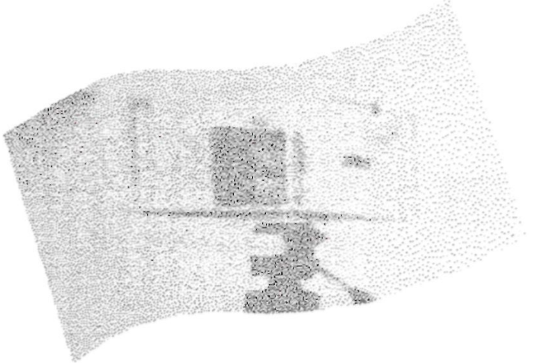
Sampling Guide for Air Contaminants in the Workplace

7th edition revised and updated

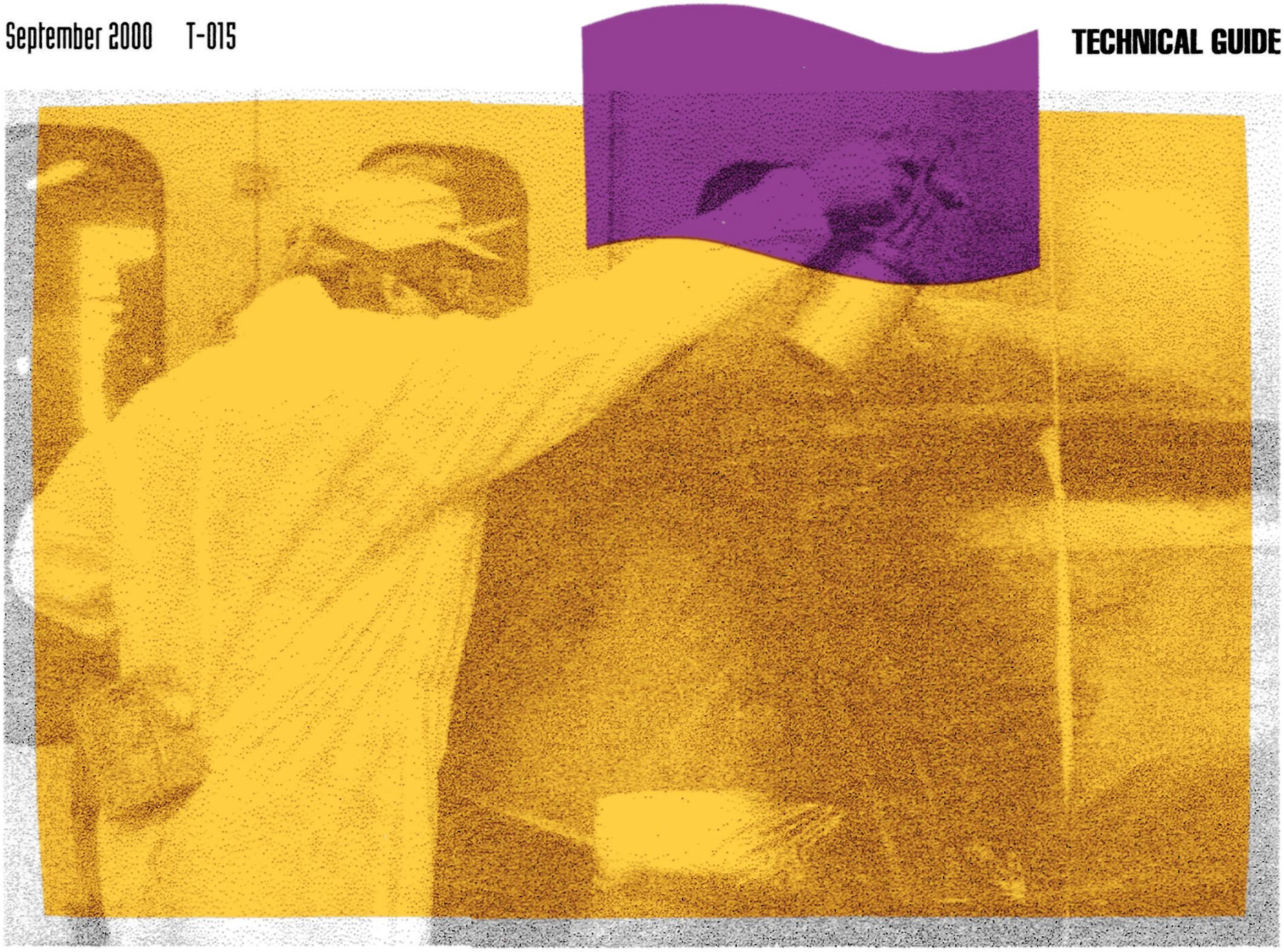
ÉTUDES ET RECHERCHES



Operation Division

September 2000 T-015

TECHNICAL GUIDE



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Note

The use of the data included in this publication as well as the application of these methods and technique are at the user's own risk: the IRSST is not responsible for any errors and damage resulting from such or application.

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Preamble

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

Introduction

The purpose of the Act respecting occupational health and safety (Loi sur la santé et la sécurité du travail) is to eliminate, at source, dangers to the health, safety and physical well-being of workers. To meet these objectives, evaluation guides describe acceptable methods for quantifying the degree of **exposure** faced by the worker in order to plan for appropriate means of control (1). Permissible exposure values have been established for chemical substances by regulation (2). Schedule 1 of the *Regulation respecting the quality of work environment* (RRQWE) presents the list of regulated chemical contaminants. This regulation specifies that …

> " *Samples of dusts, gases, fumes, vapours and mists present in the work environment must be taken and analysed so as to obtain a degree of accuracy equal to that obtained in accordance with the methods described in the* ***Guide d'échantillonnage des contaminants de Voir en milieu de travail*** *published by the Institut de recherche en santé et en sécurité du travail du Quebec, as it reads at the time it applies*" .
>
> *The strategy for sampling such contaminants must be applied in accordance with the common practices of industrial hygiene summarized in the guide mentioned in the first paragraph.»*

To assist occupational health and safety fieldworkers, the *Sampling Guide for Air Contaminants in the Workplace* is published, periodically revised, and distributed in Quebec. This guide includes a first section on sampling strategy. The second part describes concisely the different evaluation techniques that can be used in an industrial hygiene process in relation to the type of substances: gases and vapors 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 Quebec. This part also contains information on the use of process samples and on sampling system calibration.

