation, they comply with the international standard ISO/IEC 17025:1999 and with the AIHA's requirements to provide proof of the management of a quality system, the existence of appropriate technical competence within the IRSST, and the technical validity of the results produced. This quality system is supported by a series of documents such as procedures and work instructions that reflect the activities carried out in the laboratories. The application of the requirements of quality documentation implies that quality records and techniques are retained to allow the traceability[7] of the measurements and analyses. The provisions of the quality system are established in a Quality Manual and apply to the analyses associated with the different scopes of accreditation.

3.2 Table of substances in the ROHS and the substances analyzed by the IRSST

This part of the guide contains two tables. The first table (green pages) contains all of the substances in the ROHS (namely 706) as well as information on IRSST methods or on *other methods* that are recommended by the IRSST. The latter methods were chosen by a review committee consisting of four chemists based on the literature available in 1994. For each of the substances, a file exists in the Laboratory Division that contains a copy of the chosen method as well as some other methods that were not selected. It is important to mention that no laboratory test was performed regarding the *recommended methods*. In this context, the implementation of these methods must undergo an appropriate analytical validation process. The majority of the recommended methods come from the two following organizations: NIOSH (National Institute for Occupational Safety and Health) and OSHA (Occupational Safety and Health Administration). This is the list of documents or Web sites that were consulted.

- NIOSH Manual of Analytical Methods, second edition, Volumes 1 to 7, published from 1977 to 1980, Cincinnati, OH.
- NIOSH Manual of Analytical Methods, third edition, published from 1984 to 1994, Cincinnati, OH. *http://www.cdc.gov/niosh/nmam/*
- OSHA Analytical Methods Manual (Organic and Inorganic), published from 1985 to 1991, Salt Lake City, UT *http://www.osha.gov/dts/sltc/methods/*
- OSHA Chemical Information File, published in 1991, Salt Lake City, UT.

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[6] http://apps.aiha.org/qms_aiha/certificate/101913_certificate.pdf

[7] Traceability means following the trail taken by the sample, from its reception until the analytical report is produced.

http://www.osha.gov/dts/chemicalsampling/toc/toc_chemsamp.html

These documents can be consulted in the IRSST's Laboratory Division.

The second table (yellow pages) contains the same information as the first table, but for a limited number of substances that, without being included in the ROHS, are nevertheless offered in the framework of the IRSST's analytical services.

The information contained in these tables comes from a database that is periodically updated. The most recent version can be consulted at the following Web site:

http://www.irsst.qc.ca/en/-rsstlist.html

3.3 Description of table column titles

ROHS name

This column contains the name of the substances as given in the ROHS. Also, the presence of the IRSST logo (in the first table) followed by a number means that the substance is included in the IRSST's analytical services. The number corresponds to the IRSST's number for the analytical method.

CAS

This is the chemical's CAS *(Chemical Abstract Service Registry Number)* number. The CAS number makes chemical substances easy to identify, since they sometimes have many synonyms. It should be noted that in the case of families of substances (for example: soluble barium salts), no CAS number has been given.

TWAEV/STEV/Ceiling (mg/m³)

The numbers in this column correspond respectively to the time-weighted average exposure value (TWAEV), the short-term exposure value (STEV), or the ceiling value (Ceiling) as defined in the ROHS.

Notes

This column gives the notes for percutaneous absorption (Pc), carcinogenic effect (C1, C2 and C3), sensitizer (S), prohibited recirculation (RP), substances whose exposure must be reduced to a minimum (EM) or the notation of simple asphyxiant (Ax). Additional explanations regarding these remarks are presented in the *Definitions and Notes* section of Schedule I of the ROHS.

Sampling device

This column contains a short description of the sampling equipment. The "IRSST" inventory number for the sampling instrument is also entered in the second table. It should be noted that *Appendix 1* of this guide contains a descriptive table of this equipment.

Flow rate (L/min)

This is the recommended sampling flow rate. It is generally expressed in litres per minute. For methods using the principle of passive dosimetry, the indicated value must be interpreted as a sampling rate and not as a flow rate (see *section 2.2.3.2*).

TWAEV/STEV volumes (L)

These are the recommended sampling volumes for verifying the TWAEV or STEV. They are generally expressed in litres.

Principle

This column contains an acronym corresponding to the technique used in analyzing the contaminant. *Appendix 2* contains a table of the acronyms for the analytical principles.

MRV (µg)

This column contains the minimum reported value (on the sampling instrument) as defined in the method. However, in some cases, it is preferable to consult the analytical method to properly understand the meaning of this value.

It is important to mention that a result below the MRV (<MRV) must be treated mathematically by the occupational hygienist who uses professional judgement based on his knowledge of the workplace, on the intrinsic variability of the exposure, and on the techniques commonly used in estimating an equivalent concentration in mg/m³ between 0 and the MRV (8, 18, 32).

CV_a (%)

This parameter provides the level of analytical uncertainty for the method in question. This parameter will allow the occupational hygienist to calculate the LCL and UCL based on the equations found in Part 1 of this guide. Refer to the IRSST's Web site to obtain the CV_a value, because they are regularly updated.

Reference

This is the supporting bibliographical reference for the method. In most cases where the analysis is not implemented in the IRSST's laboratory, a NIOSH or OSHA method number or a reference (*Part 3*) is entered.

Remarks

This section contains all the relevant information regarding sampling, analysis or analytical interferences.

3.4 Sampling parameters and analytical limitations

Sampling volumes and flow rates are determined in relation to the limits of quantification of the analytical methods, the collection capacity of the various collecting media, and the characteristics of the sampling equipment. The minimum reported value (MRV) is used to establish the optimal sampling time.

It is also important to specify that a maximum of 6 metals can be determined on a single filter. For solvents, this maximum number depends on the presence or absence of chromatographic interference. In both cases, the "Remarks" column must not contain "*specific desorption*" or "*specific analysis*."

3.5 Note regarding simple asphyxiants

It is important to mention a subtlety in the methods for simple «. The applicable regulation stipulates that the concentrations of these substances must be such that the oxygen concentration in the air is not less than 19.5%. The methods suggested for simple asphyxiants are therefore related to measurement of the oxygen concentration (method 26-C).

However, in an ***occupational safety*** context, the explosiveness of some simple asphyxiants (acetylene, methane, ethylene, etc.) represents a risk that must absolutely be taken into account. In fact, even when the oxygen-related requirements are respected, *an ambient atmosphere in which the asphyxiant's concentration is greater than its lower explosive limit must be considered as extremely dangerous.*

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Acetaldehyde *75-07-0*	-- -- 45	C3 RP	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,09		IRSST 322-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Acetic acid *64-19-7*	25 37		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	1	50	HPLC-UV	40		IRSST 195-2	Acetic acid must be sampled specifically.
Acetic anhydride *108-24-7*	21		Glass fiber filter impregnated with 1-(2-pyridyl) piperazine	0,05	0,75	GC-NPD			OSHA 82	Any compound that reacts with 1-(2-pyridyl) piperazine can cause interference. Contact the IRSST before sampling.
Acetone *67-64-1*	1190 2380		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	2 1,5	GC-FID	180	1,2	IRSST 22-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.3%.
Acetone *67-64-1*	1190 2380		3M Organic Vapor Monitor #3500 **2695** Passive dosimeter	0,0401		GC-FID	180	1,2	IRSST 22-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.2%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Acetone *67-64-1*	1190 2380					DRI-PAD			IRSST 39-A	Refer to the user's guide accompanying the instrument. Acetone quantification in the field is done with a direct-reading instrument (DRI). The minimum reported value is 1mg/m^3 (0.4 ppm). The method in the reference corresponds to DRI calibration.
Acetone cyanohydrin *75-86-5*	-- -- 5	Pc RP	Porapak QS solid adsorbent tube 100/350 mg	0,2	12	GC-NPD			NIOSH 2506	Contact the IRSST before sampling.
Acetonitrile *75-05-8*	67 101		Activated charcoal tube 400/200 mg	0,01-0,2	25 3	GC-FID			NIOSH 1606	Contact the IRSST before sampling.
Acetophenone *98-86-2*	49		Tenax tube 30/15 mg	0,2	12	GC-FID			OSHA PV2003	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Acetylene *74-86-2*		Ax				DRI-EX			IRSST 9-C	The DRI is for analyzing combustible gases as a percentage of their lower explosive limit. Acetylene quantification is done in the field with a direct-reading instrument. In the paper version of the sampling guide, see the remark about simple asphyxiants. The method in the reference corresponds to DRI calibration.
Acetylsalicylic acid (Aspirin) *50-78-2*	5		Glass fiber filter	1	100	HPLC-UV				Contact the IRSST before sampling. *Other reference(s)* Purnell, C.J.,Bagon, D.A.,Warwick, C.J.,"The determination of organic contaminant concentrations in workplace atmospheres by high-performance liquid chromatography", Pergamon Ser. Environ. Sci., vol. 7, pp. 203-219 (1982). Warwick, C.J., Bagon, D.A., "Rapid Scan UV/Visible Detection in Liquid Chromatography-Application to Environmental Analysis." Chromatographia, 15(7), pp. 433-436 (1982).
Acrolein *107-02-8*	0,23 0,69		Orbo #23 tube, Supelco 20257 **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,02		IRSST 284-1	Before and after sampling, the tubes must be kept in the freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Acrylamide *79-06-1*	0,03	Pc C2 EM	OVS-7 tube with XAD-7 and glass fiber filter	1	120	HPLC-UV			OSHA PV2004	Contact the IRSST before sampling.
Acrylic acid *79-10-7*	5,9	Pc	Two 708 anasorb tubes	0,1	24	HPLC-UV			OSHA PV2005	There is a possibility of polymerization in the presence of polymerization initiators in the atmosphere. Contact the IRSST before sampling.
Acrylonitrile *107-13-1*	4,3	Pc C2 RP EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	20	GC-FID	8	4,0	IRSST 147-2	Acrylonitrile must be sampled specifically due to the desorption solvent.
Adipic acid *124-04-9*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Adiponitrile *111-69-3*	8,8	Pc	Activated charcoal tube 100/50 mg	0,1	10	GC-FID			OSHA IMIS A509	Contact the IRSST before sampling.
Aldrin *309-00-2*	0,25	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-ECD			OSHA 67	Contact the IRSST before sampling.
Allyl alcohol *107-18-6*	4,8 9,5	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	2,5		IRSST 169-1	
Allyl glycidyl ether (AGE) *106-92-3*	23 47		Tenax-GC tube 100/50mg	0,01- 0,2	3	GC-FID			NIOSH 2545	Contact the IRSST before sampling.
Allyl propyl disulfide *2179-59-1*	12 18		Chromosorb-106 tube	0,2	10 3	GC-FPD			OSHA PV2086	Contact the IRSST before sampling.
Aluminum [7429-90-5], (as Al), Alkyls (NOC) *7429-90-5*	2									Contact the IRSST before sampling. No supporting reference is suggested for this product.
Aluminum (as Al), Metal *7429-90-5*	10		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	10	5,15	IRSST 362	Aluminium oxides formed during welding are not dissolved with the actual digestion method. Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total aluminium.
Aluminum [7429-90-5], (as Al), Pyrotechnical powders *7429-90-5*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Aluminum [7429-90-5], (as Al), Soluble salts *7429-90-5*	2		Polyvinyl chloride filter Gelman 66467 **903** PVC filter-37	1,5	180	FAAS	20	7	IRSST 212-3	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble aluminium.

ROHS Substances table

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Aluminum [7429-90-5], (as Al), Welding fumes *7429-90-5*	5		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	10	5,15	IRSST 362	Aluminium oxides formed during welding are not dissolved with the actual digestion method. Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total aluminium.
Aluminum oxide (as Al) *1344-28-1*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
4-Aminodiphenyl *92-67-1*		Pc C1 RP EM	Ttwo glass fiber filters impregnated with sulfuric acid	1	100	GC-ECD			OSHA 93	The filters must be transferred and stored in water until analysis. Any compound that reacts with sulfuric acid and is retained on the filters can cause interference. Contact the IRSST before sampling.
2-Aminoethanol *141-43-5*	7,5 15		Impregnated glass fiber filter, Millipore AP4003705 **955** Impregned FGF	1	15	HPLC-MS	6		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
2-Aminoethanol *141-43-5*	7,5 15		XAD-2 tube impregnated with 10%(w/w) 1-naphthylisothiocyanate (NIT) # SKC 226-30-18 **2170** XAD-2 impregnated with NIT	0,2	4	HPLC-UV	0,15		IRSST 303-1	
2-Aminopyridine *504-29-0*	1,9		Two glass fiber filters impregnated with sulfuric acid	1	240	GC-NPD			OSHA 1282	Contact the IRSST before sampling.
Amitrole *61-82-5*	0,2	C3 RP	Glass midget impinger containing deionized water	1	60	HPLC-UV			OSHA PV2006	Contact the IRSST before sampling.
Ammonia *7664-41-7*	17 24					DRI-PAD			IRSST 39-A	Refer to the user's guide accompanying the instrument. Ammonia is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 0.5 mg/m³ (0.80 ppm). The reference method corresponds to calibration of the DRI.
Ammonia *7664-41-7*	17 24		Tube of carbon beads pretreated with sulfuric acid, #SKC 226-29 **2144** Pretreated carbon beads 500/260 mg	0,10 - 0,5	24 7,5	IC-CD	9,4	4,42	IRSST 220-1	These tubes have a limited shelf life. It is important to respect the expiration date printed on the package. The ammonium ion (NH4+) is being analyzed, so all ammonium salts will cause interference. The analytical results are expressed as ammonia (NH3).

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Ammonium chloride fume *12125-02-9*	10 20		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Ammonium chloride fume *12125-02-9*	10 20		Mixed cellulose ester filter	2	960 30	IC-CD			OSHA ID188	Contact the IRSST before sampling.
Ammonium perfluorooctanoate *3825-26-1*	0,1	Pc	Mixed cellulose ester filter in series with a glass midget impinger containing methanol			GC-ECD				Contact the IRSST before sampling. *Other reference(s)* Belisle, J. and Hagen, D.F. "A method for the determination of perfluorooctanoic acid in blood and other biological samples",Analytical biochemistry 101, 369-376 Ubel, F.A., Sorenson, S.D. and Roach, D.E. "Health status of plant worker exposed to fluorochemicals a preliminary report ", Ind. Hyg Assoc J. (41) Août 1980
Ammonium sulfamate *7773-06-0*	10		Mixed cellulose ester filter	2	960 30	IC-CD			OSHA ID188	Contact the IRSST before sampling.
Ammonium sulfamate *7773-06-0*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Aniline *62-53-3*	7,6	Pc	Impregnated glass fiber filter, # Millipore AP4003705 **955** Impregned FGF	1	15	HPLC-MS	6		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
o-Anisidine *90-04-0*	0,5	Pc C3	XAD-2 tube 150/75 mg	0,5-1	225	HPLC-UV			NIOSH 2514	Contact the IRSST before sampling.
p-Anisidine *104-94-9*	0,5	Pc	XAD-2 tube 150/75 mg	0,5-1	225	HPLC-UV			NIOSH 2514	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Antimony [7440-36-0], metal and compounds (as Sb)	0,5		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	10		IRSST 55-2	Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
Antimony trioxide (as Sb) *1309-64-4*	0,5	C3	Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	10		IRSST 55-2	Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
Antimony trioxide, production (as Sb) *1309-64-4*		C2 RP EM	Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	10		IRSST 55-2	Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
ANTU (alpha-Naphthylthiourea) *86-88-4*	0,3		Polytetrafluorocarbon (teflon) filter	1,5-2	480	HPLC-UV			NIOSH S276	Contact the IRSST before sampling.
Argon *7440-37-1*		Ax				DRI-elec			IRSST 26-C	Since argon is a simple asphyxiant, the field method for determination of oxygen in air is done with a direct-reading instrument (DRI). The minimum reported value is 1% oxygen. The reference method corresponds to calibration of the DRI.
Arsenic, elemental [7440-38-2], and inorganic compounds (except Arsine) (as As)	0,1		Mixed cellulose ester filter	1-4		ICP			NIOSH 7300	Contact the IRSST before sampling. The recommended sampling volume is 5 to 2000 litres.
Arsenic trioxide, production *1327-53-3*		C2 RP EM	Mixed cellulose ester filter followed by a cellulose pad impregnated with sodium carbonate and glycerol.	1-3	1000	FAAS			NIOSH 7901	Contact the IRSST before sampling. There is no reference value for the standard, but measurement could be required nonetheless by targeting the lowest possible limit of detection, given the C2 carcenogenicity notation.
Arsine *7784-42-1*	0,16		Activated charcoal tube 100/50 mg	0,01-0,2	10	ET-AAS			NIOSH 6001	Contact the IRSST before sampling. Stable for 6 days at 25°C. The different arsenic compounds can interfere with arsine. An MCE filter place before the tube can remove the aerosols.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Asbestos, Actinolite *12172-67-7*	1 f/cc 5 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Asbestos, Amosite *12172-73-5*	0,2 f/cc 1 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Asbestos, Anthophyllite *17068-78-9*	1 f/cc 5 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Asbestos, Chrysotile *12001-29-5*	1 f/cc 5 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Asbestos, Crocidolite *12001-28-4*	0,2 f/cc 1 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Asbestos, Tremolite *14567-73-8*	1 f/cc 5 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Asphalt (petroleum) fumes *8052-42-4*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific. Additional information is also available in communiqué SAC-Labo 2008-02.
Atrazine *1912-24-9*	5		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	480	GC-ECD			NIOSH 5602	Contact the IRSST before sampling. Other pesticides can cause interference.
Azinphos-methyl *86-50-0*	0,2	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Tributyl phosphate, tris-(2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Barium, soluble compounds (as Ba) *7440-39-3*	0,5		Gelman 66467 polyvinyl chloride filter **903** PVC filter-37	1,5	180	ICP-MS	0,005		IRSST 374	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble barium.
Barium sulfate *7727-43-7*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Barium sulfate *7727-43-7*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Benomyl *17804-35-2*	10		OVS-2 tube with XAD-2 and glass fiber filter	1	60	HPLC-UV			OSHA IMISB407	Contact the IRSST before sampling.
Benz(a)anthracene *56-55-3*		C2 EM	Glass fiber filter pretreated in the laboratory, Millipore AP4003705 in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,11		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Benzene *71-43-2*	3 15,5	C1 RP EM	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0355		GC-FID	2	1,4	IRSST 24-3	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.7%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Benzene *71-43-2*	3 15,5	C1 RP EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	12 3	GC-FID	2	1,4	IRSST 24-3	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 3.6%.
Benzidine (production) *92-87-5*		Pc C1 RP EM	Two glass fiber filters impregnated with sulfuric acid	1	100	GC-ECD			OSHA 65	The filter must be transferred and stored in a container of water until analysis. Contact the IRSST before sampling.
Benzo(a)pyrene *50-32-8*	0,005	C2 RP EM	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,12		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Benzo(b)fluoranthene *205-99-2*		C2 EM								Contact the IRSST before sampling. IRSST method 225-2 could be adapted for the analysis of benzo(b)fluoranthene
p-Benzoquinone *106-51-4*	0,44		XAD-2 tube	0,1-0,2	24	HPLC-UV			NIOSH S181	Contact the IRSST before sampling.
Benzoyl peroxide *94-36-0*	5		Mixed cellulose ester filter	1-3	400	HPLC-UV			NIOSH 5009	Contact the IRSST before sampling. Keep the sampled cold during transport. Loss of 9% after one week at 25°C.
Benzyl chloride *100-44-7*	5,2		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	2,7	4,0	IRSST 253-1	

ROHS Substances table

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Beryllium [7440-41-7], metal and compounds (as Be) *7440-41-7*	0,00015	C1 RP EMS	Mixed cellulose ester filter 0.8 µm, 37mm or 25 mm, closed cassette **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,0005	3,59	IRSST 359	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. Specific sampling must be carried out for this substance. The analytical results are expressed as total beryllium.
Biphenyl *92-52-4*	1,3		XAD-7 tube 100/50 mg	0,2	20	GC-FID			OSHA PV2022	Contact the IRSST before sampling.
Bismuth telluride (as Bi2Te3), Se-doped *1304-82-1*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Bismuth telluride (as Bi2Te3), Se-doped *1304-82-1*	5		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling. A stoichiometric factor must be applied.
Bismuth telluride (as Bi2Te3), Undoped *1304-82-1*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Bismuth telluride (as Bi2Te3), Undoped *1304-82-1*	10		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling. A stoichiometric factor must be applied.
Boron oxide *1303-86-2*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Boron tribromide *10294-33-4*	-- -- 10	RP	Prefilter PTFE with silver membrane	0,3-1	360	IC-CD			NIOSH 6011	Contact the IRSST before sampling. The bromide and bromate ions are analyzed.