The third part specifies the sampling and analytical methods for each of the substances listed in Schedule 1 of the RRQWE. It also contains information on the sampling and analysis of a limited number of unregulated substances, which are offered within the scope of the IRSST laboratories' analytical services.

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[1] Unofficial translation

Part 1 : Sampling strategy

Introduction

This section on sampling strategy is based on American (3) and European (4) procedures, condensed and adapted to the context of the Quebec occupational health and safety network. It reminds users that a representative result is obtained by using a realistic strategy, adapted to the goals of an intervention and supported by appropriate statistical treatment. All of the steps must be the subject of a quality assurance program, and certain steps of a quality control program

Whether the objectives are preventive ones, such as those pursued by most fieldworkers in occupational health, or compliance with the regulation as formulated by the inspection network of the Commission de la santé et de la sécurité du travail (CSST, Quebec occupationnal health and safety board), the objective of the proposed strategy is to check contaminant concentration levels in relation to target 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 RRQWE, 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 setting up 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 goals of the intervention be properly defined and that a rational procedure be followed. The decision flowchart in Figure 1 helps in visualizing 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 the 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 consists of identifying potential exposure to contaminants. This identification is done through consultation or by preparing a list of all contaminants, substances or reagents that could contribute to worker exposure. This list includes, depending on the case, the starting materials, the impurities, the intermediates, the final products, and the byproducts. In the Quebec context, the consulting of safety data sheets, made mandatory by the implementation of WHMIS (*the Workplace Hazardous Materials Information System),* makes the documentation work easier up to a certain peint. Permissible exposure values 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 depend on the organizational context of the person carrying out the intervention, such as the preparation of a report.

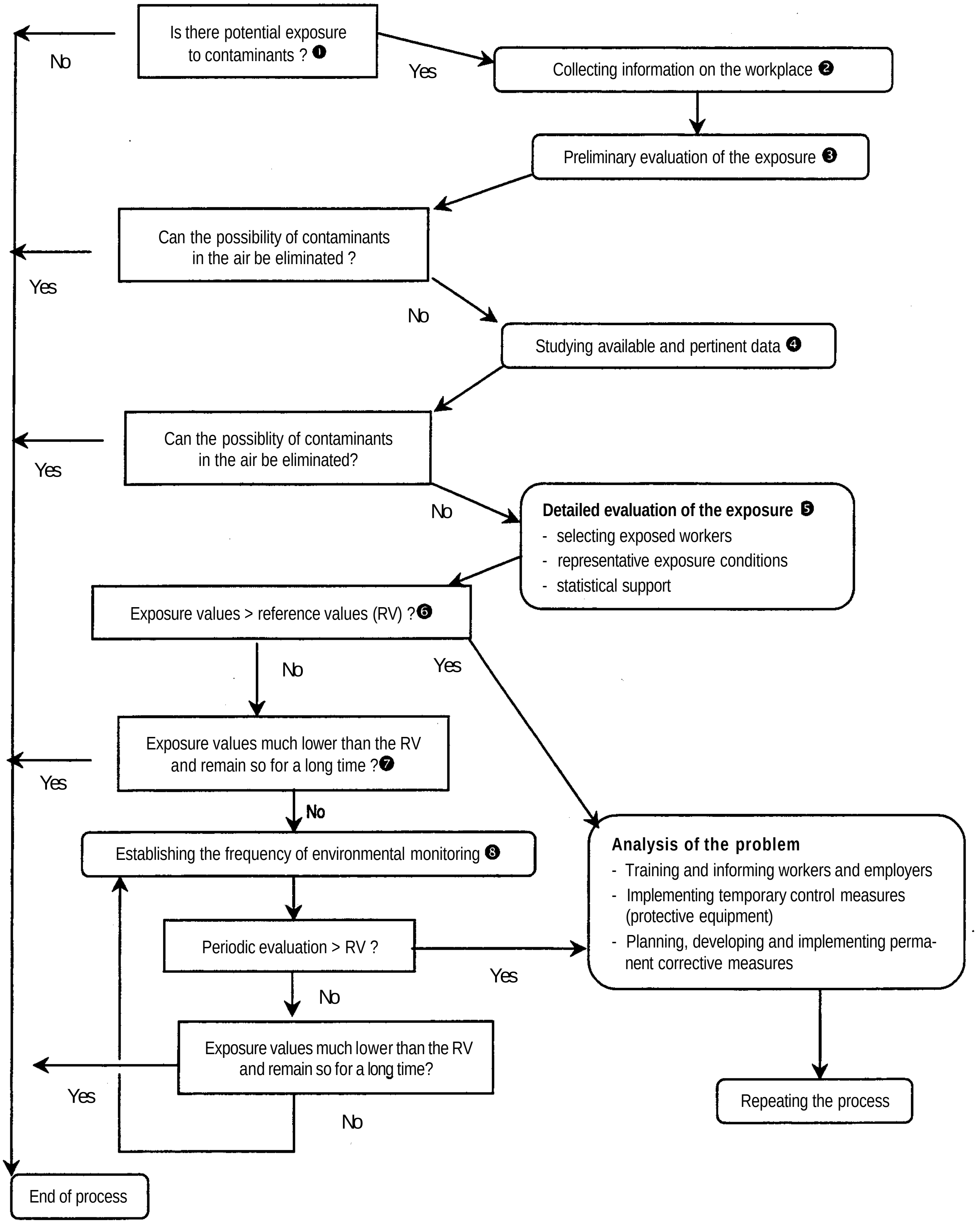


Figure 1- Decision flowchart for exposure evaluation

1.1.2 Collecting information on the workplace

The second step ② involves collecting information on the processes and procedures in order to evaluate potential exposure to the identified contaminants. This step is generally for describing the following aspects :