ROHS Substances table

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Boron trifluoride *7637-07-2*	-- -- 2,8	RP	Glass fritted tip impinger containing 10 mL of 0,1 N ammonium fluoride	1	480	SE			OSHA ID216SG	Contact the IRSST before sampling.
Bromacil *314-40-9*	10		Glass midget impinger containing 15 mL of ethylene glycol	1	50	HPLC-UV			OSHA IMISB708	Contact the IRSST before sampling.
Bromine *7726-95-6*	0,66 1,3		Silver membrane filter	0,3-1	360 15	IC-CD			NIOSH 6011	Contact the IRSST before sampling. Protect the samples from light. Can be kept for more than 30 days at 25°C. Hydrogen sulfide, hydrochloric and hydrobromic acids may cause interference.
Bromine pentafluoride *7789-30-2*	0,72		MCE filter with pretreated cellulose pad	1-2	800	SE			NIOSH 7902	Contact the IRSST before sampling.
Bromoform *75-25-2*	5,2	Pc	Activated charcoal tube 100/50 mg	0,01-0,2	70	GC-FID			NIOSH 1003	Contact the IRSST before sampling.
Bromotrifluoromethane *75-63-8*	6090		Two 400/200 mg and 100/50 mg activated charcoal tubes in series	0,01-0,05	1	GC-FID			NIOSH 1017	Contact the IRSST before sampling.
1,3-Butadiene *106-99-0*	4,4	C2 EM	Activated charcoal tube impregnated with TBC #SKC 226-73 **2189** Activated charcoal with TBC	Max: 0,075	10	GC-FID	4,4		IRSST 171-1	1,3-Butadiene must be sampled specifically due to the sampling device used.
Butane *106-97-8*	1900					DRI-EX			IRSST 9-C	A DRI is used for measuring combustible gases in terms of percentage of their lower explosive limit. In the paper version of the guide, refer to the note about simple asphyxiants.
2-Butoxyethanol *111-76-2*	97		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	27	2,9	IRSST 94-2	2-butoxy ethanol must be sampled specifically due to a specific desorption solvent. However, simultaneous sampling and analysis of the monomethyl ether of propylene glycol are possible.
n-Butyl acetate *123-86-4*	713 950		Activated charcoal tube #SKC ST226-01 **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	71	4,0	IRSST 77-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.1%.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
sec-Butyl acetate *105-46-4*	950		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0286		GC-FID	475		IRSST 274-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 5%. Refer to the 3M passive monitor guide on the IRSST's Web site.
sec-Butyl acetate *105-46-4*	950		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	475		IRSST 274-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.1%.
tert-Butyl acetate *540-88-5*	950		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	475		IRSST 275-1	
n-Butyl acrylate *141-32-2*	10		Activated charcoal tube impregnated with 4-tert-butylcatechol	0,05	12	GC-FID			OSHA PV2011	Contact the IRSST before sampling.
n-Butyl alcohol *71-36-3*	-- -- 152	Pc RP	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	81	5,0	IRSST 90-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 2.1%.
n-Butyl alcohol *71-36-3*	-- -- 152	Pc RP	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0343		GC-FID	81	5,0	IRSST 90-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.0%. Refer to the 3M passive monitor guide on the IRSST's Web site.
sec-Butyl alcohol *78-92-2*	303		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	65	1,0	IRSST 276-2	
tert-Butyl alcohol *75-65-0*	303		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	150		IRSST 277-1	
tert-Butyl chromate (as CrO3) *1189-85-1*	-- -- 0,1	Pc RP	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS			IRSST 365	IRSST method #365 could be adapted for this product. Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
n-Butyl glycidyl ether (BGE) *2426-08-6*	133		Activated charcoal tube 100/50mg	0,01-0,2	20	GC-FID			NIOSH 1616	Contact the IRSST before sampling.
n-Butyl lactate *138-22-7*	30		Activated charcoal tube 100/50mg	0,2	10	GC-FID			OSHA PV2080	Contact the IRSST before sampling.
Butyl mercaptan *109-79-5*	1,8		Glass fiber filter impregnated with a solution of 5% (w/v) mercuric acetate	0,1-0,2	150	GC-FPD			NIOSH 2542	Contact the IRSST before sampling. Protect the samples from light.
n-Butylamine *109-73-9*	-- -- 15	Pc RP	Silica gel tube impregnated with sulfuric acid	0,01-1	100	GC-NPD			NIOSH 2012	Contact the IRSST before sampling.
o-sec-Butylphenol *89-72-5*	31	Pc	XAD-7 tube 100/50 mg	0,2	20	GC-FID			OSHA PV2128	Contact the IRSST before sampling.
p-tert-Butyltoluene *98-51-1*	6,1		Activated charcoal tube 100/50 mg	Max: 0,2	29	GC-FID			NIOSH 1501	Contact the IRSST before sampling. Alcohols, ketones, ethers and halogenated hydrocarbons may cause interference.
Cadmium elemental and compounds (as Cd) *7440-43-9*	0,025	C2 EM	Mixed cellulose ester filter, 0.8 µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,05	3,1	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total cadmium.
Calcium carbonate *471-34-1*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Calcium chromate (as Cr) *13765-19-0*	0,001	C2 RP EM	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS	0,04	2,29	IRSST 365	For surface wipe sampling, refer to Appendix 3 of the sampling guide. The analytical results are expressed as total water-soluble chromium VI. Surface tests for chromates can be carried out, and the required equipment (kit #2625) is available at the IRSST. See communiqué 2008-06 on our Web site. Analysis time of 8 days for welding fumes and 10 days for the other processes following the sampling date. Ship all samples by rapid courier within a period not exceeding 24 hours after sampling. Any substance that produces a response on the detector at 540 nm and that has a retention time similar to Cr VI is a potential interference.
Calcium cyanamide *156-62-7*	0,5		Mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	5	5	IRSST 1-1	Specific sampling must be carried out for this substance. IRSST method 1-1 is for total calcium, which does not specifically include calcium cyanamide. A stoichiometric factor must be applied.
Calcium hydroxide *1305-62-0*	5		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	5	5	IRSST 1-1	Specific sampling must be carried out for this substance. The analytical results are expressed as total calcium. A stoichiometric factor must be applied.
Calcium oxide *1305-78-8*	2		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	5	5	IRSST 1-1	Specific sampling must be carried out for this substance. The analytical results are expressed as total calcium. A stoichiometric factor must be applied.
Calcium silicate (synthetic) *1344-95-2*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Calcium sulfate *7778-18-9*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Calcium sulfate *7778-18-9*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Camphor (synthetic) *76-22-2*	12 19		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	20 3	GC-FID	12	3,0	IRSST 83-1	Camphor must be specifically sampled due to a specific desorption solvent.
Caprolactam, Dust *105-60-2*	1 3		OVS-7 tube with XAD-7 and glass fiber filter	1	100 15	HPLC-UV			OSHA PV2012	Contact the IRSST before sampling.
Caprolactam, Vapour *105-60-2*	23 46		OVS-7 tube with XAD-7 and glass fiber filter	1	100 15	HPLC-UV			OSHA PV2012	Contact the IRSST before sampling.
Captafol *2425-06-1*	0,1	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	240	GC-ECD			OSHA IMIS0528	Contact the IRSST before sampling.
Captan *133-06-2*	5		OVS-2 tube with XAD-2 and glass fiber filter	1	60	HPLC-UV			OSHA IMIS0529	Contact the IRSST before sampling.
Captan *133-06-2*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Carbaryl *63-25-2*	5		OVS-2 tube with XAD-2 and glass fiber filter	1	60	HPLC-UV			OSHA 63	Contact the IRSST before sampling.
Carbofuran *1563-66-2*	0,1		OVS-2 tube with XAD-2 and glass fiber filter	1	480	HPLC-UV			OSHA PV2127	Contact the IRSST before sampling.
Carbon black *1333-86-4*	3,5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Carbon dioxide *124-38-9*	9000 54000					DRI-PAD			IRSST 320-1	The minimum reported value is 5.4 mg/m³ (3 ppm). In the case of a respirable compressed air (RCA) sample, analysis is done at the IRSST.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Carbon dioxide *124-38-9*	9000 54000					DRI-IR			IRSST 34-C	Refer to the user's guide accompanying the instrument. Carbon dioxide is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 18 mg/m^3 (10 ppm). The reference method corresponds to calibration of the DRI.
Carbon disulfide *75-15-0*	12 36	Pc	Activated charcoal tube preceded by a drying tube	0,01- 0,2	25 3	GC-FPD			NIOSH 1600	The samples must be stored in the refrigerator until analysis. Contact the IRSST before sampling.
Carbon monoxide *630-08-0*	40 230					DRI-elec			IRSST 3-B	Refer to the user's guide accompanying the instrument. Quantification of carbon monoxide is done in the field with a direct-reading instrument (DRI). The minimum reported value is 1.1 mg/m^3 (1 ppm). The reference method corresponds to calibration of the DRI.
Carbon monoxide *630-08-0*	40 230					DRI-PAD			IRSST 320-1	The reported minimum value is of 0.2 mg/m^3 (0.2 ppm). In the case of a respirable compressed air (RCA) sample, the analysis is done at the IRSST.
Carbon tetrabromide *558-13-4*	1,4 4,1		XAD-4 tube	0,2	10 3	GC-ECD			OSHA IMIS0565	Contact the IRSST before sampling.
Carbon tetrachloride *56-23-5*	31 63	Pc C2 EM	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0302 0		GC-FID	25	0,8	IRSST 157-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.3%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Carbon tetrachloride *56-23-5*	31 63	Pc C2 EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	15	GC-FID	25	0,8	IRSST 157-2	
Carbonyl fluoride *353-50-4*	5,4 13									Contact the IRSST before sampling. No supporting reference is suggested for this product.
Catechol *120-80-9*	23	Pc	OVS-7 tube with XAD-7 and glass fiber filter	1	100	GC-FID			OSHA PV2014	Contact the IRSST before sampling.
Cellulose (paper fibres) *9004-34-6*	10 Pt		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	1,5	180	Grav	25	4,9	IRSST 48-1	Sampling of respirable dusts is also possible by using the flow rate appropriate to the cyclone used. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Cesium hydroxide *21351-79-1*	2		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling.
Chlordane *57-74-9*	0,5	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-ECD			OSHA 67	Contact the IRSST before sampling.
Chlorinated camphene *8001-35-2*	0,5 1	Pc C3	Mixed cellulose ester filter	0,2-1	30 15	GC-ECD			NIOSH 5039	Contact the IRSST before sampling. Some pesticides may cause interference during the analysis.
Chlorinated diphenyl oxide *55720-99-5*	0,5		Mixed cellulose ester filter	0,5-1,5	200	GC-ELD			NIOSH 5025	Contact the IRSST before sampling.
Chlorine *7782-50-5*	1,5 2,9		Silver membrane filter	0,3-1	90 15	IC-CD			NIOSH 6011	Contact the IRSST before sampling. Protect the samples from light. Can be kept for more than 30 days at 25°C.
Chlorine dioxide *10049-04-4*	0,28 0,83		Glass fritted tip impinger containing potassium iodide.	0,5	120 7,5	IC-CD			OSHA ID202	Stable for at least 3 months at ambient temperature
Chlorine trifluoride *7790-91-2*	-- -- 0,38	RP	Mixed cellulose ester filter with sodium carbonate treated pad	1,5	90	SE			OSHA ID110	Contact the IRSST before sampling.
Chloroacetaldehyde *107-20-0*	-- -- 3,2	RP	Silica gel tube 520/260 mg	0,5	7,5	GC-ECD			OSHA 76	The samples must be stored in the freezer until analysis. Contact the IRSST before sampling.
Chloroacetone *78-95-5*	-- -- 3,8	Pc RP								Contact the IRSST before sampling. No supporting reference is suggested for this product.
alpha-Chloroacetophenone *532-27-4*	0,32		Silica gel tube 100/50 mg	0,2	10	HPLC-UV			OSHA IMIS0618	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Chloroacetyl chloride *79-04-9*	0,23 0,69	Pc	Tenax-GC tube impregnated with 9-[(N-methylamino) methyl] anthracene (MAMA)	0,1	5 1,5	HPLC-Flu				Contact the IRSST before sampling. *Other reference(s)* Klein, A.J., Morrell, S.G., Hicks, O.H., Worley, J.W., "Determination of Chloroacetyl Chloride in Air by High-Performance Liquide Chromato-graphy", Anal. Chem., 58 (4), pp.753-755 (1986).
Chlorobenzene *108-90-7*	230		Activated charcoal tube 100/50 mg	0,01-0,2	10	GC-FID			NIOSH 1003	Contact the IRSST before sampling.
o-Chlorobenzylidene malononitrile *2698-41-1*	-- -- 0,39	Pc RP	Polytetrafluorocarbon filter in series with a Tenax-GC tube	1,5	90	HPLC-UV			NIOSH P&CAM304	Contact the IRSST before sampling.
Chlorobromomethane *74-97-5*	1060		Activated charcoal tube 100/50 mg	0,01-0,2	5	GC-FID			NIOSH 1003	Contact the IRSST before sampling.
Chlorodifluoromethane *75-45-6*	3540		SKC ST226-09 activated charcoal tube **2121** Activated charcoal 400/200 mg	0,2	5	GC-FID	12	10,4	IRSST 153-1	Chlorodifluoromethane must be sampled specifically due to the sampling device used. Freon 22. However, simultaneous sampling and analysis of 1,1,2-trichloro-1,2,2-ethane (Freon 113) are possible.
Chlorodiphenyl (42% chlorine) *53469-21-9*	1	Pc C2 EM	SKC FLT225-16 glass fiber filter in series with an SKC ST226-39 Florisil tube	0,05-0,2	40	GC-ECD			NIOSH 5503	Contact the IRSST before sampling. PCB chromatograms must be interpreted with care. DDT, DDE, chlorinated pesticides and sulfur compounds of petroleum products may cause interference.
Chlorodiphenyl (54% chlorine) *11097-69-1*	0,5	Pc C2 EM	Glass fiber filter in series with a Florisil tube	0,05-0,2	40	GC-ECD			NIOSH 5503	Contact the IRSST before sampling. PCB chromatograms must be interpreted with care (consult MENVIQ as needed). DDT, DDE, chlorinated pesticides and sulfur compounds of petroleum products may cause interference.
Chloroform *67-66-3*	24,4	C2 RP EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	15	GC-FID	22	1,8	IRSST 26-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.93%.
Chloromethyl methyl ether *107-30-2*		C1 RP EM	Two glass fritted impingers containing a solution of methanol and 2,4,6-trichlorophenol.	0,5	50	GC-ECD			OSHA 10	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
bis (Chloromethyl) ether *542-88-1*	0,0047	C1 RP EM	Two glass fritted impingers containing a solution of methanol and 2,4,6-trichlorophenol.	0,5	50	GC-ECD			OSHA 10	Contact the IRSST before sampling.
1-Chloro-1-nitropropane *600-25-9*	10		Chromosorb-108 tube	0,2	12	GC-FID			NIOSH S211	Contact the IRSST before sampling.
Chloropentafluoroethane *76-15-3*	6320		Activated charcoal tube 100/50 mg	0,05	2,5	GC-FID			OSHA IMISC135	Contact the IRSST before sampling.
Chloropicrin *76-06-2*	0,67		Two XAD-4 80/40 mg tubes in series	0,2	5	GC-ECD			OSHA PV2103	Contact the IRSST before sampling.
ß-Chloroprene *126-99-8*	36	Pc	Activated charcoal tube 100/50 mg	0,01-0,1	8	GC-FID			NIOSH 1002	Contact the IRSST before sampling.
3-Chloropropene *107-05-1*	3 6		Activated charcoal tube 100/50 mg	0,01-1	100 15	GC-FID			NIOSH 1000	Contact the IRSST before sampling.
2-chloropropionic acid *598-78-7*	0,44	Pc	Silica gel tube 100/50 mg	0,05-0,2	100	IC-CD			NIOSH 2008	Contact the IRSST before sampling. Stable for at least 7 days at 25°C and 32 days at 4°C
o-Chlorostyrene *2039-87-4*	283 425		Activated charcoal tube 100/50 mg	0,01-0,2	20 3	GC-FID			NIOSH 1003	Contact the IRSST before sampling. NIOSH method 1003 is for halogenated hydrocarbons, which does not specifically include o-chlorostyrene.
o-Chlorotoluene *95-49-8*	259		Activated charcoal tube 100/50 mg	0,01-0,2	10 3	GC-FID			NIOSH 1003	Contact the IRSST before sampling. NIOSH method 1003 is for halogenated hydrocarbons, which does not specifically include o-chlorotoluene.
Chlorpyrifos *2921-88-2*	0,2	Pc	OVS tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Chromium (metal) *7440-47-3*	0,5		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	1	3,75	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total chromium.
Chromium (III) compounds (as Cr)	0,5		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	1	3,75	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total chromium.
Chromium VI, water insoluble inorganic compounds (as Cr)	0,01	C1 RP EMS	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS	0,04	4,4	IRSST 365	For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total water-insoluble chromium VI. Surface tests for chromates can be carried out, and the required equipment (kit #2625) is available at the IRSST. See communiqué 2008-06 on our Web site. Analysis time of 8 days for welding fumes and 10 days for the other processes following the sampling date. Ship all samples by rapid courier within a period not exceeding 24 hours after sampling. Any substance that produces a response on the detector at 540 nm and that has a retention time similar to Cr VI is a potential interference.
Chromium VI, water soluble inorganic compounds (as Cr)	0,05	C1 RP EMS	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS	0,04	2,29	IRSST 365	For surface wipe sampling, refer to Appendix 3 of the sampling guide. The analytical results are expressed as total water-soluble chromium VI. Surface tests for chromates can be carried out, and the required equipment (kit #2625) is available at the IRSST. See communiqué 2008-06 on our Web site. Analysis time of 8 days for welding fumes and 10 days for the other processes following the sampling date. Ship all samples by rapid courier within a period not exceeding 24 hours after sampling. Any substance that produces a response on the detector at 540 nm and that has a retention time similar to Cr VI is a potential interference.
Chromium VI, water soluble inorganic compounds (as Cr)	0,05	C1 RP EMS	Not available (refer to commmuniqué 2012-03) **927**						IRSST 365	For chromium VI in an acid aerosol.
Chromyl chloride *14977-61-8*	0,16									Contact the IRSST before sampling. No supporting reference is suggested for this product.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Chrysene *218-01-9*		C2 RP EM	Millipore AP4003705 glass fiber filter pretreated in the laboratory, in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,1		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Clopidol *2971-90-6*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Coal dust (less than 5% crystalline silica) *53570-85-7*	2 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Coal dust (more than 5% crystalline silica)	0,1 Pr		Cyclone in series with an Omega P-08370K polyvinyl chloride filter **902** PVC filter-37 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	800	XRD	6	5	IRSST 206-2	The analytical results are expressed as quartz.
Coal dust (more than 5% crystalline silica)	0,1 Pr		Cyclone in series with an Omega P-08370K polyvinyl chloride filter **902** PVC filter-37 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	800	FTIR	6	5	IRSST 78	
Coal tar pitch volatiles, as benzene solubles *65996-93-2*	0,2	C1 RP EM	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **911** GF filter-37	2	960	Grav	50		IRSST 201-1	After sampling, the samples must be stored in the freezer protected from light. The gravimetric result is used to establish the compliance with the standard. Simultaneous sampling and analysis of PAHs are possible if the complete sampling train is used (see the example of benzo(a)pyrene).
Cobalt, elemental and inorganic compounds (as Co) *7440-48-4*	0,02	C3	Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,04	3,15	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total cobalt.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Cobalt hydrocarbonyl (as Co) *16842-03-8*	0,1									Contact the IRSST before sampling. No supporting reference is suggested for this product.
Cobalt tetracarbonyl (as Co) *10210-68-1*	0,1									Contact the IRSST before sampling. No supporting reference is suggested for this product.
Copper [7440-50-8], Fume (as Cu)	0,2		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,4	2,77	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total copper.
Copper [7440-50-8], Dust and mists (as Cu)	1		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,4	2,77	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total copper.
Corundum *1302-74-5*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Cotton dust, cotton waste processing operation of waste recycling and garnetting	1		Vertical elutriator and SKC 225-8-01-1 polyvinyl chloride filter **997** PVC filter-37, 3 parts	7,4	450	Grav	25	4,9	IRSST 48-1	Stationary open cassette sampling due to use of the elutriator. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Cotton dust, in yarn manufacturing and cotton washing operations	0,2		Vertical elutriator and SKC 225-8-01-1 polyvinyl chloride filter **997** PVC filter-37, 3 parts	7,4	450	Grav	25	4,9	IRSST 48-1	Stationary open cassette sampling due to use of the elutriator. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Cotton dust, in textile mill waste house operations or in yarn manufacturing to dust from "lower-grade washed cotton"	0,5		Vertical elutriator and SKC 225-8-01-1 polyvinyl chloride filter **997** PVC filter-37, 3 parts	7,4	450	Grav	25	4,9	IRSST 48-1	Stationary open cassette sampling due to use of the elutriator. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Cotton dust, in textile slashing and weaving operations	0,75		Vertical elutriator and SKC 225-8-01-1 polyvinyl chloride filter **997** PVC filter-37, 3 parts	7,4	450	Grav	25	4,9	IRSST 48-1	Stationary open cassette sampling due to use of the elutriator. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Cresol (all isomers) *1319-77-3*	22	Pc	XAD-7 tube 100/50 mg	0,01-0,1	24	GC-FID			NIOSH 2546	Contact the IRSST before sampling.
Crotonaldehyde *4170-30-3*	5,7		Cassette containing two glass fiber filters impregnated with 2,4-dinitrophenylhydrazine (DNPH) and phosphoric acid	0,1	6	HPLC-UV			OSHA 81	Any compound (e.g., some aldehydes and ketones) that reacts with dinitrophenylhydrazine can cause interference during sampling. Contact the IRSST before sampling.
Crufomate *299-86-5*	5		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference.
Cumene *98-82-8*	246		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0245		GC-FID	86	4,0	IRSST 159-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 3.7%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Cumene *98-82-8*	246		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	86	4,0	IRSST 159-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.61%.
Cyanamide *420-04-2*	2		XAD-2 tube impregnated with 1-naphthylisothiocyanate (NIT)	0,1	10	HPLC-UV			OSHA 60	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Cyanides (as Cn) *57-12-5*	-- -- 11	Pc RP	Glass midget impinger containing 15 mL of 0,1 N potassium hydroxide	0,5-1,0	180	SE			NIOSH 7904	Contact the IRSST before sampling. For surface wipe sampling, use surface kit #3020. Some anions and metals can cause interference.
Cyanogen *460-19-5*	21		XAD-2 tube impregnated with 2-(hydroxymethyl) piperidine	0,2	12	GC-NPD			OSHA PV2104	Contact the IRSST before sampling.
Cyanogen chloride *506-77-4*	-- -- 0,75	RP	XAD-2 tube impregnated with 2-hydroxymethyl piperidine	0,2	1	GC-NPD			OSHA IMISC146	Contact the IRSST before sampling.
Cyclohexane *110-82-7*	1030		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	3	GC-FID	160		IRSST 194-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.56%.
Cyclohexane *110-82-7*	1030		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0324		GC-FID	160		IRSST 194-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.2%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Cyclohexanol *108-93-0*	206	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	100		IRSST 134-1	
Cyclohexanone *108-94-1*	100	Pc	SKC ST226-110 Chromosorb-106 tube **2127** Chromosorb-106	Max: 0,2	10	GC-FID	20	2,0	IRSST 135-1	Cyclohexanone must be sampled specifically due to the sampling device used.
Cyclohexene *110-83-8*	1010		Activated charcoal tube 100/50 mg	0,2	7	GC-FID			NIOSH 1500	Contact the IRSST before sampling.
Cyclohexylamine *108-91-8*	41		Silica gel tube 150/75mg	0,01-1	3	GC-FID			NIOSH 2010	Contact the IRSST before sampling.
Cyclonite *121-82-4*	1,5	Pc	Glass fiber filter	1	120	HPLC-UV			OSHA PV2135	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Cyclopentadiene *542-92-7*	203		Chromosorb-104 tube impregnated with 20% (w/w) maleic anhydride	0,01-0,05	5	GC-FID			NIOSH 2523	Contact the IRSST before sampling.
Cyclopentane *287-92-3*	1720									Contact the IRSST before sampling. IRSST method 144-2 is for n-pentane and can be adapted to cyclopentane.
Cyhexatin *13121-70-5*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Cyhexatin *13121-70-5*	5		Glass fiber filter in series with an XAD-2 tube 80/40 mg	1-1,5	300	HPLC-SAAE			NIOSH 5504	Contact the IRSST before sampling.
2,4-D *94-75-7*	10	C2 EM	Glass fiber filter, binderless	1-3	200	HPLC-UV			NIOSH 5001	Contact the IRSST before sampling.
DDT (Dichlorodiphenyltrichloroethane) *50-29-3*	1	C3	Glass fiber filter	1,5	90	GC-ECD			OSHA IMIS0847	Contact the IRSST before sampling.
Decaborane *17702-41-9*	0,25 0,75	Pc	Mixed cellulose ester filter	2	480 30	ICP			OSHA ID125G	Contact the IRSST before sampling.
Demeton® *8065-48-3*	0,11	Pc	Mixed cellulose ester filter with XAD-2 tube 150/75 mg	0,2-1	480	GC-FPD			NIOSH 5514	Contact the IRSST before sampling.
Di-sec-octyl phthalate *117-81-7*	5 10	C3	Whatman 7188 003 cellulose nitrate filter **912** CN filter-37	1,0	30 15	HPLC-UV	8		IRSST 309-1	Store in refrigerator after sampling.
2,6-Di-tert-butyl-p-cresol *128-37-0*	10		OVS-7 tube with XAD-7 and glass fiber filter	1	100	GC-FID			OSHA PV2108	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Diacetone alcohol *123-42-2*	238		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	46	4,1	IRSST 133-1	Diacetone alcohol must be specifically sampled due to a specific desorption solvent.
1,6-Diaminohexane *124-09-4*	2,3		Silica gel tube 150/75 mg	0,01-1	30	GC-NPD			NIOSH 2010	Contact the IRSST before sampling.
Diazinon® *333-41-5*	0,1	Pc	Supelco ORBO 49P tube, # 2-350 **2180** Orbo 49P	0,2-1	480	GC-NPD	2		IRSST 228-1	Diazinon must be specifically sampled due to the sampling device used and a specific desorption solvent.
Diazomethane *334-88-3*	0,34		XAD-2 tube impregnated with octanoic acid.	0,2	10	GC-FID			NIOSH 2515	Contact the IRSST before sampling.
Diborane *19287-45-7*	0,11		Teflon filter in series with a charcoal tube impregnated with an oxidant.	0,5-1	120	ICP-MS			NIOSH 6006	Contact the IRSST before sampling.
1,2-Dibromoethane *106-93-4*	155	Pc C2 RP EM	Activated charcoal tube 100/50 mg	0,02-0,2	25	GC-ECD			NIOSH 1008	Contact the IRSST before sampling.
Dibutyl phenyl phosphate *2528-36-1*	3,5	Pc	Polytetrafluorocarbon (teflon) filter	1-3	200	GC-FPD			NIOSH 5017	Contact the IRSST before sampling. NIOSH method 5017 is for dibutyl phosphate and can be adapted to this substance.
Dibutyl phosphate *107-66-4*	8,6 17		Polytetrafluorocarbon (teflon) filter	1-3	200 45	GC-FPD			NIOSH 5017	Contact the IRSST before sampling.
Dibutyl phthalate *84-74-2*	5		Whatman 7188 003 cellulose nitrate filter **912** CN filter-37	1,0	30	HPLC-UV	8		IRSST 308-1	Store in refrigerator after sampling.
2-N-Dibutylaminoethanol *102-81-8*	14	Pc	Silica gel tube 300/150 mg	0,01-0,2	24	GC-FID			NIOSH 2007	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
1,3-Dichloro -5,5-dimethyl hydantoin *118-52-5*	0,2 0,4									Contact the IRSST before sampling. No supporting reference is suggested for this product. *Other reference(s)* Pilipenko, A.T., Zui, O.V., Terletskaga, A.V.,"Chemiluminescence determination of 1,3-dibromo-5,5-dimethylhydantoin and 1,3-dichloro-5,5-dimethylhydantoin in water and air" Zh. Anal. Khim., 41(4), p.705
Dichloroacetylene *7572-29-4*	-- -- 0,39	RP	Activated charcoal tube 100/50 mg	0,2	3	GC-FID			OSHA IMIS0865	Contact the IRSST before sampling.
o-Dichlorobenzene *95-50-1*	-- -- 301	RP	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	150		IRSST 62-1	
p-Dichlorobenzene *106-46-7*	120	C3	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	60		IRSST 37-1	
3,3'-Dichlorobenzidine *91-94-1*		Pc C2 RP EM	Glass fiber filter	0,2	100	HPLC-UV			NIOSH 5509	Contact the IRSST before sampling.
1,4-Dichloro-2-butene *764-41-0*	0,025	Pc C2 EM	Activated charcoal tube 400/200 mg	0,2	24	GC-ECD			OSHA 07	Contact the IRSST before sampling. OSHA method 07 is for organic vapours and can be adapted to this substance.
Dichlorodifluoromethane *75-71-8*	4950		Two 400/200 mg et 100/50 mg activated charcoal tubes in series.	0,01- 0,05	4	GC-FID			NIOSH 1018	Contact the IRSST before sampling. Freon 12.
1,1-Dichloroethane *75-34-3*	405									Contact the IRSST before sampling. IRSST method 173-1 can be adapted to this product.
1,2-Dichloroethane *107-06-2*	4 8	C2 EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	20 10	GC-FID	8,1	5,0	IRSST 173-1	1,2-dichloroethane must be specifically sampled due to a specific desorption solvent.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Dichloroethyl ether *111-44-4*	29 58	Pc	Activated charcoal tube 100/50 mg	0,01-1	15 2	GC-FID			NIOSH 1004	Contact the IRSST before sampling.
1,1-Dichloroethylene *75-35-4*	4		Activated charcoal tube	0,01-0,2	7	GC-FID			NIOSH 1015	Contact the IRSST before sampling.
1,2-Dichloroethylene *540-59-0*	793		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	3	GC-FID	120		IRSST 174-1	
Dichlorofluoromethane *75-43-4*	42		Two 400/200 mg activated charcoal tubes in series	0,01-0,05	3	GC-FID			NIOSH 2516	Contact the IRSST before sampling. Freon 21.
1,1-Dichloro-1-nitroethane *594-72-9*	12		Activated charcoal tube 100/50 mg	0,01-1	15	GC-FID			NIOSH 1601	Contact the IRSST before sampling.
1,2-Dichloropropane *78-87-5*	347 508		Activate charcoal tube 100/50 mg	0,01-0,2	3,5 3	GC-ELD			NIOSH 1013	Contact the IRSST before sampling.
Dichloropropene (cis and trans) *542-75-6*	4,5	Pc C3	Activated charcoal tube 100/50 mg	0,01-0,2	5	GC-FID			NIOSH 1003	Contact the IRSST before sampling.
2,2-Dichloropropionic acid *75-99-0*	5,8		Silica gel tube 150/75 mg	0,2	10	HPLC-UV			OSHA PV2017	Contact the IRSST before sampling.
1,2 Dichloro-1,1,2,2-tetrafluoroethane *76-14-2*	6990		Two 400/200 mg and 100/50 mg activated charcoal tubes in series.	0,01-0,05	4	GC-FID			NIOSH 1018	Contact the IRSST before sampling. Freon 114.
Dichlorvos *62-73-7*	0,9	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-FPD			OSHA 62	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Dicrotophos *141-66-2*	0,25	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Dicyclopentadiene *77-73-6*	27		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	20	GC-FID	30	4,0	IRSST 242-1	
Dicyclopentadienyl iron *102-54-5*	10									Contact the IRSST before sampling. IRSST method 362 is for iron and can be adapted to iron dicyclopentadiene. IRSST method 48-1 (gravimetric analysis) can also be used, given the standard of 10 mg/m³.
Dieldrin *60-57-1*	0,25	Pc	OVS-2 tube with XAD-2 with glass fiber filter	1	480	GC-ECD			OSHA 67	Contact the IRSST before sampling.
Diethanolamine *111-42-2*	13	Pc	Impregnated Millipore AP4003705 glass fiber filter **955** Impregned FGF	1	15	HPLC-MS	10		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
Diethyl ether *60-29-7*	1210 1520		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	3 3	GC-FID	72	4,0	IRSST 28-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.67%.
Diethyl ketone *96-22-0*	705		Activated charcoal tube 100/50 mg	0,2	10	GC-FID			OSHA 07	Contact the IRSST before sampling.
Diethyl phthalate *84-66-2*	5		Whatman 7188 003 cellulose nitrate filter **912** CN filter-37	1,0	30	HPLC-UV	8		IRSST 310-1	Store in refrigerator after sampling.
Diethylamine *109-89-7*	15 45	Pc	XAD-7 tube impregnated with 10% 7-chloro-4-nitrobenzo-2-oxa-1,3-diazole	0,2	10 3	HPLC-UV			OSHA IMIS0910	Contact the IRSST before sampling.
2-Diethylaminoethanol *100-37-8*	48	Pc	Silica gel tube 300/150 mg	0,2	24	GC-FID			NIOSH 2007	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Diethylene triamine *111-40-0*	4,2	Pc	XAD-2 tube impregnated with 1-naphthylisothiocyanate (NIT)	0,01-0,1	10	HPLC-UV			OSHA 60	Contact the IRSST before sampling.
Difluorodibromomethane *75-61-6*	858		Two 100/50 mg activated charcoal tubes in series	0,01-0,2	10	GC-FID			NIOSH 1012	Contact the IRSST before sampling.
Diglycidyl ether (DGE) *2238-07-5*	0,53		Activated charcoal tube 100/50 mg	0,01-1	150	GC-FID			NIOSH 1619	Contact the IRSST before sampling.
Diisobutyl ketone *108-83-8*	145		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	30	1,5	IRSST 252-1	
Diisopropyl ether *108-20-3*	1040 1300		Activated charcoal tube 100/50 mg	0,01-0,05	3 0,75	GC-FID			NIOSH 1618	Contact the IRSST before sampling.
Diisopropylamine *108-18-9*	21	Pc								Contact the IRSST before sampling. IRSST method 363 is for amines in the air and can be adapted to diisopropylamine.
Dimethyl carbamoyl chloride *79-44-7*		C2 RP EM	Tenax-GC tube	0,2	48	GC-Hall				Contact the IRSST before sampling. *Other reference(s)* Mantienzo, L.J., Hensler, C.J., "Détermination of N,N-dimethylcarbamoyl chloride (DMCC) in air". Am. Ind. Hyg. Assoc. J., 43(11), pp. 838-844 (1982).
Dimethyl sulfate *77-78-1*	0,52	Pc C2 RP EM	Porapak tube	0,01-0,2	6	GC-ELD			NIOSH 2524	Contact the IRSST before sampling.
N,N-Dimethylacetamide *127-19-5*	36	Pc	Silica gel tube 150/75 mg	0,01-1	80	GC-FID			NIOSH 2004	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Dimethylamine *124-40-3*	9		Impregnated glass fiber filter, # Millipore AP4003705 **955** Impregned FGF	1	15	HPLC-MS	13		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
N,N-Dimethylaniline *121-69-7*	25 50	Pc		0,2	30 3	GC-FID			OSHA PV2064	Contact the IRSST before sampling.
N,N-Dimethylformamide *68-12-2*	30	Pc	SKC 226-10 silica gel tube **2140** Silica gel 150/75 mg	Max: 0,2	5	GC-FID	7,5		IRSST 148-1	N,N-dimethylformamide must be sampled specifically due to the sampling device used.
1,1-Dimethylhydrazine *57-14-7*	1,2	Pc C2 RP EM	Glass fritted tip impinger containing 15 mL of 0.1 N hydrochloric acid	0,2-1	100	UV/VIS-S			NIOSH 3515	Contact the IRSST before sampling. Some compounds may cause interference during the analysis.
Dimethylphthalate *131-11-3*	5		Whatman 7188 003 cellulose nitrate filter **912** CN filter-37	1,0	30	HPLC-UV	8		IRSST 311-1	Store in refrigerator after sampling.
Dinitolmide *148-01-6*	5		Glass fiber filter	1	240	HPLC-UV			OSHA IMIS0985	Contact the IRSST before sampling.
Dinitro-ortho-cresol *534-52-1*	0,2	Pc	Mixed cellulose ester filter in series with a glass fritted tip impinger containing 10 mL of ethylene glycol	1,5	180	HPLC-UV			NIOSH S166	The filter is added to the contents of the impinger at the end of sampling. Contact the IRSST before sampling.
Dinitrobenzene (all isomers) *25154-54-4*	1	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	60	GC-FID			OSHA IMIS0970	Contact the IRSST before sampling.
Dinitrotoluene *25321-14-6*	0,2	Pc C3	Modified Tenax-GC tube	1	60	GC-ECD			OSHA 44	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Dioxane *123-91-1*	72	Pc C3	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	20		IRSST 160-2	
Dioxathion *78-34-2*	0,2	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-FPD			OSHA IMIS2740	Contact the IRSST before sampling.
Diphenylamine *122-39-4*	10		Two glass fiber filters impregnated with sulfuric acid.	1	100	HPLC-UV			OSHA 78	The samples must be stored in the refrigerator. Contact the IRSST before sampling.
Dipropylene glycol monomethyl ether *34590-94-8*	606 909	Pc	Activated charcoal tube 100/50 mg	0,1	10	GC-FID			OSHA 101	Contact the IRSST before sampling. Sample stable for 15 days at ambient temperature.
Diquat *231-36-7*	0,5 Pt		OVS-2 tube with XAD-2 and glass fiber filter	0,1-1	480	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.
Diquat *231-36-7*	0,1 Pr		Cyclone in series OVS-2 with XAD-2 and glass fiber filter	1,7 (nylon) 2,75 (GS3)	480	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.
Disulfiram *97-77-8*	2		Glass fiber filter	1	120	HPLC-UV			OSHA IMIS2682	Contact the IRSST before sampling.
Disulfoton *298-04-4*	0,1		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Diuron *330-54-1*	10		OVS-2 tube with XAD-2 and glass fiber filter	0,1-1	480	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.
Divinyl benzene *1321-74-0*	53		Activated charcoal tube impregnated with 4-tert-butylcatechol	0,05	12	GC-FID			OSHA 89	Contact the IRSST before sampling.