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

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

1.1.3 Preliminary evaluation of the exposure

The third step ③, the preliminary evaluation of the exposure, involves finding a link between the potential exposures and the information on the workplace in order to establish the likelihood of 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 number of emission sources;
- the emission rate for each source;
- the location and characteristics of each source;
- the dispersion of the contaminant by air currents;
- the nature and efficiency of the control measures (ventilation or elimination at source).

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

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

Rapid methods for qualitative evaluation may detect the presence or absence of a contaminant. Detector tubes, even if they are not very selective or precise, provide interesting indications about the presence and relative concentrations of several contaminants.

1.1.4 Studying available and pertinent data

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

This quantitative information is obtained in the fourth step ④ by studying available and pertinent data originating from results collected previously in the worker's environment or 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 (step 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 resources, but without sacrificing scientific objectivity, the requirements of the detailed exposure evaluation may 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 the 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 sacrificed. Measurement strategies (maximum exposure scenario) may also be adopted, namely at a workstation where a worker seems more likely to be exposed than his coworkers, or sampling near 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 rigor, 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 using 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. The 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 in the statistical treatment

- ***Variations***

The main sources of variation that affect estimates 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 caused by the imprecision of the analytical and sampling methods as well as by the unexpected variations in me concentrations from hour to hour or from day to day. Systematic errors can be corrected when they are detected with stringent quality assurance programs. They are due to instrumental factors as well as to human error. They cannot be quantified statistically. In order to better understand the subtle differences between these two types of errors, here are a few examples.

Random errors include:
- fluctuation in pump flows;
- 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:
- improper calibration or use of the instruments;
- errors in the recording of measurements 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 normal 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** (Figure 2) distribution or a **lognormal** (Figure 32) distribution. It is important to determine the type of distribution that exists in the workplaces in question.

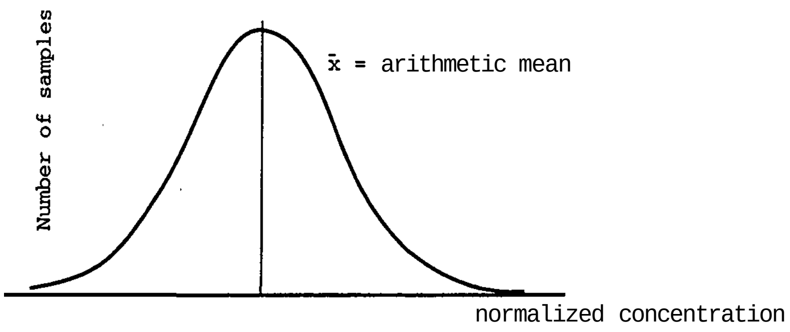


Figure 2- Normal distribution

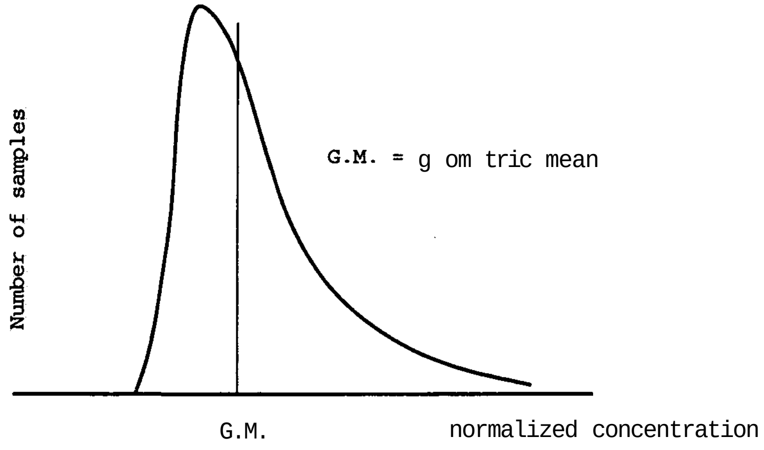


Figure 3- Lognormal distribution

Fluctuating concentrations and the length of the measurement period (long or short) for a sample are some factors mat 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 doing 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 interpretation and comparison of results, normalized concentration values are used. They are obtained by dividing the measured value by the reference value, which is based on the chemical analyzed and the objective of the hygienist:

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

$$\boxed{x = \frac{X}{R.V.}}$$

X = Concentration found
R.V. = 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 : Arithmetic standard deviation (a)

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

Equation 4 *: Coefficient of variation (represents the standard deviation applied to the mean of a series of measurements)*

$$\boxed{CV = \frac{\sigma}{\bar{x}}}$$

CV = Coefficient of variation

The coefficient of variation represents the standard deviation applied 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 (GM.), normalized value*

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

Equation 6 : Geometric standard deviation (s), normalized value

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

- *Precision of the sampling*

The sampling precision resulting solely from the pumps is usually estimated at 0.05 (5%). Furthermore, this is the precision that sampling pump manufacturers guarantee in their specifications. The coefficient of variation for the sampling (CV_s) is a function of all of the steps leading to the collection of the sample, and may be quantified by the fieldworker in relation to his quality assurance procedures.

- ***Precision of the analysis***

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

- ***Total coefficient of variation***

The total coefficient of variation 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)

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

Since we do not have the true CV_s, we use a CV_s estimated at 0.05 (5%) in calculating the CV_T for 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 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 centre 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.

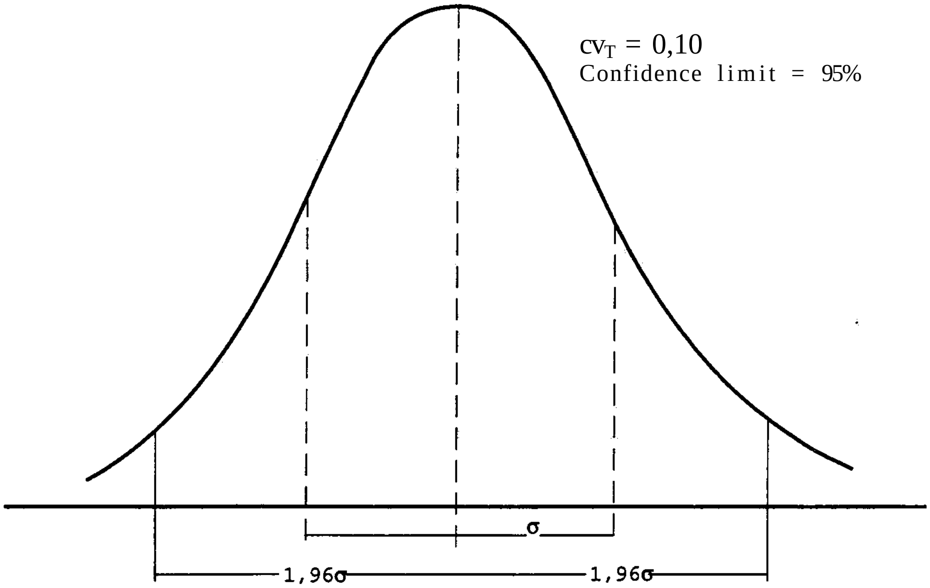


Figure 4- Normal distribution of a series of 8-hour samples

To determine whether the chosen reference value is exceeded with a confidence limit of 95%, 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) groups all the results under me curve between the values -1.645σ and infinity.