ROHS Substances table

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Emery *12415-34-8*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Endosulfan *115-29-7*	0,1	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	60	GC-ECD			OSHA PV2023	Contact the IRSST before sampling.
Endrin *72-20-8*	0,1	Pc	Mixed cellulose ester filter in series with a Chromosorb-102 tube	0,5-1	120	GC-ECD			NIOSH 5519	Contact the IRSST before sampling.
Enflurane *13838-16-9*	566		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	5	GC-FID			IRSST 339-1	Enflurane must be specifically sampled due to the specific analysis performed. However, simultaneous sampling and analysis of halothane and isoflurane is possible. Enflurane standards have limited availability because this anesthetic agent is practically no longer used in Quebec. For this reason, contact the IRSST before sampling.
Epichlorohydrin *106-89-8*	7,6	Pc C2 RP EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	20	GC-FID	9	2,0	IRSST 223-2	Epichlorohydrin must be specifically sampled due to the specific analysis performed.
EPN *2104-64-5*	0,1	Pc	Glass fiber filter	1-2	120	GC-FPD			NIOSH 5012	The filters are transferred to a vial at the end of sampling. Contact the IRSST before sampling.
Ethane *74-84-0*		Ax				DRI-EX			IRSST 9-C	A DRI can be used for analyzing combustible gases as a percentage of their lower explosive limit. In the paper version of the guide, refer to the note about simple asphyxiants. The reference method corresponds to calibration of the direct-reading instrument (DRI).
Ethion *563-12-2*	0,4	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
2-Ethoxyethanol (EGEE) *110-80-5*	18	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	6	GC-FID	5,4	6,0	IRSST 137-1	2-Ethoxyethanol must be specifically sampled due to a specific desorption solvent. However, simultaneous sampling and analysis of the 2-Methoxyethanol is possible.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
2-Ethoxyethyl acetate (EGEEA) *111-15-9*	27	Pc	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0266		GC-FID	15	1,5	IRSST 207-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.5%. Refer to the 3M passive monitor guide on the IRSST's Web site.
2-Ethoxyethyl acetate (EGEEA) *111-15-9*	27	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	15	1,5	IRSST 207-2	
Ethyl acetate *141-78-6*	1440		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	6	GC-FID	400	4,0	IRSST 21-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.4%.
Ethyl acetate *141-78-6*	1440		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0345		GC-FID	400	4,0	IRSST 21-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.7%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Ethyl acrylate *140-88-5*	20 61	C3 S	Activated charcoal tube impregnated with 4-tert-butylcatechol (TBC) **2189** Activated charcoal with TBC	0,05	12	GC-FID	12	2,4	IRSST 319-1	Ethyl acrylate must be sampled specifically because of the sampling device used. However, simultaneous sampling and analysis of methyl acrylate est possible.
Ethyl alcohol *64-17-5*	1880		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,05	1	GC-FID	95	4,0	IRSST 91-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 3.4%.
Ethyl alcohol *64-17-5*	1880		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0437		GC-FID	95	4,0	IRSST 91-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 5%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Ethyl amyl ketone *541-85-5*	131									Contact the IRSST before sampling. IRSST method 265-2 is for methyl isoamyl ketone and can be adapted to ethyl amyl ketone.
Ethyl benzene *100-41-4*	434 543		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	43,3	0,7	IRSST 250-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.53%.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Ethyl bromide *74-96-4*	223	Pc C3	Activated charcoal tube 100/50 mg	0,01-0,2	4	GC-FID			NIOSH 1011	Contact the IRSST before sampling.
Ethyl butyl ketone *106-35-4*	234		Activated charcoal tube 100/50 mg	0,01-0,2	25	GC-FID			NIOSH 1301	Contact the IRSST before sampling.
Ethyl chloride *75-00-3*	2640		Two activated charcoal tubes in series 400/200 mg	0,01-0,05	3	GC-FID			NIOSH 2519	Contact the IRSST before sampling.
Ethyl formate *109-94-4*	303		Activated charcoal tube 100/50 mg	0,01-0,2	10	GC-FID			NIOSH 1452	Contact the IRSST before sampling.
Ethyl mercaptan *75-08-1*	1,3		Glass fiber filter impregnated with a solution of 5% (w/w) mercuric acetate.	0,1-0,2	150	GC-FPD			NIOSH 2542	Contact the IRSST before sampling. Protect the samples from light.
Ethyl silicate *78-10-4*	85		XAD-2 tube	0,05	9	GC-FID			NIOSH S264	Contact the IRSST before sampling.
Ethylamine *75-04-7*	18		XAD-7 tube impregnated with 10% (w/w) NBD chloride	0,2	10	HPLC-UV			OSHA 36	
Ethylene *74-85-1*		Ax				DRI-EX			IRSST 9-C	A DRI can be used for measuring combustible gases according to the percentage of their lower explosive limit. In the paper version of the guide, refer to the note about simple asphyxiants. The reference method corresponds to calibration of the direct-reading instrument (DRI).
Ethylene chlorohydrin *107-07-3*	-- -- 3,3	Pc RP	Activated charcoal tube 100/50 mg	0,01-0,2	35	GC-FID			NIOSH 2513	Contact the IRSST before sampling.
Ethylene glycol (vapour and mist) *107-21-1*	-- -- 127	RP	Glass fiber filter with an SKC 226-15 silica gel tube **2143** silica gel 520/260 mg **3030** GF-13	Maximum : 0,2	10	GC-FID	50	3,2 et 1,8	IRSST 258-1	Ethylene glycol (vapour and mist) must be specifically sampled because of the sampling device used and a specific desorption solvent. The application range and the precision must be reviewed considering the lowering of the PEL.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Ethylene glycol dinitrate *628-96-6*	-- -- 1,2	Pc RP	Tenax-GC tube	1	15	HPLC-UV			OSHA 43	Contact the IRSST before sampling.
Ethylene imine *151-56-4*	0,88	Pc	Glass midget impinger containing Folin reagent	0,2	48	HPLC-UV			NIOSH 3514	Contact the IRSST before sampling. Propylene imine, 2-bromo methylamine and ammonia may cause interference during the analysis.
Ethylene oxide *75-21-8*	1,8	C2 RP EM	Anasorb 747-T8 tube	0,05	12	GC-ECD			OSHA 1010	Contact the IRSST before sampling.
Ethylene oxide *75-21-8*	1,8	C2 RP EM				DRI-PAD			IRSST 39-A	Refer to the user's guide accompanying the instrument. Ethylene oxide is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 0.43 mg/m^3 (0.24 ppm). The reference method corresponds to calibration of the DRI.
Ethylenediamine *107-15-3*	25	Pc	XAD-2 tube impregnated with 1-naphthylisothiocyanate (NIT)	0,1	10	HPLC-UV			OSHA 60	Contact the IRSST before sampling.
Ethylidene norbornene *16219-75-3*	-- -- 25	RP								Contact the IRSST before sampling. No supporting reference is suggested for this product.
N-Ethylmorpholine *100-74-3*	24	Pc	Silica gel tube 150/75 mg	0,2	10	GC-FID			NIOSH S146	Contact the IRSST before sampling.
Fenamiphos *22224-92-6*	0,1	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Fensulfothion *115-90-2*	0,1		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Fenthion *55-38-9*	0,2	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Ferbam *14484-64-1*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Ferrovanadium (dust) *12604-58-9*	1 3		Mixed cellulose ester filter	1,5	180	ICP-MS			IRSST 362	Contact the IRSST before sampling. IRSST method 362 is for iron and vanadium and can be used for this substance.
Fibres, Artificial Vitreous Mineral Fibres, Fibrous glass, continuous filament	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Fibres, Artificial Vitreous Mineral Fibres, Fibrous glass, microfibres	1 f/cc		Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Glass wool	2 f/cc		Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Rock wool	1 f/cc		Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Slag wool	1 f/cc		Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Fibres, Artificial Vitreous Mineral Fibres, Refractory fibres (ceramic or others)	1 f/cc	C3	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Fibres, Natural Mineral Fibres, Attapulgite *12174-11-7*	1 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Fibres, Natural Mineral Fibres, Erionite *66733-21-9*		C1				PLM			IRSST 244-2	The use of this substance is prohibited. Caracterization of fibers in bulk samples or deposited dust is by method 244-2.
Fibres-Natural Mineral Fibres, Wollastonite *13983-17-0*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Fibres-Natural Mineral Fibres, Wollastonite *13983-17-0*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Fibres, Organic Synthetic Fibres, Carbon and graphite fibres	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Fibres, Organic Synthetic Fibres, Carbon and graphite fibres	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Fibres, Organic Synthetic Fibres, Para-aramide fibres (Kevlar®, Twaron®)	1 f/cc		Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Fibres, Organic Synthetic Fibres, Polyolefin fibres	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Fluorides (as F)	2,5		Mixed cellulose ester filter followed by a pretreated cellulose pad	1-2	800	SE			NIOSH 7902	Contact the IRSST before sampling. Recommended volume between 12 and 800 litres.
Fluorine *7782-41-4*	0,2		Mixed cellulose ester filter followed by a pretreated cellulose pad	1-2	800	SE			NIOSH 7902	Contact the IRSST before sampling.
Fonofos *944-22-9*	0,1	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Formaldehyde *50-00-0*	-- -- 3	C2 RP EM	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	3		IRSST 329-1	Before and after sampling, tubes must be stored in a freezer. Additional information is also available in laboratory customer service communiqué SAC-Labo 2006-08. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Formaldehyde *50-00-0*	-- -- 3	C2 RP EM	XAD-2 tube impregnated with HMP **2188** XAD-2 120/60 mg impregnated with HMP	Max: 0,1	25	GC-NPD	2	4,5	IRSST 295-1	Formaldehyde must be specifically sampled due to the sampling device used and a specific desorption solvent. The tubes must be stored in the freezer before and after sampling. Additional information is also available in laboratory customer service communiqué SAC-Labo 2006-08.
Formaldehyde *50-00-0*	-- -- 3	C2 RP EM				DRI-PAD			IRSST 39-A	Refer to the user's guide accompanying the instrument. Additional information is also available in laboratory customer service communiqué SAC-Labo 2006-08. The minimum reported value is 0.15 mg/m³ (0.12 ppm). The reference method corresponds to calibration of the direct-reading instrument (DRI). Formaldehyde quantified in the field with a DRI.
Formaldehyde *50-00-0*	-- -- 3	C2 RP EM	SKC #500-100 UMEX-100 passive sampler **6100** Passive sampler	0,0286		HPLC-UV	0,21		IRSST 357-1	Keep in freezer before and after sampling. For monitors, flow must be considered as being a sampling rate. Additional information is also available in the laboratory services communiqué SAC-Labo 2006-08. Stable for 3 weeks after sampling.
Formamide *75-12-7*	18	Pc	Silica gel tube 150/75 mg	0,1	10	GC-FID			OSHA IMIS1292	Contact the IRSST before sampling.
Formic acid *64-18-6*	9,4 19		PTFE filter with treated silica gel tube 400/200 mg	0,05- 0,2	24 3	IC-CD			NIOSH 2011	Contact the IRSST before sampling. The sample is stable for 1 week at 25°C.
Furfural *98-01-1*	7,9	Pc	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,11		IRSST 328-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Furfuryl alcohol *98-00-0*	40 60	Pc	Porapak Q tube #SKC 226-115 **2162** Porapak Q 150/75 mg	Max: 0,05	6 0,75	GC-FID	4,7	4,0	IRSST 87-2	Furfuryl alcohol must be sampled specifically due to the sampling device used and a specific desorption solvent.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Gasoline *8006-61-9*	890 1480	C3	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	450	1,0	IRSST 304-1	
Germanium tetrahydride *7782-65-2*	0,63		Activated charcoal tube 100/50 mg	0,2	48	ET-AAS			OSHA IMIS1360	A mixed cellulose ester filter can be considered preceding the activated charcoal tube to eliminate the germanium compounds present as aerosol. Contact the IRSST before sampling.
Glutaraldehyde *111-30-8*	-- -- 0,41	RP S	Two glass fiber filters #SKC 227-5 impregnated with 2,4-dinitrophenylhydrazine (DNPH) and phosphoric acid. **921** GF Filter-DNPH-37	1	15	HPLC-UV	0,27		IRSST 283-1	Open cassette sampling The sampling device must be refrigerated before and after sampling.
Glycerin (mist) *56-81-5*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Glycidol *556-52-5*	76		Activated charcoal tube 100/50 mg	0,01-1	100	GC-FID			NIOSH 1608	Contact the IRSST before sampling.
Grain dust (oat, wheat, barley)	4 Pt		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	1,5	180	Grav	25	4,9	IRSST 48-1	Sampling of respirable dusts is also possible by using the flow rate appropriate to the cyclone used. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Graphite (all forms except fibers) *7782-42-5*	2 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Gypsum *13397-24-5*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Gypsum 13397-24-5	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Hafnium 7440-58-6	0,5		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling. Fluorine and other hafnium compounds may cause interference during the analysis.
Halothane 151-67-7	404		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	5	GC-FID	41	0,7	IRSST 266-2	Halothane must be specifically sampled due to the specific analysis performed. However, simultaneous sampling and analysis of isoflurane and enflurane are possible.
Helium 7440-59-7		Ax				DRI-elec			IRSST 26-C	Since helium is a simple asphyxiant, helium quantification is done in the field with a direct-reading instrument (DRI). The minimum reported value is 1% oxygen. The reference method corresponds to calibration of the DRI.
Heptachlor 76-44-8	0,05	Pc C3	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-ECD			OSHA 67	Contact the IRSST before sampling. OSHA method 67 is for chlordane and can be adapted to this substance.
Heptachlore epoxide 1024-57-3	0,05	Pc C3	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-ECD			OSHA 67	Contact the IRSST before sampling. OSHA method 67 is for chlordane and can be adapted to this substance.
n-Heptane 142-82-5	1640 2050		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0289		GC-FID	320	4,0	IRSST 142-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.4%. Refer to the 3M passive monitor guide on the IRSST's Web site.
n-Heptane 142-82-5	1640 2050		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	4 3	GC-FID	320	4,0	IRSST 142-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.71%.
Hexachlorobenzene 118-74-1	0,025	Pc C3	OVS-2 tube with XAD-2 and glass fiber filter	1	480	GC-ECD			OSHA 67	Contact the IRSST before sampling. OSHA 67 method is for chlordane and can be adapted to this substance.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Hexachlorobutadiene *87-68-3*	0,21	Pc C2 RP EM	XAD-2 tube	0,05-0,2	100	GC-ECD			NIOSH 2543	Contact the IRSST before sampling.
Hexachlorocyclopentadiene *77-47-4*	0,11		Two porapak T tubes in series	0,01-0,2	90	GC-ECD			NIOSH 2518	Contact the IRSST before sampling.
Hexachloroethane *67-72-1*	9,7	Pc C3	Activated charcoal tube 100/50mg	0,01-0,2	10	GC-FID			NIOSH 1003	Contact the IRSST before sampling.
Hexachloronaphthalene *1335-87-1*	0,2	Pc	Mixed cellulose ester filter	1	30	GC-ECD			NIOSH S100	Contact the IRSST before sampling.
Hexafluoroacetone *684-16-2*	0,68	Pc								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Hexamethyl phosphoramide *680-31-9*		Pc C2 RP EM	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	480	GC-FPD			NIOSH 5600	Contact the IRSST before sampling.
Hexamethylene diisocyanate *822-06-0*	0,034	EM S	Pretreated Millipore AP4003705 glass fiber filter in series with a Teflon filter #MSI Z50WP03700 **917** PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0,027		IRSST 376	Refer to the sampling guidelines supplied with the equipment. If more than one isocyanate is requested, provide a bulk sample. For surface wipe sampling, contact Laboratory Customer Service. The two filters in the sampling cassette allow specific analysis of monomer HDI in vapour form and in aerosol form. The result supplied in the report is the sum of the monomers of HDI of the two fractions. Determination of the corresponding oligomers is also done during the analysis. IPDI can be determined simultaneously on the same sample. However, the analytical method does not differentiate HDI oligomers from IPDI oligomers. The sampling time can be longer than 15 minutes if the TDI is present in vapour form only.
Hexamethylene diisocyanate *822-06-0*	0,034	EM S	Impregnated glass fiber filter **970** Impregnated GFF	1,0	15	HPLC-MS	0,0006		IRSST 366	The recommended volume is 15 litres; however the sampling time can be up to 8 hours. Store the samples in a refrigerator before and after sampling. Five isocyanates can be requested at the same time: HDI, TDI, MDI, IPDI and HMDI. The analysis is done for the isocyanates present in vapour form only and the result is expressed as a monomer concentration.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
n-Hexane *110-54-3*	176	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	4	GC-FID	15	0,3	IRSST 141-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.8%.
n-Hexane *110-54-3*	176	Pc	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,032		GC-FID	15	0,3	IRSST 141-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.2%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Hexane (other isomers)	1760 3500									Contact the IRSST before sampling. IRSST method 141-2 is for normal hexane and can be adapted to isomers of this substance.
sec-Hexyl acetate *108-84-9*	295		Activated charcoal tube 100/50 mg	0,01-0,2	10	GC-FID			NIOSH 1450	Contact the IRSST before sampling. NIOSH method 1450 is for esters and can be adapted to secondary hexyl acetate.
Hexylene glycol *107-41-5*	-- -- 121	RP	Activated charcoal tube 100/50 mg	0,05-0,1	3	GC-FID			OSHA PV2101	Contact the IRSST before sampling.
Hydrazine *302-01-2*	0,13	Pc C2 RP EM	Treated glass fiber filter	1	240	HPLC-UV			OSHA 108	
Hydrogen *1333-74-0*		Ax				DRI-EX			IRSST 9-C IRSST 9-C	A DRI is used for measuring combustible gases in terms of percentage of their lower explosive limit. In the paper version of the sampling guide, refer to the note about simple asphyxiants. The reference method corresponds to the calibration of the direct-reading instrument (DRI).
Hydrogen bromide *10035-10-6*	-- -- 9,9	RP	Treated silica gel tube SKC 226-10-03 **2147** Silica gel 400/200 mg	0,2	48	IC-CD	5,1	1,91	IRSST 211-1	Five ions can be determined simultaneously, namely bromide, chloride, nitrate, phosphate and sulfate. Analytical results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable for 21 days at 25°C. All bromide ions not coming from the acid may cause positive interference.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Hydrogen chloride *7647-01-0*	-- -- 7,5	RP	Treated SKC 226-10-03 silica gel tube **2147** Silica gel 400/200 mg	0,2	15	IC-CD	5,1	8,85	IRSST 211-1	Five ions can be determined simultaneously, namely bromide, chloride, nitrate, phosphate and sulfate. Analytical results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable for 21 days at 25°C. All chloride ions not coming from the acid may cause positive interference.
Hydrogen cyanide *74-90-8*	-- -- 11	Pc RP	Soda lime tube	0,05-0,2	90	IC-CD			NIOSH 6017	Contact the IRSST before sampling. For surface wipe sampling, use surface kit #3020. A high concentration of hydrogen sulfide causes negative interference.
Hydrogen fluoride (as F) *7664-39-3*	-- -- 2,6	RP	Mixed cellulose ester filter followed by a pretreated cellulose pad	1-2	800	SE			NIOSH 7902	Contact the IRSST before sampling. Recommended volume between 12 and 800 litres.
Hydrogen peroxide *7722-84-1*	1,4		Passive monitor			UV/VIS-S			OSHA VI-6	Contact the IRSST before sampling. 8-hour sampling is recommended.
Hydrogen selenide (as Se) *7783-07-5*	0,16		Glass fritted tip impinger containing deionized water	1	480	ET-AAS			OSHA IMIS1475	Contact the IRSST before sampling.
Hydrogen sulfide *7783-06-4*	14 21					DRI-elec			IRSST 7-B	Refer to the user's guide accompanying the instrument. Hydrogen sulfide is quantified in the field using a direct-reading instrument (DRI). The minimum reported value is 1.4 mg/m³ (1 ppm). The reference method corresponds to calibration of the DRI.
Hydrogenated terphenyls *61788-32-7*	4,9		PTFE filter	1-3	30	GC-FID			NIOSH 5021	Contact the IRSST before sampling.
Hydroquinone *123-31-9*	2		Omega M-083700AF mixed cellulose ester filter (37 mm) and a container filled with 1% acetic acid . **905** MCE filter-37 **919** Vial of acetic vial	1,5	90	HPLC-UV	18		IRSST 156-1	The sampling method on filter is for the aerosol form of hydroquinone. If sampling is done above 20°C, the temperature must be noted on the analysis requisition form accompanying the samples. Hydroquinone is unstable on the filter and must be stabilized. Immediately after sampling, the filter must be placed in the container of 1% acetic acid supplied by the laboratory.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
2-Hydroxypropyl acrylate *999-61-1*	2,8	Pc	Activated charcoal tube impregnated with 4-tert-butylcatechol (TBC)	0,1	10	GC-FID			OSHA PV2078	Contact the IRSST before sampling.
Indene *95-13-6*	48		Activated charcoal tube 100/50mg	0,2	10	GC-FID			OSHA 07	Contact the IRSST before sampling. OSHA 07 method is for organic vapors and can be adapted to indene.
Indium [7440-74-6] and compounds (as In)	0,1		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling.
Iodine *7553-56-2*	-- -- 1	RP	Treated SKC-226-80 charcoal tube	0,5	7,5	SE			OSHA ID-212	Contact the IRSST before sampling.
Iodoform *75-47-8*	10		Glass fiber filter in series with an XAD-4 tube	0,1	10	GC-ECD			OSHA IMIS1517	Contact the IRSST before sampling.
Iron pentacarbonyl (as Fe) *13463-40-6*	0,23 0,45		Glass fritted tip impinger containing 10 mL of a mixture of hydrochloric acid and iodine-potassium iodide	1	480 15	Colo			OSHA IMIS1521	Contact the IRSST before sampling.
Iron salts, soluble (as Fe)	1									Contact the IRSST before sampling. No supporting reference is suggested for this product.
Iron trioxide, dust and fume (as Fe) *1309-37-1*	5		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	10	2,95	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total iron.
Isoamyl alcohol *123-51-3*	361 452		Activated charcoal tube 100/50 mg	0,01-0,2	10 3	GC-FID			NIOSH 1405	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Isobutyl acetate *110-19-0*	713		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	180	6,4	IRSST 249-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.69%.
Isobutyl acetate *110-19-0*	713		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,031		GC-FID	180	6,4	IRSST 249-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.0%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Isobutyl alcohol *78-83-1*	152		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	75	1,8	IRSST 278-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 3.6%.
Isobutyl alcohol *78-83-1*	152		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0359		GC-FID	75	1,8	IRSST 278-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.9%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Isocyanate oligomers		S	Pretreated Millipore AP4003705 glass fiber filter in series with an MSI Z50WP03700 polytetrafluorocarbon (teflon) filter **917** PTF filter GF filter Vial	1	15	HPLC-UV			IRSST 376	Refer to the corresponding isocyanate.
Isooctyl alcohol *26952-21-6*	266	Pc	Activated charcoal tube 100/50 mg	0,01- 0,2	10	GC-FID			NIOSH 1405	Contact the IRSST before sampling.