In the same way, to determine whether the chosen reference value has been exceeded with a confidence limit of 95%, 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) groups all the results under the curve between the values +1,645 σ and - ∞.

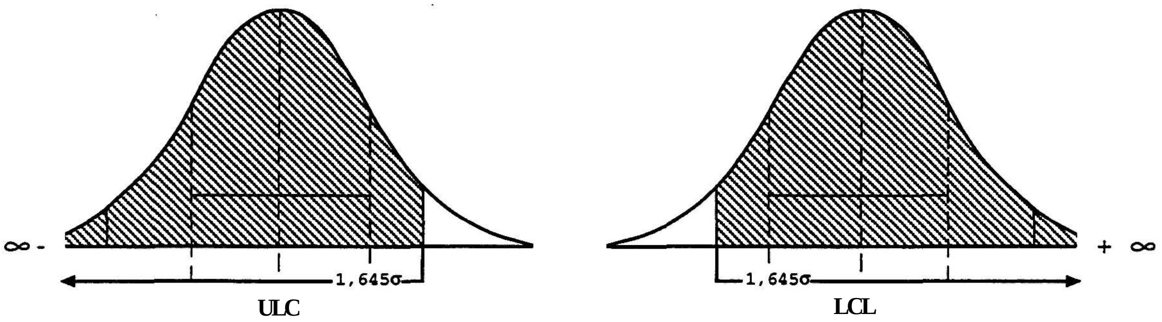


Figure 5- Illustration of the upper and lower confidence limits

1.1.5.4 Deciding whether the reference value has been exceeded or not

The total coefficient of variation of the normalized concentration measurement 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 workshift, three situations may occur: the reference value is exceeded, is not exceeded, or is possibly exceeded. The three situations are illustrated in Figure 6

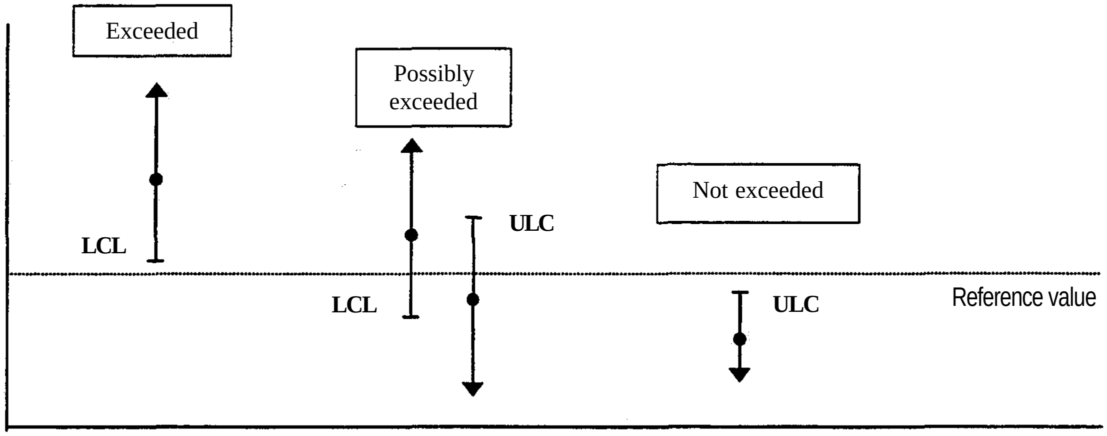


Figure 6- Classification using one-side confidence limits

For all other cases, a more detailed mathematical and statistical interpretation may be necessary. We suggest that reference (3) at the end of this document or any book of data analysis statistics be consulted.