Isophorone *78-59-1*	-- -- 28	RP	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	12	GC-FID	15		IRSST 96-1	
Isophorone diisocyanate *4098-71-9*	0,045	EM S	Impregnated glass fiber filter **970** Impregnated GFF	1,0	15	HPLC-MS	0,0007		IRSST 366	The recommended volume is 15 litres; however the sampling time can be up to 8 hours. Store the samples in a refrigerator before and after sampling. Five isocyanates can be requested at the same time: HDI, TDI, MDI, IPDI and HMDI. The analysis is done for the isocyanates present in vapour form only and the result is expressed as a monomer concentration.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Isophorone diisocyanate *4098-71-9*	0,045	EM S	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Teflon filter #MSI Z50WP03700 **917** PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0,038		IRSST 376	Refer to the sampling guidelines supplied with the equipment. If more than one isocyanate is requested, provide a process sample. The two filters in the sampling cassette allow specific analysis of monomer HDI in vapour form and in aerosol form. The result supplied in the report is the sum of the monomers of IPDI of the two fractions. Determination of the corresponding oligomers is also done during the analysis. HDI can be determined simultaneously on the same sample. Note that the analytical method does not differentiate IPDI oligomers from HDI oligomers. The sampling time can be longer than 15 minutes if the IPDI is present in vapour form only.
Isopropoxyethanol *109-59-1*	106	Pc	Activated charcoal tube 100/50mg	0,1	10	GC-FID			OSHA 07	Contact the IRSST before sampling. OSHA method 07 is for organic vapours and can be adapted to isopropoxyethanol.
Isopropyl acetate *108-21-4*	1040 1290		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	475		IRSST 279-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.74%.
Isopropyl alcohol *67-63-0*	983 1230		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0394		GC-FID	100	5,0	IRSST 93-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 5%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Isopropyl alcohol *67-63-0*	983 1230		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	3 3	GC-FID	100	5,0	IRSST 93-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 4.8%.
Isopropyl glycidyl ether (IGE) *4016-14-2*	238 356		Activated charcoal tube 100/50 mg	0,01-0,2	30 3	GC-FID			NIOSH 1620	Contact the IRSST before sampling.
Isopropylamine *75-31-0*	12 24		Impregnated glass fiber filter, Millipore AP4003705 **955** Impregned FGF	1	15	HPLC-MS	9		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
N-Isopropylaniline *768-52-5*	11	Pc	Two glass fiber filters impregnated with sulfuric acid.	1	100	HPLC-UV			OSHA 78	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Kaolin *1332-58-7*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Ketene *463-51-4*	0,86 2,6		Glass fritted tip impinger containing 10 mL of hydroxylammonium chloride	1	50 15	Colo			NIOSH S92	An impinger containing toluene and placed ahead of the main impinger can minimize the interference of the acetic anhydride. Contact the IRSST before sampling. Any compound containing an R-CO group such as esters, acid chlorides and anhydrous acids may cause interference.
L.P.G. (Liquified petroleum gas) *68476-85-7*	1800					DRI-IR			OSHA IMIS1803	Contact the IRSST before sampling.
Lead and inorganic compounds *7439-92-1*	0,05	C3	Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,1	2,86	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total lead.
Lead arsenate (as Pb3(AsO4)2) *3687-31-8*	0,15		Mixed cellulose ester filter	2	960	ICP-MS			OSHA ID121	Contact the IRSST before sampling. Method ID121 is for lead and can be adapted to this product.
Lead chromate (as Cr) *7758-97-6*	0,012	C2 RP EM	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS	0,04	4,4	IRSST 365	For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total water-insoluble chromium VI. Surface tests for chromates can be carried out, and the required equipment (kit #2625) is available at the IRSST. See communiqué 2008-06 on our Web site. Analysis time of 8 days for welding fumes and 10 days for the other processes following the sampling date. Ship all samples by rapid courier within a period not exceeding 24 hours after sampling. Any substance that produces a response on the detector at 540 nm and that has a retention time similar to Cr VI is a potential interference.
Lead tetraethyl (as Pb) *78-00-2*	0,05	Pc	XAD-2 tube	0,01-1	120	GC-PID			NIOSH 2533	Contact the IRSST before sampling.
Lead tetramethyl (as Pb) *75-74-1*	0,05	Pc	XAD-2 tube	0,01-0,2	24	GC-PID			NIOSH 2534	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Limestone *1317-65-3*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Lindane *58-89-9*	0,5	Pc	Glass fiber filter in series with a glass midget impinger containing 15 mL of isooctane	0,2-1	240	GC-ECD			NIOSH 5502	Contact the IRSST before sampling.
Lithium hydride *7580-67-8*	0,025		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling.
Magnesite *546-93-0*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Magnesium oxide fume (as Mg) *1309-48-4*	10		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	2	4,06	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total magnesium.
Malathion *121-75-5*	10	Pc	Supelco ORBO 49P tube, # 2-350 **2180** Orbo 49P	0,2-1	60	GC-NPD	15		IRSST 228-1	Malathion must be specifically sampled due to the sampling device and a specific desorption solvent.
Maleic anhydride *108-31-6*	1		Glass fiber filters impregnated with veratrylamine.	0,5	60	HPLC-UV			OSHA 86	The samples must be stored in the refrigerator until analysis. Contact the IRSST before sampling. Isocyanates, hydrochloric acid and aldehydes can cause interference during sampling.
Manganese [7439-96-5] (as Mn), Dust and compounds *7439-96-5*	5		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180 22,5	ICP-MS	1	3,16	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total manganese. A stoichiometric factor must be applied.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Manganese (as Mn), Fume *7439-96-5*	1 3		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180 22,5	ICP-MS	1	3,16	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total manganese. A stoichiometric factor must be applied.
Manganese cyclopentadienyl tricarbonyl (as Mn) *12079-65-1*	0,1	Pc	Mixed cellulose ester filter in series with a glass fritted tip impinger containing 15 mL of isopropanol	1	48	ET-AAS			OSHA IMIS1622	Contact the IRSST before sampling.
Manganese methyl cyclopentadienyl tricarbonyl (as Mn) *12108-13-3*	0,2	Pc	XAD-2 tube	0,2	10	GC-ECD			OSHA IMIS1767	Contact the IRSST before sampling.
Manganese tetroxide *1317-35-7*	1		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180 22,5	ICP-MS	1	3,16	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total manganese. A stoichiometric factor must be applied.
Mercury [7439-97-6], Alkyl compounds (as Hg)	0,01 0,03	Pc								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Mercury [7439-97-6], aryl compounds (as Hg)	0,1	Pc								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Mercury [7439-97-6], inorganic compounds (as Hg)	0,025	Pc	Mixed cellulose ester filter	2	10	CV-AAS			OSHA ID145	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Mercury [7439-97-6], inorganic compounds (as Hg)	0,025	Pc				DRI-Am			IRSST 2-A	Refer to the user's guide that accompanies the instrument. The reference method corresponds to the calibration of the direct-reading instrument (DRI).
Mercury [7439-97-6], inorganic compounds (as Hg)	0,025	Pc	Hopcalite tube	0,15-0,25	100	CV-AAS			NIOSH 6009	Contact the IRSST before sampling. Sampling on passive dosimeter is possible with a higher minimum reported value.
Mercury [7439-97-6], mecury vapor (as Hg) *7439-97-6*	0,025	Pc				DRI-Am			IRSST 2-A	Refer to the user's guide that accompanies the instrument. The reference method corresponds to the calibration of the direct-reading instrument (DRI).
Mercury [7439-97-6], mecury vapor (as Hg) *7439-97-6*	0,025	Pc	Hopcalite tube	0,15-0,25	100	CV-AAS			NIOSH 6009	Contact the IRSST before sampling. Sampling on passive dosimeter is possible with a higher minimum reported value.
Mesityl oxide *141-79-7*	40		Activated charcoal tube 100/50 mg	0,01-0,2	25	GC-FID			NIOSH 1301	Contact the IRSST before sampling.
Methacrylic acid *79-41-4*	70		Two 708 anasorb tubes	0,1	24	HPLC-UV			OSHA PV2005	Contact the IRSST before sampling.
Methane *74-82-8*		Ax				DRI-EX			IRSST 9-C	A DRI is used for measuring combustible gases in terms of percentage of their lower explosive limit. In the paper version of the guide, refer to the note about simple asphyxiants. The reference method corresponds to calibration of the direct-reading instrument (DRI).
Methomyl *16752-77-5*	2,5		OVS-2 tube with XAD-2 and glass fiber filter	0,1-1	480	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.
Methoxychlor *72-43-5*	10		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	480	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. NIOSH method 5600 is for organophosphorus pesticides and can be adapted to methoxychlorine.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
2-Methoxyethanol (EGME) *109-86-4*	16	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	9,6	5,1	IRSST 138-3	The analysis of 2-Methoxyethanol must be specifically sampled due to a specific desorption solvent. However, simultaneous sampling and analysis of the 2-Ethoxyethanol is possible.
2-Methoxyethyl acetate (EGMEA) *110-49-6*	24	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	15	1,0	IRSST 139-2	
4-Methoxyphenol *150-76-5*	5		XAD-7 tube 100/50 mg	0,2	20	GC-FID			OSHA IMISM329	Contact the IRSST before sampling.
Methyl acetate *79-20-9*	606 757		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,037		GC-FID	215		IRSST 136-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.6%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Methyl acetate *79-20-9*	606 757		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	7 3	GC-FID	215		IRSST 136-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method# 369); in this case the analytical uncertainty (Cva) is 0.55%.
Methyl acetylene *74-99-7*	1640		Aluminized sampling bag	0,01- 0,05	3	GC-FID			NIOSH S84	Contact the IRSST before sampling.
Methyl acetylene-propadiene mixture (MAPP) *59355-75-8*	1640 2050		Aluminized sampling bag	0,01- 0,05	3	GC-FID			NIOSH S85	Contact the IRSST before sampling.
Methyl acrylate *96-33-3*	7	Pc S	Activated charcoal tube impregnated with 4-tert-butylcatechol (TBC) **2189** Activated charcoal with TBC	0,05	12	GC-FID	3	2,1	IRSST 146-2	Methyl acrylate must be sampled specifically due to the sampling device used. However, simultaneous sampling and analysis of ethyl acrylate est possible.
Methyl alcohol *67-56-1*	262 328	Pc	Silica gel tube #SKC 226-10 **2140** Silica gel 150/75 mg	0,1	3 1,5	GC-FID	60	6,7	IRSST 92	Methanol must be sampled specifically due to the sampling device used and a specific desorption solvent.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Methyl amyl alcohol *108-11-2*	104 167	Pc	Activated charcoal tube 100/50 mg	0,01 à 0,2	10 3	GC-FID			NIOSH 1405	Contact the IRSST before sampling.
Methyl n-amyl ketone *110-43-0*	233		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	49	2,6	IRSST 316-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.1%.
Methyl bromide *74-83-9*	19	Pc	Two Anasorb 747 tubes	0,05- 0,2	3	GC-FID			OSHA PV2040	Contact the IRSST before sampling. Immediate refrigeration after sampling.
Methyl tert-butyl ether *1634-04-4*	144		Two 400/200 mg activated charcoal tubes in series	0,1-0,2	96	GC-FID			NIOSH 1615	Contact the IRSST before sampling.
Methyl n-butyl ketone *591-78-6*	20	Pc	Activated charcoal tube 100/50mg	0,01- 0,2	10	GC-FID			NIOSH 1300	Contact the IRSST before sampling.
Methyl chloride *74-87-3*	103 207	Pc	Two 100/50 mg activated charcoal tubes in series	0,01- 0,1	3 1,5	GC-FID			NIOSH 1001	Contact the IRSST before sampling.
Methyl chloroform *71-55-6*	1910 2460		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	6 3	GC-FID	450	6,4	IRSST 100-1	
Methyl chloroform *71-55-6*	1910 2460		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0309		GC-FID	450	6,4	IRSST 100-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.0%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Methyl 2-cyanoacrylate *137-05-3*	9,1 18		XAD-7 tube impregnated with phosphoric acid	0,1	12 1,5	HPLC-UV			OSHA 55	Contact the IRSST before sampling. Alcohols, free radicals or other substances likely to react with methyl 2-cyanoacrylate may cause interference.
Methyl demeton *8022-00-2*	0,5	Pc	XAD-2 tube in series with a mixed cellulose ester filter	0,2-1	200	GC-FPD			NIOSH 5514	Contact the IRSST before sampling. NIOSH method 5514 is for demeton® and can be adapted to methyl demeton.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Methyl ethyl ketone (MEK) *78-93-3*	150 300		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0363		GC-FID	30	6,0	IRSST 25-3	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.5%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Methyl ethyl ketone (MEK) *78-93-3*	150 300		SKC 226-81 Anasorb 747 tube **2190** Anasorb 747 140/70 mg	Max: 0,2	10 3	GC-FID	30	6,0	IRSST 25-3	An activated charcoal tube 100/50 mg (#2120) may be used if the samples are refrigerated immediately after sampling of a maximum duration of 15 minutes. This alternative is recommended if other organic substances must be analyzed simultaneously on the same sample, only if the risk of underestimating the concentration of methyl ethyl ketone is assumed by the user. The analysis can be done by gas chromatography couple with mass spectrometry (CG-MS, IRSST method # 369); in this case the analytical uncertainty (CVa) is 1.7%.
Methyl ethyl ketone peroxide *1338-23-4*	-- -- 1,5	RP	XAD-4 tube	1	15	HPLC-UV			NIOSH 3508	Substance is unstable at ambient temperature. Contact the IRSST before sampling.
Methyl formate *107-31-3*	246 368		SKC 226-09 charcoal tube, 11 cm long, **2121** Activated charcoal 400/200 mg	0,2	3	GC-FID	40	4,0	IRSST 349-1	Methyl formate must be sampled specifically because of the sampling device used and the specific desorption solvent.
Methyl hydrazine *60-34-4*	-- -- 0,38	Pc C2 RP EM	Glass fritted tip impinger containing 15 mL of 0.1 M hydrochloric acid	1,5	20	Colo			NIOSH 3510	Contact the IRSST before sampling. Other hydrazines, stannous or ferrous ions, zinc, sulfur dioxide, hydrogen sulfide, halogens and oxygen (in the presence of Cu I) may cause interference.
Methyl iodide *74-88-4*	12	Pc C2 EM	Activated charcoal tube 100/50mg	0,01-1	50	GC-FID			NIOSH 1014	Contact the IRSST before sampling.
Methyl isoamyl ketone *110-12-3*	234		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	10	3,5	IRSST 265-2	
Methyl isobutyl ketone *108-10-1*	205 307		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,030		GC-FID	40	1,4	IRSST 132-3	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.3%. Refer to the 3M passive monitor guide on the IRSST's Web site.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Methyl isobutyl ketone *108-10-1*	205 307		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	40	1,4	IRSST 132-3	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.3%.
Methyl isocyanate *624-83-9*	0,047	Pc	XAD-7 tube impregnated with 1-(2-pyridyl) piperazine (1-2PP)	0,05	15	HPLC-UV			OSHA 54	The samples must be stored in the refrigerator until analysis. Contact the IRSST before sampling.
Methyl isopropyl ketone *563-80-4*	705									Contact the IRSST before sampling. IRSST method 132-3 is for methyl isobutyl ketone and can be adapted to methyl isopropyl ketone.
Methyl mercaptan *74-93-1*	0,98		SKC FLT225-9007 glass fiber filter impregnated with a solution of 5% (w/v) mercuric acetate	0,1-0,2	10	GC-FPD			NIOSH 2542	Contact the IRSST before sampling. Protect the samples from light. The recommended volume is from 10 to 150 litres. Hydrogen sulfide, dimethyl sulfide, dimethyl disulfide, water vapor and propylene may cause interference during the analysis.
Methyl methacrylate (monomer) *80-62-6*	205	S	SKC 226-75 Anasorb 727 tube **2185** Anasorb 727 300/150 mg	Max: 0,25	3	GC-FID	19	1,8	IRSST 85-2	Methyl methacrylate must be sampled specifically due to the sampling device used.
Methyl parathion *298-00-0*	0,2	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Methyl propyl ketone *107-87-9*	530		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	110	2,0	IRSST 178-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.79%.
Methyl silicate *681-84-5*	6		XAD-2 tube	0,05	9	GC-FID			NIOSH S264	Contact the IRSST before sampling. NIOSH method S264 is used for ethyl silicate and can be adapted to this product.
alpha-Methyl styrene *98-83-9*	242 483		Activated charcoal tube 100/50 mg **2120** Activated charcoal 100/50 mg	Max: 0,2	3 3	GC-FID	15	1,0	IRSST 177-2	
Methylacrylonitrile *126-98-7*	2,7	Pc	Activated charcoal tube 100/50mg	0,2	20	GC-FID			NIOSH 1604	Contact the IRSST before sampling. NIOSH method 1604 is for acrylonitrile and can be adapted to this substance.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Methylal *109-87-5*	3110		Activated charcoal tube 100/50mg	0,01-0,2	2	GC-FID			NIOSH 1611	Contact the IRSST before sampling.
Methylamine *74-89-5*	6,4		Impregnated glass fiber filter, Millipore AP4003705 **955** Impregned FGF	1	15	HPLC-MS	10		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
N-Methylaniline *100-61-8*	2,2	Pc	Silica gel tube 150/75mg	0,02-0,2	20	GC-FID			NIOSH 2002	Contact the IRSST before sampling. NIOSH method 2002 is for aniline and can be adapted to this substance.
Methylcyclohexane *108-87-2*	1610		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	4	GC-FID	320		IRSST 175-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.54%.
Methylcyclohexanol *25639-42-3*	234		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	140		IRSST 176-1	
o-Methylcyclohexanone *583-60-8*	229 344	Pc	Porapak tube	0,01-0,05	6 3	GC-FID			NIOSH 2521	Contact the IRSST before sampling.
Methylene chloride *75-09-2*	174	C2 EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	3	GC-FID	27	0,9	IRSST 27-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.0%.
Methylene chloride *75-09-2*	174	C2 EM	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0379		GC-FID	27	0,9	IRSST 27-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 0.8%. Refer to the 3M passive monitor guide on the IRSST's Web site.
4,4'-Methylene bis (2-chloroaniline) (MOCA) *101-14-4*	0,22	Pc C2 RP EM	Two glass fiber filters, with only one Impregnated with sulfuric acid	1	100	GC-ECD			OSHA 71	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Methylene bis (4-cyclohexylisocyanate) *5124-30-1*	0,054	EM S	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Teflon filter #MSI Z50WP03700 **917** PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0,08		IRSST 376	Refer to the sampling guidelines supplied with the equipment. If more than one isocyanate is requested, provide a process sample. The two filters in the sampling cassette allow specific analysis of monomer HMDI in vapour form and in aerosol form. The result supplied in the report is the sum of the monomers of HMDI of the two fractions. Determination of the corresponding oligomers is also done during the analysis. The sampling time can be longer than 15 minutes if the HMDI is present in vapour form only.
Methylene bis (4-cyclohexylisocyanate) *5124-30-1*	0,054	EM S	Impregnated glass fiber filter **970** Impregnated GFF	1,0	15	HPLC-MS			IRSST 366	The recommended volume is 15 litres; however the sampling time can be up to 8 hours. Store the samples in a refrigerator before and after sampling. Five isocyanates can be requested at the same time: HDI, TDI, MDI, IPDI and HMDI. The analysis is done for the isocyanates present in vapour form only and the result is expressed as a monomer concentration.
4,4'-Methylene dianiline *101-77-9*	0,81	Pc C2 EM	Glass fiber filter impregnated with sulfuric acid	1-2	1000	HPLC-UV			NIOSH 5029	Immediately after sampling, transfer the filter to a vial containing a reactive solution. Contact the IRSST before sampling.
Methylene bis (4-phenyl isocyanate) (MDI) *101-68-8*	0,051	EM S	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Teflon filter #MSI Z50WP03700 **917** PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0,036		IRSST 376	Refer to the sampling guidelines supplied with the equipment. If more than one isocyanate is requested, provide a process sample. For surface wipe sampling, contact Laboratory Customer Service. The two filters in the sampling cassette allow specific analysis of monomer MDI in vapour form and in aerosol form. The result supplied in the report is the sum of the monomers of MDI of the two fractions. Determination of the corresponding oligomers is also done during the analysis. The sampling time can be longer than 15 minutes if the MDI is present in vapour form only.
Methylene bis (4-phenyl isocyanate) (MDI) *101-68-8*	0,051	EM S	Impregnated glass fiber filter **970** Impregnated GFF	1,0	15	HPLC-MS	0,00075		IRSST 366	The recommended volume is 15 litres; however the sampling time can be up to 8 hours. Store the samples in a refrigerator before and after sampling. Five isocyanates can be requested at the same time: HDI, TDI, MDI, IPDI and HMDI. The analysis is done for the isocyanates present in vapour form only and the result is expressed as a monomer concentration.
Metribuzin *21087-64-9*	5		OVS-2 tube with XAD-2 and glass fiber filter	0,1-1	240	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.
Mica *12001-26-2*	3 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Mineral oil (mist)	5 10		Preweighed teflon filter (5 µm), Millipore MITEX 37 mm **960** PTF filter-37	2	960	Grav	50		IRSST 356-1	Determination in air of mineral oil mist, soluble, synthetic, half-synthetic and vegetable oil. Cigarette smoke may cause interference.
Molybdenum [7439-98-7] (as Mo), Insoluble compounds *7439-98-7*	10		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	50		IRSST 73-1	Specific sampling must be carried out for this substance.The analytical results are expressed as total molybdenum.
Molybdenum [7439-98-7] (as Mo), Soluble compounds *7439-98-7*	5		Polyvinyl chloride filter Gelman 66467 **903** PVC filter-37	1,5	180	FAAS	50		IRSST 213-1	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble molybdenum.
Monocrotophos *6923-22-4*	0,25	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Morpholine *110-91-8*	71	Pc	Impregnated glass fiber filter, Millipore AP4003705 **955** Impregned FGF	1	15	HPLC-MS	52		IRSST 363	Aniline, diethanolamine, dimethylamine, ethanolamine, isopropylamine, methylamine and morpholine can be sampled at the same time.
Naled *300-76-5*	3	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. NIOSH method 5600 is for organophosphorus pesticides and can be adapted to this substance. Some phosphates may cause interference during the analysis.
Naphthalene *91-20-3*	52 79		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 1,0	200 15	GC-FID	500	5,0	IRSST 09-1	Naphthalene must be specifically sampled due to the specific analysis performed.
ß-Naphthylamine *91-59-8*		C1 RP EM	Two glass fiber filters impregnated with sulfuric acid.	1	100	GC-ECD			OSHA 93	At the end of sampling, the filters must be transferred and stored in a container of water. Contact the IRSST before sampling.
Neon *7440-01-9*		Ax				DRI-elec			IRSST 26-C	Since neon is a simple asphyxiant, oxygen quantification is done with a DRI. The minimum reported value is 1% oxygen. The reference method corresponds to calibration of the direct-reading instrument (DRI).

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Nickel, Metal *7440-02-0*	1		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	2	3,89	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total nickel.
Nickel [7440-02-0], Insoluble compounds (as Ni)	1		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	2	3,89	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total nickel.
Nickel [7440-02-0], Soluble compounds (as Ni)	0,1		Gelman 60714 polyvinyl chloride filter **903** PVC filter-37	1,5	180	FAAS	2	4,3	IRSST 214-2	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble nickel.
Nickel carbonyl (as Ni) *13463-39-3*	0,007		Mixed cellulose ester filter in series with a charcoal tube with low nickel content	0,05-0,2	80	ET-AAS			NIOSH 6007	Contact the IRSST before sampling.
Nickel sulfide roasting, fume and dust (as Ni)	1	C1 RP EM								Contact the IRSST before sampling. IRSST method 362 is for certain metals by ICP-MS and can be adapted to nickel sulfide.
Nicotine *54-11-5*	0,5	Pc	SKC 226-30-04 XAD-2 tube **2152** XAD-2 100/50 mg	1,0	100	GC-NPD	0,5	4,0	IRSST 233-1	Nicotine must be sampled specifically due to the sampling device used and the specific desorption solvent.
Nitrapyrin *1929-82-4*	10 20		OVS-2 tube with XAD-2 and glass fiber filter	1	480 15	HPLC-UV			OSHA IMIS0684	Contact the IRSST before sampling.
Nitric acid *7697-37-2*	5,2 10		Treated silica gel tube SKC 226-10-03 **2147** Silica gel 400/200 mg	0,2	48 3	IC-CD	5,1	3,55	IRSST 211-1	Five ions can be determined simultaneously, namely bromide, chloride, nitrate, phosphate and sulfate. Analytical results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable for 21 days at 25°C. All the nitrate ions not originating from the acid can cause positive interference.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
p-Nitroaniline *100-01-6*	3	Pc	Mixed cellulose ester filter	1,0-3,0	350	HPLC-UV			NIOSH 5033	Contact the IRSST before sampling.
Nitrobenzene *98-95-3*	5	Pc	Silica gel tube 100/50 mg	0,01-1	150	GC-FID			NIOSH 2005	Contact the IRSST before sampling.
p-Nitrochlorobenzene *100-00-5*	0,64	Pc	Silica gel tube 150/75mg	0,01-1	150	GC-FID			NIOSH 2005	Contact the IRSST before sampling.
4-Nitrodiphenyl *92-93-3*		Pc C1 RP EM	OVS-2 tube with XAD-2 and glass fiber filter	1,0	240	HPLC-UV			OSHA PV2082	Contact the IRSST before sampling.
Nitroethane *79-24-3*	307		Two XAD-2 tubes in series	0,01-0,05	3	GC-FID			NIOSH 2526	At the end of sampling, the front tube must be separated from the back tube to avoid migration. Reseal each end of the tubes. Contact the IRSST before sampling.
Nitrogen *7727-37-9*		Ax				DRI-elec			IRSST 26-C	Since azote is a simple asphyxiant, oxygen in the air is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 1% oxygen. The reference method corresponds to calibration of the DRI.
Nitrogen dioxide *10102-44-0*	5,6					DRI-elec			IRSST 30-B	Refer to the user's guide accompanying the instrument. Nitrogen dioxide is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 0.9 mg/m³ (0.5 ppm). The reference method corresponds to calibration of the DRI.
Nitrogen monoxide *10102-43-9*	31					DRI-elec			IRSST 06-A	Refer to the user's guide accompanying the instrument. Nitric oxide is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 1.2 mg/m³ (1 ppm). The reference method corresponds to calibration of the DRI.. Azote monoxyde quantified with DRI.
Nitrogen trifluoride *7783-54-2*	29					DRI-IR			OSHA IMIS1907	Contact the IRSST before sampling.
Nitroglycerin (NG) *55-63-0*	-- -- 1,86	Pc RP	Tenax tube, 100/50 mg	0,2-1	100	GC-ECD			NIOSH 2507	Contact the IRSST before sampling. Can be kept for at least 25 days at 25°C.