A situation in which the reference value (step ⑥) is exceeded leads to action that is not within the scope of the sampling strategy. However, exposure values clearly below the reference value and that remain so for a long time may result in priority being given to interventions at other workstations. Unfortunately, there is no universal definition of an exposure that is clearly below the reference value (step ⑦). This concept must be defined by the person doing the intervention, based on his objectives and decision-making context Some indexes can be used in different cases. Europeans (4) use an empirical value of 0.1 x reference value. Most of the IRSST reference methods cover at least a range of concentrations from 0.1 to 2-5 times the TWAEV and the STEV. However, it must be remembered that the RRQWE requires, for carcinogens and isocyanates, that the exposure of workers to these substances "... *must be reduced to a minimum, even where that exposure is within the standards provided for in Schedule 1.* "

1.1.5.5 Selecting exposed workers

For certain intervention objectives whose purpose is often to establish a causal relationship between a health problem and 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 worker exposure has to be documented in order to implement a health or an environmental-monitoring program, it is generally impossible to measure the exposure of all workers at every moment. Various approaches yield a representativity in the choice of 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 of the entire group.

The ideal approach consists of separating the population of workers into groups whose exposure would be homogeneous or similar, and of randomly choosing from this group of exposed workers, those whose exposure will be evaluated. Thus, from a homogeneously exposed population of workers, individuals are selected randomly, using random number tables (3). Tables Al to A4 in Table 1 give the number of workers to be sampled in a homogeneous risk population. The content of these tables is based on statistical parameters and attempts to anticipate the various statistical scenarios of these groups in relation to the probability of including at least one of the workers most at risk.

Sometimes the Quebec 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 (4) 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 homogeneous group

Table A1 - At least one worker among the top 10 %, 90 % confidence level													
Size of the 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 top 10 %, 95 % confidence level												
Size of the 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 top 20 %, 90 % confidence level

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

Table A4 - At least one worker among the top 20 %, 95 % confidence level

Size of the group	7-8	9-11	12-14	15-18	19-26	27-43	44-50	**51-∞**
Employeese 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 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 time-weighted average exposure value (TWAEV), a short-term exposure value (STEV), a ceiling value or an excursion limit In addition, if the workers' work schedule differs from the typical schedule (8 hours per 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 to the adjustment of permissible exposure values (PEVs) for unusual work schedules* published by the IRSST (5).

The exposure must be evaluated from samples collected in the respiratory zone of the worker for the entire working period or the period provided in the appropriate reference value, namely 8 hours for a TWAEV, the complete duration of the workshift for an AMEV, and 15 minutes for an STEV. The respiratory zone is defined in the RRQWE as being a hemisphere having a 300-mm radius extending in front of me 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 result in data on homogeneous exposure being collected, samples must be used to establish the variability of tins exposure with time (day, night, seasons, climatic conditions, during certain operations, etc.) and in space (different work stations or emission sources).

The results of single samples that cover the full eight-hour work shift can be compared directly to the TWAEV, or if they cover a period of 15 minutes, to the STEV. In the case of unusual schedules, the single sample must cover the total duration of the workshift and the results compared to the AMEV.

Consecutive full-period samples offer the same advantage as single samples regarding comparability 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 me exposure results. In general, with homogeneous exposure, the mean daily exposure (MDE) value can be calculated from multiple samples of a total duration of at least two hours or from 5 samples of the duration prescribed in the reference method, and where these samples are distributed uniformly within an eight-hour time period in a workday or within the duration of the workshift in the case of an unusual schedule. Several examples of calculations of the MDE, 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 measurement methods or measuring instruments, samples cannot be collected over a short period, and 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 strategy. 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 samples covering a partial period, and the grab sample applied to the TWAEV, AMEV or to the STEV, require a good knowledge of 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 efficiency of means of control and elimination at source, or exposure 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 Quebec regulation. For example, for asbestos, the RRQWE specifies " *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 operator of an establishment that employs fifty 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 ...*".