ROHS Substances table

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Nitromethane *75-52-5*	250		Chromosorb-106 tube	0,01- 0,05	3	GC-NPD			NIOSH 2527	Contact the IRSST before sampling. Stable for 7 days at 25°C.
1-Nitropropane *108-03-2*	91		XAD-4 tube 80/40 mg	0,1	4	GC-FID			OSHA 46	Contact the IRSST before sampling.
2-Nitropropane *79-46-9*	36	C2 RP EM	XAD-4 tube 80/40 mg	0,1	4	GC-FID			OSHA 46	Contact the IRSST before sampling.
N-Nitrosodimethylamine *62-75-9*		Pc C2 RP EM	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	4,4	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
Nitrotoluene (all isomers) *1321-12-6*	11	Pc	Silica gel tube 150/75 mg	0,01- 0,02	30	GC-FID			NIOSH 2005	Contact the IRSST before sampling.
Nitrous oxide *10024-97-2*	90					DRI-PAD			IRSST 320-1	The minimum reported value is 0.09 mg/m^3 (0.05 ppm). In the case of a respirable compressed air (RCA) sample, analysis is done at the IRSST.
Nonane *111-84-2*	1050		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0246		GC-FID	210		IRSST 306-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.4%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Nonane *111-84-2*	1050		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	4	GC-FID	210		IRSST 306-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.76%.
Octachloronaphthalene *2234-13-1*	0,1 0,3	Pc	Mixed cellulose ester filter	1	30	GC-ECD			NIOSH S97	Contact the IRSST before sampling.
Octane *111-65-9*	1400 1750		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0266		GC-FID	290	4,0	IRSST 143-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.3%. Refer to the 3M passive monitor guide on the IRSST's Web site.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Octane *111-65-9*	1400 1750		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	4 3	GC-FID	290	4,0	IRSST 143-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.63%.
Osmium tetroxide (as Os) *20816-12-0*	0,0016 0,0047		Mixed cellulose ester filter in series with a glass fritted tip impinger containing 15 mL of distilled water	1	480 15	ICP			OSHA IMIS1960 OSHA ID125G	Contact the IRSST before sampling. Method ID-125G is for metals in the air and can be adapted to osmium tetroxide.
Oxalic acid *144-62-7*	1 2		Mixed cellulose ester filter	2	960 15	IC-CD			NIOSH 7903	Contact the IRSST before sampling.
Oxygen difluoride *7783-41-7*	-- -- 0,11	RP								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Ozone *10028-15-6*	-- -- 0,2	RP				DRI-elec			IRSST 05-B	Refer to the user's guide that accompanies the instrument. Ozone is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 0.1 mg/m^3 (0.05 ppm). The reference method corresponds to calibration of the DRI.
Ozone *10028-15-6*	-- -- 0,2	RP				HMOS			IRSST 05-B	Refer to the user's guide that accompanies the instrument. Ozone is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 0.1 mg/m^3 (0.05 ppm). The reference method corresponds to calibration of the DRI.
Paraffin wax, fume *8002-74-2*	2		Glass fiber filter	2	960	GC-FID			OSHA PV2047	Contact the IRSST before sampling. The sampling volume can vary from 30 to 960 litres.
Paraquat, respirable particulates *4685-14-7*	0,1 Pr		Polytetrafluorocarbon (teflon) filter	1,7 (nylon) 2,75 (GS3)	200	HPLC-UV			NIOSH 5003	Contact the IRSST before sampling.
Parathion *56-38-2*	0,1	Pc	Supelco ORBO 49P tube, # 2-350 **2180** Orbo 49P	0,2-1	480	GC-NPD	2		IRSST 228-1	Parathion must be specifically sampled due to the sampling device and a specific desorption solvent.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Particulates Not Otherwise Classified (PNOC)	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Pentaborane *19624-22-7*	0,013 0,039		Glass fritted tip impinger containing deionized water	1	480 15	ICP			OSHA IMIS1986 OSHA ID125G	Contact the IRSST before sampling. OSHA method ID-125G is for metallic elements and compounds and can be adapted to pentaborane. The device and the parameters on OSHA data sheet IMIS1986 are used.
Pentachloronaphthalene *1321-64-8*	0,5	Pc	OVS-2 with XAD-2 Tube and glass fiber filter	1	100	GC-ECD			OSHA IMIS1988	Contact the IRSST before sampling.
Pentachloronitrobenzene *82-68-8*	0,5		Silica gel tube150/50 mg	1	150	GC-FID			NIOSH 2005	Contact the IRSST before sampling. NIOSH method 2005 is for nitroaromatic compounds and can be adapted for this substance.
Pentachlorophenol *87-86-5*	0,5	Pc C2 RP EM	Omega M-083700AF mixed cellulose ester filter (37 mm) in series with an SKC IMP225-36-2 glass fritted tip impinger containing 15 mL of ethylene glycol **1401** Trap **1402** Holster **1420** GFT impinger **908** MCE filter-37	1,5	180	HPLC-UV	9		IRSST 46-1	The filter must be added to the contents of the impinger at the end of sampling.
Pentaerythritol *115-77-5*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
n-Pentane *109-66-0*	350		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0353		GC-FID	21	1,0	IRSST 144-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.5%. Refer to the 3M passive monitor guide on the IRSST's Web site.
n-Pentane *109-66-0*	350		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	4	GC-FID	21	1,0	IRSST 144-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.5%.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
n-Amyl acetate *628-63-7*	266 532		3M 3500 organic vapor monitor **2695** Passive dosimeter	0,026		GC-FID	265		IRSST 74-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.9%. Refer to the 3M passive monitor guide on the IRSST's Web site
n-Amyl acetate *628-63-7*	266 532		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	265		IRSST 74-1	The analysis can be done with gas chromatography with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.4%.
sec-Amyl acetate *626-38-0*	266 532		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	335		IRSST 272-1	
tert-Amyl acetate *625-16-1*	266 532		Activated charcoal tube 100/50 mg	0,1-0,2	10	GC-FID			NIOSH 1450	Contact the IRSST before sampling. NIOSH method 1450 is for esters and can be adapted to this product.
Isoamyl acetate *123-92-2*	266 532		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	260		IRSST 273-1	
2-Methyl-1-butyl acetate *624-41-9*	266 532		Activated charcoal tube 100/50 mg	0,1-0,2	10	GC-FID			NIOSH 1450	Contact the IRSST before sampling. NIOSH method 1450 is for esters and can be adapted to this product.
3-Pentyl acetate *620-11-1*	266 532		Activated charcoal tube 100/50 mg	0,1-0,2	10	GC-FID			NIOSH 1450	Contact the IRSST before sampling. NIOSH method 1450 is for esters and can be adapted to this product.
Perchloroethylene *127-18-4*	170 685	C3	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	68	0,6	IRSST 140-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.75%.
Perchloroethylene *127-18-4*	170 685	C3	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0283		GC-FID	68	0,6	IRSST 140-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.8%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Perchloromethyl mercaptan *594-42-3*	0,76					DRI-IR			OSHA IMIS2030	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Perchloryl fluoride *7616-94-6*	13 25			1-2	250	SE			NIOSH 7902	Contact the IRSST before sampling. NIOSH method 7902 is for fluorides and can be adapted to this substance.
Perfluoroisobutylene *382-21-8*	-- -- 0,082	RP								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Perlite *83969-76-0*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Perlite *83969-76-0*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Phenol *108-95-2*	19	Pc	SKC IMP 225-36-1 glass midget impinger containing 15 mL of 0.1 N sodium hydroxide **1422** Glass midget impinger	1	15	HPLC-UV	6,2		IRSST 12-4	
Phenothiazine *92-84-2*	5	Pc	Glass fiber filter	1	100	GC-NPD			OSHA PV2048	Contact the IRSST before sampling.
Phenyl ether, vapour *101-84-8*	7 14		Activated charcoal tube 100/50 mg	0,01-0,2	50 3	GC-FID			NIOSH 1617	Contact the IRSST before sampling.
Phenyl glycidyl ether (PGE) *122-60-1*	0,61	Pc C3 S	Activated charcoal tube 100/50 mg	0,01-1	150	GC-FID			NIOSH 1619	Contact the IRSST before sampling.
Phenyl mercaptan *108-98-5*	2,3		Glass fiber filter impregnated with a solution of 5% (w/v) mercuric acetate	0,1-0,2	150	GC-FPD			NIOSH 2542	The samples must be protected from light until analysis. Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
meta-Phenylenediamine *108-45-2*	0,1		Two glass fiber filters treated with 0.26N sulfuric acid	1	100	HPLC-UV			OSHA 87	Contact the IRSST before sampling. Sample is stable for 15 days at ambient temperature.
ortho-Phenylenediamine *95-54-5*	0,1	C2 EM	Two glass fiber filters treated with 0.26N sulfuric acid	1	100	HPLC-UV			OSHA 87	Contact the IRSST before sampling. Sample is stable for 15 days at ambient temperature.
p-Phenylenediamine *106-50-3*	0,1	Pc S	Two SKC FLT225-7 glass fiber filters impregnated with sulfuric acid.	1	100	HPLC-UV			OSHA 87	Contact the IRSST before sampling.
Phenylhydrazine *100-63-0*	0,44	Pc C2 RP EM	Glass fritted tip impinger containing 15 mL of 0.1N HCL	0,2-1	100	UV/VIS-S			NIOSH 3518	Contact the IRSST before sampling.
n-Phenyl-ß-naphthylamine *135-88-6*		C2 RP EM	Two pretreated glass fiber filters	1	240	HPLC-UV			OSHA 96	Contact the IRSST before sampling.
Phenylphosphine *638-21-1*	-- -- 0,23	RP								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Phorate *298-02-2*	0,05 0,2	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240 15	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Phosdrin *7786-34-7*	0,092 0,27	Pc	OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240 15	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Phosgene *75-44-5*	0,4		XAD-2 tube impregnated with 2-(hydroxymethyl) piperidine	1	240	GC-NPD			OSHA 61	Contact the IRSST before sampling.
Phosphine *7803-51-2*	0,42 1,4		Pretreated glass fiber filter in series with a polyester filter pretreated with mercuric chloride	1	240	ICP			OSHA 1003	Contact the IRSST before sampling. Stable for at least 17 days at ambient temperature.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Phosphoric acid *7664-38-2*	1 3		Treated silica gel tube SKC 226-10-03 **2147** Silica gel 400/200 mg	0,2	48 3	IC-CD	5,2	4,68	IRSST 211-1	Five ions can be determined simultaneously, namely bromide, chloride, nitrate, phosphate and sulfate. Analytical results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable for 21 days at 25°C. All phosphate ions not originating from the acid can cause positive interference.
Phosphorus (yellow) *7723-14-0*	0,1		Tenax-GC tube	0,01-0,2	100	GC-FPD			NIOSH 7905	A filter can be used if the phosphorus is present in particulate form. Contact the IRSST before sampling.
Phosphorus oxychloride *10025-87-3*	0,63		Glass fritted tip impinger containing 10 mL of a solution of sodium carbonate and sodium bicarbonate	1	240	IC-CD			OSHA IMIS2094	Contact the IRSST before sampling.
Phosphorus pentachloride *10026-13-8*	0,85		Polyvinyl chloride filter in series with a glass fritted tip impinger containing 15 mL of deionized water	0,2	48	Colo			OSHA IMIS2091	The use of a stainless steel filter support (#SKC SCN225-26) is suggested. The filter is thrown away after sampling. Contact the IRSST before sampling.
Phosphorus pentasulfide *1314-80-3*	1 3		Polyvinyl chloride filter	1-2	120 30	IC-CD			OSHA ID128SG	Contact the IRSST before sampling.
Phosphorus trichloride *7719-12-2*	1,1 2,8		Glass fritted tip impinger containing deionized water	0,05-0,2	100 3	Colo			NIOSH 6402	Contact the IRSST before sampling.
Phthalic anhydride *85-44-9*	6,1		Mixed cellulose ester filter Omega M-083700AF open-face **906** MCE filter-37 open cassette	1,5	100	HPLC-UV	60		IRSST 82-1	
m-Phthalodinitrile *626-17-5*	5		Activated charcoal tube 100/50 mg	0,2	20	GC-NPD			OSHA IMIS2015	Contact the IRSST before sampling.
Picloram *1918-02-1*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Picric acid *88-89-1*	0,1		Mixed cellulose ester filter 0.8µm, 37mm	1,5	180	HPLC-UV			NIOSH S228	Contact the IRSST before sampling.
Pindone *83-26-1*	0,1		OVS-2 tube with XAD-2 and glass fiber filter	0,1-1	480	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.
Piperazine dihydrochloride *142-64-3*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Plaster of Paris *26499-65-0*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Plaster of Paris *26499-65-0*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Platinum, Metal *7440-06-4*	1		Mixed cellulose ester filter	2	960	ICP-MS			OSHA ID121	Contact the IRSST before sampling.
Platinum [7440-06-4], Soluble salts (as Pt)	0,002		Mixed cellulose ester filter	2	960	ICP-MS			OSHA ID121	Contact the IRSST before sampling.
Polytetrafluoroethylene decomposition products *9002-84-0*										Contact the IRSST before sampling. No supporting reference is suggested for this product.
Portland cement *65997-15-1*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Portland cement *65997-15-1*	5 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Potassium hydroxide *1310-58-3*	-- -- 2	RP	Gelman 60714 polyvinyl chloride filter **903** PVC filter-37	1,5	180	FAAS	6,3		IRSST 288-1	A specific sampling must be carried out for this substance. All soluble potassium salts are positive interferences. The results are expressed as total soluble potassium. A stoichiometric factor must be applied.
Propane *74-98-6*	1800		Two carbosieve S-III tubes 130/65 mg	0,1	5	GC-FID			OSHA PV2077	Contact the IRSST before sampling.
Propane *74-98-6*	1800					DRI-EX			IRSST 9-C	A DRI is used for analyzing combustible gases as a percentage of their lower explosive limit. In the paper version of the guide, refer to the note about simple asphyxiants. The reference method corresponds to calibration of the direct-reading instrument (DRI).
Propane sultone *1120-71-4*		C2 RP EM	Diffusion denuder impregnated with 2-mercaptobenzothiazole			HPLC-UV				Contact the IRSST before sampling. No supporting reference is suggested for this product. *Other reference(s)* Oldewerne, J., Klockow, D., "Chromatographic procedures for the determination of 1,3-propane sultone (1,2-oxathiolane-2,2-dioxide) in workplace atmosphere." Fresenius Z. Anal. Chem., 325, pp. 57-63 (1986).
Propargyl alcohol *107-19-7*	2,3	Pc	Activated charcoal tube impregnated with hydrobromic acid 100/50 mg	0,05	6	GC-ECD			OSHA 97	Contact the IRSST before sampling.
ß-Propiolactone *57-57-8*	1,5	C2 RP EM								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Propionic acid *79-09-4*	30		Silica gel tube 400/200 mg	0,2		GC-FID			OSHA 07	Contact the IRSST before sampling.
Propoxur (baygon) *114-26-1*	0,5		OVS-2 tube with XAD-2 and glass fiber filter	0,1-1	180	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
n-Propyl acetate *109-60-4*	835 1040		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0301		GC-FID	420		IRSST 168-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.7%. Refer to the 3M passive monitor guide on the IRSST's Web site.
n-Propyl acetate *109-60-4*	835 1040		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	420		IRSST 168-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.91%.
n-Propyl alcohol *71-23-8*	492 614	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	250	4,9	IRSST 280-1	
n-Propyl alcohol *71-23-8*	492 614	Pc	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0397		GC-FID	250	4,9	IRSST 280-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.8%. Refer to the 3M passive monitor guide on the IRSST's Web site.
n-Propyl nitrate *627-13-4*	107 172		Activated charcoal tube 100/50mg	0,2-1	70 15	GC-FID			NIOSH S227	Contact the IRSST before sampling.
Propylene *115-07-1*		Ax				DRI-EX			IRSST 9-C	A DRI is used for analyzing combustible gases as a percentage of their lower explosive limit. In the paper version of the guide, refer to the note about simple asphyxiants. The reference method corresponds to calibration of the direct-reading instrument (DRI).
Propylene glycol dinitrate *6423-43-4*	0,34	Pc	Tenax-GC tube	1	15	HPLC-UV			OSHA 43	Contact the IRSST before sampling. OSHA method 43 can be adapted to propylene glycol dinitrate.
Propylene glycol monomethyl ether *107-98-2*	369 553		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	0,2	10	GC-FID	74	0,1	IRSST 334-1	Monomethyl ether of ethylene glycol must be specifically sampled due to a specific desorption solvent. However, simultaneous sampling and analysis of 2-butoxyethanol is possible.
Propylene imine *75-55-8*	4,7	Pc C2 RP EM	Glass fritted tip impinger containing Folin reagent	0,2	48	HPLC-UV			NIOSH 3514	Protect the impingers from the light and in the refrigeration. Contact the IRSST before sampling. NIOSH method 3514 is used for ethylene imine and can be adapted to this product.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Propylene oxide *75-56-9*	48	C2 RP EM	Activated charcoal tube 100/50 mg	0,01-0,2	5	GC-FID			NIOSH 1612	Contact the IRSST before sampling.
Pyrethrum *8003-34-7*	5		OVS-2 tube with XAD-2 and glass fiber filter	1	60	GC-ECD			OSHA 70	Contact the IRSST before sampling.
Pyridine *110-86-1*	16		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 1,0	5	GC-NPD	4		IRSST 199-1	Pyridine must be sampled specifically due to the sampling device used and a specific desorption solvent.
Resorcinol *108-46-3*	45 90		Versatile OVS-7 tube with XAD-7 and a glass fiber filter	0,05-0,1	24	GC-FID			NIOSH 5701	Keeps for 30 days at 5°C protected from light. Contact the IRSST before sampling.
Rhodium [7440-16-6], Metal and insoluble compounds (as Rh) *7440-16-6*	0,1		Mixed cellulose ester filter	1-5	480	ICP-MS			ASTM D7439-08	Contact the IRSST before sampling.
Rhodium [7440-16-6], Soluble compounds (as Rh) *7440-16-6*	0,001		Mixed cellulose ester filter	1-5	480	ICP-MS			ASTM D7439-08	Contact the IRSST before sampling.
Ronnel *299-84-3*	10		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	60	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. Some phosphates may cause interference during the analysis.
Rosin core solder pyrolysis products (as Formaldehyde) *8050-09-7*	0,1	S								Contact the IRSST before sampling. No supporting reference is suggested for this substance.
Rotenone *83-79-4*	5		Polytetrafluorocarbon (teflon) filter	1-4	100	HPLC-UV			NIOSH 5007	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Rouge	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Rubber solvent (Naphtha) *8030-30-6*	1590		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	800		IRSST 154-1	A process sample must be supplied.
Selenium and compounds (as Se) *7782-49-2*	0,2		Mixed cellulose ester filter	1-4	500	ICP			NIOSH 7300	Contact the IRSST before sampling.
Selenium hexafluoride (as Se) *7783-79-1*	0,16					DRI-IR			OSHA IMIS2231	Contact the IRSST before sampling.
Sesone *136-78-7*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Silica, Amorphous, Diatomaceous earth (uncalcined) *61790-53-2*	6 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Silica - Amorphous, fumes *69012-64-2*	2 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Silica, Amorphous, fused *60676-86-0*	0,1 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Silica, Amorphous, gel *63231-67-4*	6 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Silica, Amorphous, precipitated *1343-98-2*	6 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Silica, Crystalline, Cristobalite *14464-46-1*	0,05 Pr		Cyclone in series with a polyvinyl chloride filter **902** PVC filter-37 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	1000	XRD	7	7	IRSST 206-2	
Silica, Crystalline, Quartz *14808-60-7*	0,1 Pr	C2 EM	Cyclone in series with an Omega P-08370K polyvinyl chloride filter **902** PVC filter-37 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	800	XRD	6	5	IRSST 206-2	The analytical results are expressed as quartz.
Silica, Crystalline, Quartz *14808-60-7*	0,1 Pr	C2 EM	Cyclone in series with an Omega P-08370K polyvinyl chloride filter **902** PVC filter-37 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	800	FTIR	6	5	IRSST 78	
Silica, Crystalline, Tridymite *15468-32-3*	0,05 Pr									Contact the IRSST before sampling. Tridymite cannot be identified when quartz and cristobalite are present.
Silica, Crystalline, Tripoli *1317-95-9*	0,1 Pr									Contact the IRSST before sampling. Tripoli cannot be identified when quartz is present.
Silicon *7440-21-3*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Silicon carbide (non fibrous) *409-21-2*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Silicon tetrahydride *7803-62-5*	6,6		Glass fritted tip impinger containing 15 mL of potassium hydroxide	1	480	ICP			OSHA IMIS2237 OSHA ID125G	The samples must be stored in plastic containers and shipped as soon as possible. Contact the IRSST before sampling. OSHA method ID-125G is for total silicon and can be adapted to this product.
Silver, Metal *7440-22-4*	0,1		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	0,05		IRSST 375	Specific sampling must be carried out for this substance. The analytical results are expressed as total silver.
Silver [7440-22-4], Soluble compounds (as Ag) *7440-22-4*	0,01									Contact the IRSST before sampling. IRSST method 20-3 is for total silver and can be adapted to soluble silver compounds.
Soapstone *14378-12-2*	6 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Soapstone *14378-12-2*	3 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Sodium azide *26628-22-8*	-- -- 0,3	RP	Polyvinyl chloride filter in series with a silica gel tube 150/75 mg.	1	5	IC-VIS			OSHA ID211	Contact the IRSST before sampling. OSHA method ID211 is for the simultaneous determination of sodium azide (NaN3) and hydrazoic acid (HN3) since sodium azide is converted into hydrazoic acid on contact with moisture.
Sodium bisulfite *7631-90-5*	5									Contact the IRSST before sampling. IRSST method 287-1 is for the analysis of total soluble sodium and can be adapted to this product.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Sodium bisulfite *7631-90-5*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Sodium fluoroacetate *62-74-8*	0,05 0,15	Pc	Mixed cellulose ester filter	1,5-2	480	IC-CD			NIOSH S301	Contact the IRSST before sampling.
Sodium hydroxide *1310-73-2*	-- -- 2	RP	Gelman 66467 polyvinyl chloride filter 5 µm **903** PVC filter-37	1,5	180	FAAS	5		IRSST 287-1	Specific sampling must be carried out for this substance. All soluble sodium salts are positive interferences. The results are expressed as total soluble sodium. A stoichiometric factor must be applied.
Sodium metabisulfite *7681-57-4*	5									Contact the IRSST before sampling. IRSST method 287-1 is for the analysis of total soluble sodium and can be adapted to this product.
Sodium metabisulfite *7681-57-4*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Borates, tetra, sodium salt , Anhydrous *1330-43-4*	1		Mixed cellulose ester filter	1-4	500	ICP			NIOSH 7300	Contact the IRSST before sampling. NIOSH method 7300 is used for metals and can be adapted to boron.
Borates, tetra, sodium salt , Decahydrate *1303-96-4*	5		Mixed cellulose ester filter	1-4	500	ICP			NIOSH 7300	Contact the IRSST before sampling. NIOSH method 7300 is used for metals and can be adapted to boron.
Borates, tetra, sodium salt , Pentahydrate *12045-88-4*	1		Mixed cellulose ester filter	1-4	500	ICP			NIOSH 7300	Contact the IRSST before sampling. NIOSH method 7300 is used for metals and can be adapted to boron.
Starch *9005-25-8*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Substances table

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Stibine (as Sb) *7803-52-3*	0,51		Silica gel tube impregnated with mercuric bichloride	0,01- 0,2	50	UV/VIS-S			NIOSH 6008	Contact the IRSST before sampling.
Stoddard solvent *8052-41-3*	525		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	275	5,0	IRSST 80-1	A process sample must be supplied.
Strontium chromate (as Cr) *7789-06-2*	0,0005	C2 RP EM	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS	0,04	4,4	IRSST 365	For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total water-insoluble chromium VI. Surface tests for chromates can be carried out, and the required equipment (kit #2625) is available at the IRSST. See communiqué 2008-06 on our Web site. Analysis time of 8 days for welding fumes and 10 days for the other processes following the sampling date. Ship all samples by rapid courier within a period not exceeding 24 hours after sampling. Any substance that produces a response on the detector at 540 nm and that has a retention time similar to Cr VI is a potential interference.
Strychnine *57-24-9*	0,15		Glass fiber filter	1-3	200	HPLC-UV			NIOSH 5016	Contact the IRSST before sampling.
Styrene (monomer) *100-42-5*	213 426	Pc C3				DRI-PAD			IRSST 39-A	Refer to the user's guide accompanying the instrument. Styrene is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is of 0.5 mg/m³ (0.12 ppm). The reference method corresponds to calibration of the DRI.
Styrene (monomer) *100-42-5*	213 426	Pc C3	3M Organic Vapor Monitor #3500 **2695** Passive dosimeter	0,0289		GC-FID	27	1,4	IRSST 31-3	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 3.0%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Styrene (monomer) *100-42-5*	213 426	Pc C3	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	5 3	GC-FID	27	1,4	IRSST 31-3	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 3.0%.
Subtilisins (Proteolytic enzymes as 100 % pure crystalline enzyme)	-- -- 0,00006	RP								Contact the IRSST before sampling. No supporting reference is suggested for this product.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Succinaldehyde *638-37-9*	4	Pc								Contact the IRSST before sampling. IRSST method 283-1 is for glutaraldehyde and could be adapted to succinic aldehyde
Sucrose *57-50-1*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Sulfometuron methyl *74222-97-2*	5		OVS 2 tube with XAD-2 and glass fiber filter	0,1-1	480	HPLC-UV			NIOSH 5601	Contact the IRSST before sampling. NIOSH method 5601 is for organonitrogen pesticides and can be adapted to this product.
Sulfotep *3689-24-5*	0,2	Pc	OVS-2 tube with XAD-2 and glass fiber filter			GC-MS			NIOSH 5605	Contact the IRSST before sampling. NIOSH method 5605 is for pesticides and can be adapted to this product.
Sulfur dioxide *7446-09-5*	5,2 13					DRI-elec			IRSST 8-B	Refer to the user's guide accompanying the instrument. Sulfur dioxide is quantified in the field with a direct-reading instrument (DRI). The minimum reported value is 1.3 mg/m^3 (0.5 ppm). The reference method corresponds to calibration of the DRI.
Sulfur dioxide *7446-09-5*	5,2 13		Impregnated Anasorb 747 tube preceded by a filter	0,1	12 1,5	IC-CD			OSHA ID200	Contact the IRSST before sampling. The analytical result for the particles collected on filter is expressed as sulfate.
Sulfur hexafluoride *2551-62-4*	5970		Aluminized sampling bag			GC-ECD			NIOSH 6602	Contact the IRSST before sampling.
Sulfur monochloride *10025-67-9*	-- -- 5,5	RP	Glass fritted tip impinger containing deionized water	1	30 5	IC-CD			OSHA IMIS2320	Contact the IRSST before sampling.
Sulfur pentafluoride *5714-22-7*	-- -- 0,1	RP	Cellulose ester filter followed by a pretreated cellulose pad	1-2	800	SE			NIOSH 7902	Contact the IRSST before sampling. NIOSH method 7902 is for aerosol and gas fluorides and can be adapted to this product.
Sulfur tetrafluoride *7783-60-0*	-- -- 0,44	RP	Cellulose ester filter followed by a pretreated cellulose pad	1-2	800	SE			NIOSH 7902	Contact the IRSST before sampling. NIOSH method 7902 is for aerosol and gas fluorides and can be adapted to this product.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Sulfuric acid *7664-93-9*	1 3		Treated silica gel tube SKC 226-10-03 **2147** Silica gel 400/200 mg	0,2	48	IC-CD	5,1	5,73	IRSST 211-1	Five ions can be determined simultaneously, namely bromide, chloride, nitrate, phosphate and sulfate. Analytical results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable for 21 days at 25°C. All sulfate ions not originating from the acid can cause positive interference.
Sulfuric acid *7664-93-9*	1 3		Mixed cellulose ester filter	2	480	IC-CD			OSHA ID-113	After sampling, transfer the filter to a glass container. All the sulfate ions not originating from the acid can cause positive interference.
Sulfuryl fluoride *2699-79-8*	21 42		Activated charcoal tube 800/200 mg	0,05- 0,1	3 1,5	IC-CD			NIOSH 6012	Contact the IRSST before sampling.
Sulprofos *35400-43-2*	1		OVS-2 tube with XAD-2 and glass fiber filter			GC-MS			NIOSH 5605	Contact the IRSST before sampling. NIOSH method 5605 is for pesticides and can be adapted to this product.
2,4,5-T *93-76-5*	10	C2 RP EM	Glass fiber filter, binderless	1-3	200	HPLC-UV			NIOSH 5001	Contact the IRSST before sampling.
Talc, fibrous	1 f/cc	C1 EM	Cassette with conductive extension and mixed cellulose ester filter, Environmental Express CS250080 **918** MCE filter-25	0,5-16	400	PCM			IRSST 243-1	Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box supplied by the IRSST (#3010). In relatively uncontaminated atmospheres, where the fibre concentration is much lower than 0.1 fibres/mL, use larger sampling volumes (3000 to 10000L) in order to obtain quantifiable densities. The method applies to the counting of all fibres whose refractive index is compatible with the mounting solution. The minimum reported value is 25 fibres/mm². Characterization of the fibres in bulk samples or in deposited dusts is done using method 244-2. An analysis using a transmission electron microscopy (TEM) method may be required for some materials containing fine asbestos fibres, for example floor tiles.
Talc, non fibrous *14807-96-6*	3 Pr		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25 **997** PVC filter-37, 3 parts	1,7 (nylon) 2,75 (GS3)	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Tantalum [7440-25-7], metal and oxide dusts (as Ta)	5		Mixed cellulose ester filter	2	480	ICP			OSHA ID125G	Contact the IRSST before sampling. OSHA method ID-125G is for several metals and can be adapted to this product.
Tellurium and compounds (as Te) *13494-80-9*	0,1		Mixed cellulose ester filter	1-2	960	ICP			NIOSH 7300	Contact the IRSST before sampling.
Tellurium hexafluoride (as Te) *7783-80-4*	0,1		Mixed cellulose ester filter in series with an activated charcoal tube	1	390	FAAS			NIOSH S187	Contact the IRSST before sampling.
Temephos *3383-96-8*	10		OVS-2 tube with XAD-2 and glass fiber filter			GC-MS			NIOSH 5605	Contact the IRSST before sampling. NIOSH method 5605 is for pesticides and can be adapted to this product.
TEPP *107-49-3*	0,047	Pc	Two chromosorb 102 tubes in series	0,01-0,2	40	GC-FPD			NIOSH 2504	Contact the IRSST before sampling.
Terephthalic acid *100-21-0*	10		Activated charcoal tube 100/50 mg	0,2	10	HPLC-UV			OSHA IMIS P198	Contact the IRSST before sampling.
Terphenyls *26140-60-3*	-- -- 5	RP	PTFE filter	1-3	30	GC-FID			NIOSH 5021	Contact the IRSST before sampling.
1,1,2,2-Tetrabromoethane *79-27-6*	14		Silica gel tube 100/50 mg	0,2-1	100	GC-FID			NIOSH 2003	Contact the IRSST before sampling.
1,1,1,2-Tetrachloro-2,2-difluoroethane *76-11-9*	4170		Activated charcoal tube 100/50 mg	0,01-0,035	2	GC-FID			NIOSH 1016	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
1,1,2,2-Tetrachloro-1, 2-difluoroethane *76-12-0*	4170		Activated charcoal tube 100/50 mg	0,01-0,035	2	GC-FID			NIOSH 1016	Contact the IRSST before sampling.
1,1,2,2-Tetrachloroethane *79-34-5*	6,9	Pc								Contact the IRSST before sampling. No supporting reference is suggested for this product.
Tetrachloronaphthalene *1335-88-2*	2		OVS-2 tube with XAD-2 and glass fiber filter	1	100	GC-ECD			OSHA IMIS2350	Contact the IRSST before sampling.
Tetrahydrofuran *109-99-9*	300		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	9	GC-FID	53	0,8	IRSST 179-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.8%.
Tetramethyl succinonitrile *3333-52-6*	2,8	Pc	Activated charcoal tube 100/50 mg	Max: 1	55	GC-FID			OSHA 07	Contact the IRSST before sampling.
Tetranitromethane *509-14-8*	0,04	C2 EM	Glass midget impinger containing 15 mL of ethyl acetate	0,5-1	100	GC-NPD			NIOSH 3513	Contact the IRSST before sampling.
Tetrasodium pyrophosphate *7722-88-5*	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Tetryl *479-45-8*	1,5		Mixed cellulose ester filter	1,5	100	Colo			NIOSH S225	Contact the IRSST before sampling. Other aromatic nitro compounds may cause interference.
Thallium, elemental [7440-28-0], and soluble compounds (as Tl)	0,1	Pc	Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
4,4'-Thiobis (6-tert-butyl-m-cresol) *96-69-5*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Thioglycolic acid *68-11-1*	3,8	Pc	Glass midget impinger containing deionized water	1	120	HPLC-UV			OSHA IMIS2423	Contact the IRSST before sampling.
Thionyl chloride *7719-09-7*	-- -- 4,9	RP	Glass fritted tip impinger containing deionized water	0,5	7,5	IC-CD			OSHA ID174SG	Contact the IRSST before sampling.
Thiram® *137-26-8*	5		Polytetrafluorocarbon (teflon) filter	1-4	400	HPLC-UV			NIOSH 5005	Contact the IRSST before sampling. Stable for 7 days at 25°C.
Tin, Metal *7440-31-5*	2		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	25		IRSST 5-1	Specific sampling must be carried out for this substance. The analytical results are expressed as total tin.
Tin [7440-31-5], Organic compounds (as Sn) *7440-31-5*	0,1 0,2	Pc	Glass fiber filter with XAD-2 tuber	1-1,5	500	HPLC-FGAA			NIOSH 5504	Contact the IRSST before sampling. Each organic compound of tin must be treated as a specific case. Sample is stable for 7 days at 0°C.
Tin [7440-31-5], Oxide and inorganic compounds, except SnH4 (as Sn) *7440-31-5*	2		Omega M-083700AF or Omega M-082500AFP mixed cellulose ester filter **905** MCE filter-37 **915** MCE filter-25	1,5	180	FAAS	25		IRSST 5-1	Specific sampling must be carried out for this substance. The analytical results are expressed as total tin.
Titanium dioxide *13463-67-7*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
o-Tolidine *119-93-7*		Pc C2 RP EM	Two glass fiber filters impregnated with sulfuric acid	1	100	GC-ECD			OSHA 71	The filters must be transferred to vials containing deionized water within 10 hours of sampling. Contact the IRSST before sampling. Any compound that reacts with the sulfuric acid on the filters may cause interference.
Toluene *108-88-3*	188	Pc	3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0314		GC-FID	20	3,0	IRSST 16-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.9%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Toluene *108-88-3*	188	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	5	GC-FID	20	3,0	IRSST 16-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.56%.
Toluene diisocyanate (TDI) (isomers mixture) *26471-62-5*	0,036 0,14	EM S	Impregnated glass fiber filter **970** Impregnated GFF	1,0	15	HPLC-MS	0,0006		IRSST 366	The recommended volume is 15 litres; however the sampling time can be up to 8 hours. Store the samples in a refrigerator before and after sampling. Five isocyanates can be requested at the same time: HDI, TDI, MDI, IPDI and HMDI. The analysis is done for the isocyanates present in vapour form only and the result is expressed as a monomer concentration.
Toluene diisocyanate (TDI) (isomers mixture) *26471-62-5*	0,036 0,14	EM S	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Teflon filter #MSI Z50WP03700 **917** PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0,03		IRSST 376	Refer to the sampling guidelines supplied with the equipment. If more than one isocyanate is requested, provide a process sample. For surface wipe sampling, contact Laboratory Customer Service. The two filters in the sampling cassette allow specific analysis of monomer TDI in vapour form and in aerosol form. The result supplied in the report is the sum of the monomers of TDI of the two fractions. Determination of the corresponding oligomers is also done during the analysis. The sampling time can be longer than 15 minutes if the TDI is present in vapour form only.
o-Toluidine *95-53-4*	8,8	Pc C2 RP EM	Two glass fiber filters impregnated with sulfuric acid	1	100	GC-ECD			OSHA 73	Contact the IRSST before sampling. . Any compound that reacts with the sulfuric acid may cause interference.
m-Toluidine *108-44-1*	8,8	Pc	Two glass fiber filters impregnated with sulfuric acid	1	100	GC-ECD			OSHA 73	Contact the IRSST before sampling. . All compounds that can react with sulfuric acid can cause interference.
p-Toluidine *106-49-0*	8,8	Pc C2 EM	Two glass fiber filters impregnated with sulfuric acid.	1	960	GC-ECD			OSHA 73	Keeps for at least 15 days at 21°C. Contact the IRSST before sampling. All compounds that can react with sulfuric acid can cause interference.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Tributyl phosphate *126-73-8*	2,2		Mixed cellulose ester filter	1-3	100	GC-FPD			NIOSH 5034	According to NIOSH 5034, two mixed cellulose ester filters in series can be used in the case where the temperature of the sampling site exceeds 23°C. Contact the IRSST before sampling.
Trichloroacetic acid *76-03-9*	6,7		Silica gel tube 100/50 mg	0,2	10	HPLC-UV			OSHA PV2017	Contact the IRSST before sampling.
1,2,4-Trichlorobenzene *120-82-1*	-- -- 37	RP	Polytetrafluorocarbon (teflon) filter in series with an XAD-2 tube	0,01-0,2	10	GC-ECD			NIOSH 5517	Contact the IRSST before sampling.
1,1,2-Trichloroethane *79-00-5*	55	Pc	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	22		IRSST 102-1	
Trichloroethylene *79-01-6*	269 1070		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10 3	GC-FID	58	0,8	IRSST 75-3	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.78%.
Trichloroethylene *79-01-6*	269 1070		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0311		GC-FID	58	0,8	IRSST 75-3	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 0.6%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Trichlorofluoromethane *75-69-4*	-- -- 5620	RP	Activated charcoal tube 400/200 mg	Max: 0,05	4	GC-FID			NIOSH 1006	Contact the IRSST before sampling.
Trichloronaphthalene *1321-65-9*	5	Pc	OVS-2 tube with XAD-2 and glass fiber filter	1	100	GC-ECD			OSHA IMIS2483	Contact the IRSST before sampling.
1,2,3-Trichloropropane *96-18-4*	60	Pc	Activated charcoal tube 100/50 mg	0,01-0,2	10	GC-FID			NIOSH 1003	Contact the IRSST before sampling.
1,1,2-Trichloro-1,2,2-trifluoroethane *76-13-1*	7670 9590		SKC 226-09 activated charcoal tube **2121** Activated charcoal 400/200 mg	0,2	5	GC-FID	2	1,4	IRSST 191-1	Specific desorption must be carried out for this substance. Freon 113. However, the simultaneous sampling and analysis of chlorodifluoromethane (Freon 22) is possible.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Tri-o-cresyl phosphate *78-30-8*	0,1	Pc	Mixed cellulose ester filter	1-3	100	GC-FPD			NIOSH 5037	Contact the IRSST before sampling.
Triethanolamine *102-71-6*	5	S	Glass fiber filter	1	100	GC-FID			OSHA PV2141	Contact the IRSST before sampling.
Triethylamine *121-44-8*	20,5 61,5	Pc	XAD-7 tube treated with phosphoric acid	0,1-0,2	24	GC-NPD			OSHA PV2060	Stable for more than 14 days at 21°C. Contact the IRSST before sampling.
Triglycidyl isocyanurate (TGIC) (alpha-) irsst *59653-73-5*	0,05		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	2,0	240	HPLC-MS	0,7	4	IRSST 364	This method gives a result expressed in total triglycidyl isocyanurate, corresponding to the mixture of the alpha and beta isomers. A gravimetric result of the total dust can be supplied on request.
Triglycidyl isocyanurate (TGIC) (beta) irsst *59653-74-6*	0,05		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	2,0	240	HPLC-MS	0,7	4	IRSST 364	This method gives a result expressed in total triglycidyl isocyanurate, corresponding to the mixture of the alpha and beta isomers. A gravimetric result of the total dust can be supplied on request.
Triglycidyl isocyanurate (TGIC) (mixed isomers) irsst *2451-62-9*	0,05		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	2,0	240	HPLC-MS	0,7	4	IRSST 364	This method gives a result expressed in total triglycidyl isocyanurate, corresponding to the mixture of the alpha and beta isomers. A gravimetric result of the total dust can be supplied on request.
Trimellitic anhydride *552-30-7*	-- -- 0,04	RP S		2,0	480	HPLC-UV			OSHA 98	Contact the IRSST before sampling.
Trimethyl benzene irsst *25551-13-7*	123		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0263		GC-FID	62	0,8	IRSST 251-1	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 2.7%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Trimethyl benzene irsst *25551-13-7*	123		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	62	0,8	IRSST 251-1	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 1.1%.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Trimethyl phosphite *121-45-9*	10		OVS-2 tube with XAD-2 and glass fiber filter	0,2-1	240	GC-FPD			NIOSH 5600	Contact the IRSST before sampling. NIOSH method 5600 is for organophosphorus pesticides and can be adapted to this product.
Trimethylamine *75-50-3*	12 36		XAD-7 tube traited with phosphoric acid	0,1-0,2	20	GC-FID			OSHA PV2060	Contact the IRSST before sampling.
2,4,6-Trinitrotoluene (TNT) *118-96-7*	0,5	Pc	Tenax-GC tube with a glass fiber filter	1	60	GC-ECD			OSHA 44	Contact the IRSST before sampling.
Triphenyl amine *603-34-9*	5		Glass fritted impinger containing 15 mL of isopropanol	1	250	HPLC-UV			OSHA IMIS2534	Contact the IRSST before sampling.
Triphenyl phosphate *115-86-6*	3		Mixed cellulose ester filter	1-3	100	GC-FPD			NIOSH 5038	Contact the IRSST before sampling.
Tungsten [7440-33-7] (as W) , Insoluble compounds *7440-33-7*	5 10		Mixed cellulose ester filter	2	480	ICP			OSHA ID213	Contact the IRSST before sampling.
Tungsten [7440-33-7] (as W) , Soluble compounds *7440-33-7*	1 3		Mixed cellulose ester filter	2	480	ICP			OSHA ID213	Contact the IRSST before sampling.
Turpentine *8006-64-2*	112	S	Activated charcoal tube 100/50 mg	0,2	12	GC-FID	125	5,7	IRSST 254-1	In the case of a simultaneous evaluation of delta-carene, alpha-pinene or beta-pinene, contact the IRSST before samping.
Δ-3 Carene *13466-78-9*	112	S								Contact the IRSST before sampling. IRSST method 254-1 is for turpentine and can be adapted to this product.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
α-Pinene *80-56-6*	112	S								Contact the IRSST before sampling. IRSST method 254-1 is for turpentine and can be adapted to this product.
β-Pinene *127-91-3*	112	S								Contact the IRSST before sampling. IRSST method 254-1 is for turpentine and can be adapted to this product.
Uranium [7440-61-1] (natural) , Insoluble compounds (as U) *7440-61-1*	0,2 0,6		Mixed cellulose ester filter	2	480 30	ICP			OSHA ID125G	Contact the IRSST before sampling. The results are expressed as total uranium
Uranium (natural) [7440-61-1], Soluble compounds (as U) *7440-61-1*	0,05		Polyvinyl chloride filter	2	240	Polaro			OSHA ID170SG	Contact the IRSST before sampling.
n-Valeraldehyde *110-62-3*	176		Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,3		IRSST 326-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Vanadium pentoxide, fume and respirable dust (as V2O5) *1314-62-1*	0,05		Cyclone in series with mixed cellulose ester filter, 0.8µm, 25 and 37 mm **905** MCE filter-37 **915** MCE filter-25	1,7 (nylon) 2,75 (GS3)	480	ICP-MS	0,1	4,4	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The results are expressed as total vanadium. A stoichiometric factor must be applied.
Vanadium pentoxide, fume and respirable dust (as V2O5) *1314-62-1*	0,05		Cyclone in series with a 5 µm CPV filter	1,7 (nylon) 2,75 (GS3)	1000	XRD			NIOSH 7504	Contact the IRSST before sampling. The results are expressed as vanadium pentoxide

ROHS Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Vegetable oil mists (except castor, cashew and other similar irritant oils) *68956-68-3*	10		Preweighed teflon filter (5 µm), Millipore MITEX 37 mm **960** PTF filter-37	2	960	Grav	50		IRSST 356-1	Determination in air of mineral oil mist, soluble, synthetic, half-synthetic and vegetable oil. Cigarette smoke may cause interference.
Vinyl acetate *108-05-4*	35 53	C3	ORBO-92 (Carboxen-564 carbon molecular sieve) **2195** ORBO 92	Max: 0,2	12 3	GC-FID	7,5	5,0	IRSST 208-2	Vinyl acetate must be sampled specifically due to the sampling device used and of specific desorption solvent.
Vinyl bromide *593-60-2*	22	C2 EM	Activated charcoal tube 400/200 mg	0,01-0,2	6	GC-FID			NIOSH 1009	Contact the IRSST before sampling.
Vinyl chloride (monomer) *75-01-4*	2,6	C1 RP EM	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,05	5 0,75	GC-FID	0,64	1,0	IRSST 86-2	This substance must be specifically sampled.
Vinyl cyclohexene dioxide *106-87-6*	57	Pc C2 RP EM	XAD-2 tube 80/40 mg	0,2	10	GC-FID			OSHA PV2083	Contact the IRSST before sampling.
Vinyl toluene *25013-15-4*	242 483		Activated charcoal tube 100/50 mg	0,01-0,2	30	GC-FID			NIOSH 1501	Stable for more than 30 days at 5°C. Contact the IRSST before sampling.
VM&P Naphtha *8032-32-4*	1370		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	170	1,1	IRSST 29-1	A process sample must be supplied.
Warfarin *81-81-2*	0,1		Polytetrafluorocarbon (teflon) filter	1-4	400	HPLC-UV			NIOSH 5002	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Welding fumes (not otherwise classified)	5		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	For evaluating welding fumes, if personal sampling must be done inside the mask, use an adaptor available from SKC Cat. No. 225-600. If metals must be analyzed, use a preweighed MCE filter (code 916 or 913) Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Wood dust (western red cedar)	2,5 Pt		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	1,5	180	Grav	25	4,9	IRSST 48-1	Sampling of respirable dusts is also possible by using the flow rate appropriate to the cyclone used. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Wood dust hard and soft, except red cedar	5 Pt		Polyvinyl chloride filter with Accu-Cap. **910** PVC filter-37 with Accu-Cap	1,5	180	Grav	25	4,9	IRSST 48-1	Sampling of respirable dusts is also possible by using the flow rate appropriate to the cyclone used. Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Xylene (o-,m-,p-isomers)	434 651		3M 3500 organic vapour monitor **2695** Passive dosimeter	0,0273		GC-FID	100	5,0	IRSST 101-2	For the monitors, the flow must be considered as being a sampling rate. According to the data from 3M, the precision (CVsampling) of the sampling rate is 1.8%. Refer to the 3M passive monitor guide on the IRSST's Web site.
Xylene (o-,m-,p-isomers)	434 651		SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	12 3	GC-FID	100	5,0	IRSST 101-2	The analysis can be done by gas chromatography coupled with mass spectrometry (GC-MS, IRSST method #369); in this case the analytical uncertainty (CVa) is 0.57%.
m-Xylene-alpha, alpha'-diamine *1477-55-0*	-- -- 0,1	Pc RP	Two glass fiber filters impregnated with sulfuric acid	1	15	HPLC-UV			OSHA 105	Contact the IRSST before sampling.
Xylidine (mixed isomers) *1300-73-8*	2,5	Pc C2 EM	Silica gel tube 150/75 mg	0,02-0,2	20	GC-FID			NIOSH 2002	Contact the IRSST before sampling.
Yttrium [7440-65-5], metal and compounds (as Y)	1		Mixed cellulose ester filter	2	960	FAAS			OSHA ID121	Contact the IRSST before sampling.

ROHS Name CAS	TWAEV STEV Ceiling (mg/m³)	Notes	Sampling Device	Flow L/min	Volume TWAEV STEV (L)	Principle	MRV µg	CVa (%)	# meth.	Remarks
Zinc chloride, fume *7646-85-7*	1		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	1	3,19	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total zinc. A stoichiometric factor must be applied.
Zinc chromates [13530-65-9;11103-86-9; 37300-23-5] (as Cr) *13530-65-9*	0,01	C1 RP EMS	PALL CA28149-306 vinyl/acrylic copolymer filter **926** Vinyl/acrylic copolymer filter	1,5 à 4	360	IC-VIS	0,04	4,4	IRSST 365	For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total water-insoluble chromium VI. Surface tests for chromates can be carried out, and the required equipment (kit #2625) is available at the IRSST. See communiqué 2008-06 on our Web site. Analysis time of 8 days for welding fumes and 10 days for the other processes following the sampling date. Ship all samples by rapid courier within a period not exceeding 24 hours after sampling. Any substance that produces a response on the detector at 540 nm and that has a retention time similar to Cr VI is a potential interference.
Zinc stearate *557-05-1*	10		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Zinc, oxide, Dust *1314-13-2*	10 Pt		SKC 225-8-01-1 or 225-8-04 polyvinyl chloride filter **902** PVC filter-37 **914** PVC filter-25	1,5	180	Grav	25	4,9	IRSST 48-1	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Zinc, oxide, Fume *1314-13-2*	5 10		Mixed cellulose ester filter, 0.8µm, 25 and 37 mm. **905** MCE filter-37 **915** MCE filter-25	1,5	180	ICP-MS	1	3,19	IRSST 362	Cassettes 913 or 916, whose filters are preweighed, can also be used. For surface wipe sampling, contact Laboratory Customer Service. The analytical results are expressed as total zinc. A stoichiometric factor must be applied.
Zirconium [7440-67-7] and compounds (as Zr)	5 10		Mixed cellulose ester filter	2	960 30	FAAS			OSHA ID121	Contact the IRSST before sampling. Fluoride, chloride, ammonium, sulfate and nitrate salts and nickel bromide may cause interference during the analysis.

Name	CAS	Sampling device	Flow L/min	Volume	Principle	MRV µg	CVa %	# meth.	Remarks
1-Bromopropane	106-94-5	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	5	GC-FID	54	1,0	IRSST 333-1	
Acenaphtene	83-32-9	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264 **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,12		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by the sampling tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Anthracene	120-12-7	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264 **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,12		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by the sampling tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Bacteria (Culture)		Trypticase soy agar **5560** Agar-TSA bacteria agar	28	140	DLM-GC			IRSST 341	The sampling volumes are between 56 and 140 litres. For surface wipe sampling, contact Laboratory Customer Service. Bacterial identification.
Bacteria (Culture)		Trypticase soy agar **5560** Agar-TSA bacteria agar	28	140	SM			IRSST 264	The sampling volumes are between 56 and 140 litres. Bacterial counts.
Bacteria (Culture)		Polycarbonate filter 0.8 µm **930** Polycarbonate filter	2	60	DLM-GC			IRSST 341	The sampling volumes are between 20 and 60 litres. For sampling an environment with concentrations above 10,000 CFU/m³ of air. Bacterial identification.
Bacteria (Culture)		Polycarbonate filter 0.8µm **930** Polycarbonate filter	2	40	SM		22	IRSST 368	For sampling an environment with concentrations above 10,000 CFU/m³ of air. Bacterial counts. The MRV is 1600 CFU/m³.
Benzo(e)pyrene	192-97-2	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,09		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Butyraldehyde	123-72-8	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,1		IRSST 324-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.

Name	CAS	Sampling device	Flow L/min	Volume	Principle	MRV µg	CVa %	# meth.	Remarks
Desflurane	57041-67-5	SKC 226-81 Anasorb 747 tube **2190** Anasorb 747 140/70 mg	Max: 0,2	3	GC-FID	12	2,5	IRSST 354-1	Desflurane must be specifically sampled dur to the sampling device used and a specific desorption solvent. However, simultaneous sampling and analysis of sevoflurane is possible. A permissible exposure value (of TWA type) of 70 mg/m³ has been proposed by the Swedish National Board of Occupational Safety and Health.
Dust, inhalable fraction		IOM sampler with stainless steel cassette and polyvinyl chloride fliter, 5 µm, 25mm, preweighed **907** IOM, stainless steel cassette and PVC filter-25mm,	2,0	400	Grav	40	0,72	IRSST 373	Additional information is available in Info-Labo 91-03. The weight measurement method for dusts is by definition non-specific.
Endotoxins		Treated glass fiber filter #Gelman 61652 **935** GF Filter-Treated	2	480	LAL		15	IRSST 332	A prior agreement must first be made with the person in charge of the IRSST microbiology laboratory.
Fluoranthene	206-44-0	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,11		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Fluorene	86-73-7	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,15		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Heptanal	111-71-7	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,04		IRSST 321-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Hexanal	66-25-1	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,07		IRSST 327-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Isobutyraldehyde	78-84-2	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,03		IRSST 325-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.

Name	CAS	Sampling device	Flow L/min	Volume	Principle	MRV µg	CVa %	# meth.	Remarks
Isoflurane	26675-46-7	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	5	GC-FID	20		IRSST 285-1	Isoflurane must be specifically sampled due to the specific analysis performed. However, simultaneous sampling and analysis of halothane and enflurane is possible. A permissible exposure value (of TWA type) of 80 mg/m³ has been proposed by the Swedish National Board of Occupational Safety and Health.
Isovaleraldehyde	590-86-3	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,05		IRSST 330-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Kerosene	8008-20-6	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	Max: 0,2	10	GC-FID	275		IRSST 80-1	A bulk sample must be supplied.
Limonene	138-86-3	SKC 226-01 activated charcoal tube **2120** Activated charcoal 100/50 mg	0,2	5	GC-FID	25	2,5	IRSST 353-1	
Moulds (culture)		Polycarbonate filter, 0.8µm **930** Polycarbonate filter	2	40	SM		22	IRSST 368	Mould counts. The MRV is 1600 CFU/m³.
Moulds (culture)		Polycarbonate filter, 0.8µm **930** Polycarbonate filter	2	60	DLM			IRSST 340	The sampling volumes are between 20 and 60 litres. Mould identification
Moulds (culture)		Malt extract agar **5570** Agar-Agar mould malt	28	140	SM			IRSST 264	The sampling volumes are between 56 and 140 litres. Mould counts.
Moulds (culture)		Malt extract agar **5570** Agar-Agar mould malt	28	140	DLM			IRSST 340	The sampling volumes are between 56 and 140 litres. For surface wipe sampling, contact Laboratory Customer Service. Mould identification
N-Nitrosodibutylamine	924-16-3	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	3,7	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
N-Nitrosodiethylamine	55-18-5	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	6,4	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
N-Nitrosodipropylamine	621-64-7	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	3,7	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
N-Nitrosomethylethylamine	10595-95-6	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	9,3	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
N-Nitrosomorpholine	59-89-2	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	3,9	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.

Name	CAS	Sampling device	Flow L/min	Volume	Principle	MRV µg	CVa %	# meth.	Remarks
N-Nitrosopipéridine	100-75-4	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	4,3	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
N-Nitrosopyrrolidine	930-55-2	Florisil tube 500 mg with pre-tube **2210** Florisil tube with pre-tube	1-2	1000	GC-NPD	0,04	3,7	IRSST 371	The recommended sampling volume is 400 to 1000 litres. The samples can be kept for 4 weeks in the dark at 4°C.The simulltaneous determination of 8 nitrosamines can be done on the same tube.
Phenanthrene	85-01-8	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,12		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Propionaldehyde	123-38-6	Supelco 2-0257 Orbo 23 tube **2186** Orbo 23 120/60 mg	0,1	10	GC-MS	0,04		IRSST 323-1	Before and after sampling, tubes must be stored in a freezer. Eleven aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acrolein and formaldehyde. This method must not be used for the specific evaluation of formaldehyde; the methods to be used in this case are 295-1 and 357-1.
Pyrene	129-00-0	Millipore AP4003705 glass fiber filter pretreated in the laboratory in series with a Supelco 2-0264 Orbo-42 tube **2187** Orbo 42 100/50 mg **911** GF filter-37	2	960	GC-MS	0,12		IRSST 225-2	The sampling train consists of a cassette that will collect the PAHs in particulate form, followed by a tube that will adsorb the PAHs in vapour form. This tube is connected directly to the pump by Tygon tubing. After sampling, the samples must be stored in the freezer protected from light. The tubes and filters must be shipped together. Ten hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene et le benzo(a)pyrene.
Respirable combustible dust (RCD)		Silver filter 25 mm (IRSST #950)	1,7 (nylon) 2,75 (GS3)	1000	Grav			CANMET	The reference value for respirable combustible dust (RCD) according to the Regulation respecting occupational health and safety in mines is 0.6 mg/m³ (8-hour time-weigted average).
Sevoflurane	28523-86-6	SKC ST226-81 Anasorb 747 tube **2190** Anasorb 747 140/70 mg	Max: 0,2	3	GC-FID	30	2,5	IRSST 355-1	Sevoflurane must be specifically sampled due to the sampling device used and a specific desorption solvent. However, simultaneous sampling and analysis of desflurane is possible. A permissible exposure value (of the TWA type) of 80 mg/m³ has been proposed by the Swedish National Board of Occupational Safety and Health.
Spores		Cassette for spores with EMS 120520 microscope slide **931** Spore trap	15	150	DLM			IRSST 367	Spore counts and identification. The MRV is 13 spores/m³ for a sampling volume of 150 litres.

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Appendix 1: Sampling equipment

List of collecting media available at the IRSST

Inventory no.	Description	Limited shelf life
902	Polyvinyl chloride filter, 5 µm, 37 mm, preweighed	
903	Polyvinyl chloride filter, 5 µm, 37 mm.	
905	Mixed cellulose ester filter, 0.8 µm, 37 mm.	
906	Mixed cellulose ester filter, 0.8 µm, 37 mm, open cassette.	
907	IOM sampler with stainless steel cassette and polyvinyl chloride filter, 5 µm, 25 mm, preweighed	
908	Mixed cellulose ester filter, 0.8 µm, 37 mm.	
910	Polyvinyl chloride filter, 5 µm, 37 mm, with Accu-Cap preweighed.	
911	Pretreated glass fibre filter, 0.8 µm, 37 mm.	
912	Cellulose nitrate filter, 0.8 µm, 37 mm.	
913	Mixed cellulose ester filter, 0.8 µm, 37 mm, preweighed.	
914	Polyvinyl chloride filter, 5 µm, 25 mm, preweighed.	
915	Mixed cellulose ester filter, 0.8 µm, 25 mm.	
916	Mixed cellulose ester filter, 0.8 µm, 25 mm, preweighed.	
917	Polytetrafluorocarbon and glass fibre filters, 0.8 µm, 37 mm, with vial.	Yes
918	Mixed cellulose ester filter, 5 µm, 25 mm.	
919	Vial containing 1% acetic acid.	Yes
921	Two glass fibre filters impregnated with DNPH and phosphoric acid.	Yes
923	Two impregnated quartz filters with vial.	Yes
925	Two glass fibre filters impregnated with sulfuric acid, 37 mm.	Yes
926	Vinyl/acrylic copolymer filter, 0.8 µm, 25 mm.	Yes
927	Vinyl/acrylic copolymer filter, 0.8 µm, 25 mm impregnated.	Yes
930	Polycarbonate filter, 0.8 µm, 37 mm.	
931	Cassettes for spores with microscope slide.	Yes
935	Glass fibre filter, treated, 37 mm.	
950	Silver filter, 0.8 µm, 25 mm.	
955	Impregnated glass fibre filter.	Yes
960	Teflon filter, 5 µm, 37 mm, with plastic pad.	
970	Impregnated glass fibre filter.	Yes
997	Polyvinyl chloride filter, 5 µm, 37 mm, preweighed, 3 parts	
1401	Impinger trap.	
1402	Impinger holster.	
1414	Glass midget impinger containing 10 mL of 0.1 N sodium hydroxide.	Yes
1420	Glass fritted tip impinger containing 15 mL of ethylene glycol.	Yes
1422	Glass midget impinger containing 15 mL of 0.1 N sodium hydroxide.	Yes
1902	Aluminized bag, 2 L, for gases.	
1905	Aluminized bag, 5 L, for gases.	
2120	7 cm long, 100/50 mg of charcoal.	
2121	11 cm long, 400/200 mg of charcoal.	
2127	7 cm long, 100/50 mg of polymer.	

Inventory no.	Description	Limited shelf life
2140	7 cm long, 150/75 mg of silica gel.	
2143	11 cm long, 520/260 mg of silica gel.	
2144	11 cm long, 500/250 mg of charcoal beads (Pretreated with H2SO4).	Yes
2147	11 cm long, 400/200 mg of silica gel treated.	Yes
2152	11 cm long, 100/50 mg of styrene-divinylbenzene copolymer.	
2162	11 cm long, 150/75 mg of ethylvinylbenzene-divinylbenzene copolymer.	
2170	7 cm long 80/40 mg of XAD-2 impregnated with 1-naphthylisothiocyanate.	Yes
2180	8 cm long, 270/140 mg of XAD-2 with a glass fibre filter and polyurethane foam (OVS-2).	
2185	11 cm long, 300/150 mg of styrene polymer.	
2186	10 cm long, 120/60 mg of styrene-divinylbenzene copolymer impregnated with 2-hydroxymethyl piperidine.	Yes
2187	10 cm long, 100/50 mg of styrene-divinylbenzene copolymer.	
2188	11 cm long, 120/60 mg of XAD-2 impregnated with 2-hydroxymethyl piperidine.	Yes
2189	7 cm long, 100/50 mg of activated charcoal impregnated with t-butylcatechol.	Yes
2190	7 cm long, 140/70 mg of molecular sieve.	
2195	7 cm long, 160/80 mg of carbon molecular sieve.	
2210	Florisil tube, 500 mg with pre-tube.	Yes
2695	3M passive monitor #3500.	
3030	Glass fibre filter.	
5560	Trypticase soy agar.	Yes
5570	Malt extract agar.	Yes
6100	UMEX-100 passive samplers.	Yes

Note: Orbo #2186, 2187 and 2195 sampling tubes come in packages of 5, contrary to all the others which come in packages of 10.

Surface identification kits

Components of surface identification kits		MRV µg/media	IRSST no.
Chromium VI	- Clear bottle containing a solution of dilute sulfuric acid, 1 N H_2SO_4 - Brown bottle containing a solution of 1% diphenylcarbazide (DPC) 5 disposable droppers - paper towels - one pair of 100% nitrile gloves - Kit user's guide	0.1	2625
Cyanide	- bottle #1 containing 0.1 N NaOH - bottle #2 containing palladium dimethylglyoxime in 3 N KOH - bottle #3 containing nickel chloride and ammonium chloride in water - paper towels - one pair of 100% nitrile gloves - Kit user's guide	25	3020
Metals	- 5 petri dishes, each containing an MCE filter 37 mm 0.8 µm numbered - 5 templates, 10 cm by 10 cm - 1 bottle of demineralized water - 5 pairs of 100% nitrile gloves - Kit user's guide	*Refer to the green table of substances in the guide*[8]	3070
Beryllium	- 5 wet wipes - 5 templates, 10 cm by 10 cm - 5 polypropylene containers, numbered - 5 pairs of 100% nitrile gloves - Kit user's guide	0.05	3090
Lead		0.5	
Aliphatic isocyanates (HDI)	- 1 bag containing 25 impregnated swabs - 1 bottle containing the developing solution for HDI with the sampling protocol on the bottle - 1 pair of 100% nitrile gloves		3050
Aromatic isocyanates (MDI and TDI)	- 1 bag containing 25 impregnated swabs - 1 bottle containing the developing solution for MDI and TDI with the sampling protocol on the bottle - 1 pair of 100% nitrile gloves		3060
Mycological structures	*Slide* - Numbered Bio-tape in a case (See *protocole de prélèvement*)		5585
Mycological structures and/or identification by growth	*Sponge* - 1 plastic bag consisting of 2 sections, with one section containing gloves and the sponge bag - The second section of the numbered bag is used for shipping the sponge to the laboratory		5540
Mould identification by growth	- Swab (individually) - Petri dish containing Malt for moulds		5575 5570
Identification of bacteria by growth	- Swab (individually) - Petri dish containing TSA for bacteria		5575 5560

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[8] The MRV of metals on media (µg/media) are equivalent to those documented for the corresponding analytical method in the air (µg/filter).

Appendix 2: Table of acronyms of the analytical principles

Acronym	Analytical principle
IC-CD	Ion chromatography with conductivity detection
IC-VIS	Ion chromatography with visible detection
HPLC-Flu	High performance liquid chromatography with fluorescence detection
HPLC-FGAA	High performance liquid chromatography coupled with atomic absorption graphite furnace
HPLC-SAAE	High performance liquid chromatography with electrothermal atomic absorption spectrophotometry
HPLC-MS	High performance liquid chromatography with mass spectrometry
HPLC-UV	High performance liquid chromatography with UV detection
HPLC-UV-Flu	High performance liquid chromatography with UV and fluorescence detection
COLO	Colorimetry
GC-NPD	Gas chromatography with nitrogen-phosphorus detection
GC-ECD	Gas chromatography with electron capture detection
GC-ELD	Gas chromatography with electrolytic conductivity detection
GC-FID	Gas chromatography with flame ionization detection
GC-FPD	Gas chromatography with flame photometric detection
GC-PID	Gas chromatography with photoionization detection
GC-Hall	Gas chromatography with Hall electrolytic detector
GC-MS	Gas chromatography with mass spectrometry
XRD	X-ray diffraction
SE	Ion specific electrode
HMOS	Metal oxide semiconductor
ICP-MS	Inductively coupled plasma mass spectrometry
DRI-Am	Direct-reading instrument – Amalgamation
DRI-EX	Direct-reading instrument – Explosimeter
DRI-IR	Direct-reading instrument – Infrared detection
DRI-PAD	Direct-reading instrument – Photoacoustic detection
DRI-elec	Direct-reading instrument – Electrochemical cell
FTIR	Fourier transform infrared spectrophotometry
LAL	Limulus amebocyte lysate
DLM	Direct light microscopy
DLM-GC	Direct light microscopy and gas chromatography
PLM	Polarized light microscopy
PCOM	Phase contrast optical microscopy
Grav	Gravimetric measurement
Polaro	Differential pulse polarography
ET-AAS	Electrothermal atomic absorption spectrophotometry
FAAS	Flame atomic absorption spectrophotometry
CV-AAS	Cold vapour atomic absorption spectrophotometry
ICP	Inductively coupled plasma spectrometry
SM	Stereomicroscopy
UV/VIS-S	Ultraviolet and visible spectrophotometry