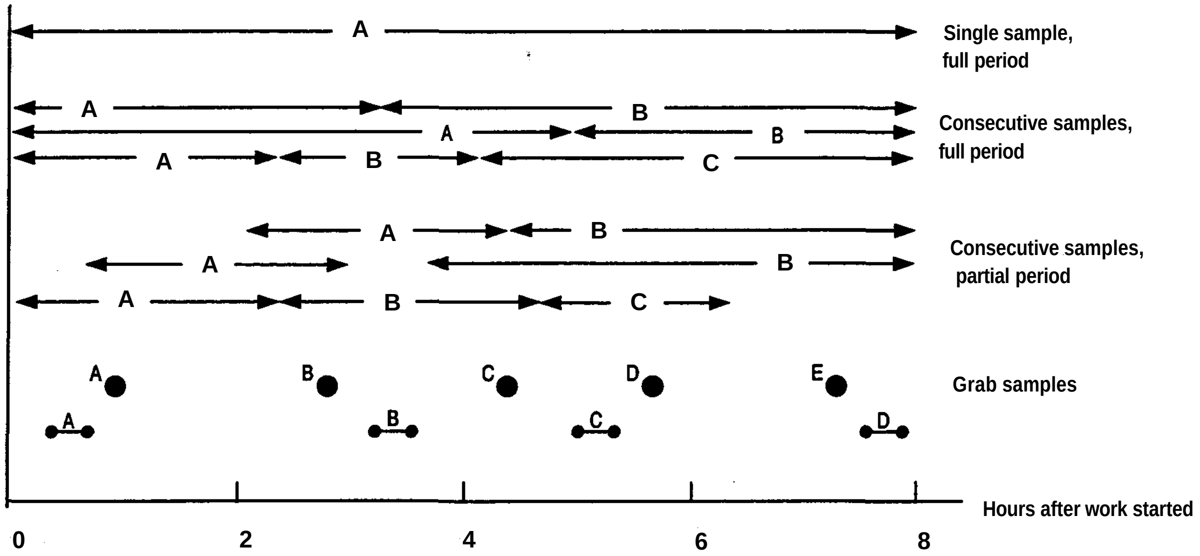


Figure 7- Types of samples for characterizing an 8-hour exposure (TWAEV)

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 and repair cycles;
- consequences of breakdowns in the facilities for control or elimination at source;
- ambient concentrations close to limit or reference values;
- efficiency of means of control;
- variability of results with time.

Reference 4 gives an example of how to determine the frequency of an exposure evaluation.

1.2 Calculating the MDE, the R_m and the excursion limit

1.2.1 Calculating daily exposure doses

Exposure doses for a series of measurements covering the total period of 8 working hours are calculated using the following formula for the purposes of application of a TWAEV:

Equation 10 *: Calculation of the mean daily exposure, MDE (mg/m^3 or ppm)*

$$\boxed{MDE = \frac{C_1 t_1 + C_2 t_2 + \ldots + C_n t_n}{t_{1+} t_2 + \ldots + t_n}}$$

MDE = *Mean daily exposure (mg/m^3 or ppm)*
C_n = *Concentration measured at a workstation*
t_n = *Time in hours of the sampling period for a total of 8 hours*
l,2,...n = *Indication of the period sampled*

For the application of an AMEV, the sum of the times in the denominator must equal the duration of the workshift.

For a mixture of solvents with similar effects on the same target organs, the coefficient of the sum of the fractions of the mixture (R_m) is used. This calculation is done using permissible time-weighted average exposure values for each of the solvents and the value of the measurement for 8 hours of exposure for each solvent.

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

C_n = *Concentration of each of the substances in the air*
M_n = *Time-weighted average exposure value*
l,2,...n = Indication of each of the substances

$$R_m = \frac{C_1}{M_1} + \frac{C_2}{M_2} + ... + \frac{C_n}{M_n}$$

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 (M) must be replaced by the AMEV (Ma), as needed.

- ***Example 1***

An operator works 7 hours and 20 minutes on a task in which he is exposed to a substance listed in Schedule 1 of the RRQWE. The concentration measured during this period is 0.12 mg/m^3. What is his time-weighted average exposure?

7.33 hours at 0,12 mg/m^3
0.67 hours at 0 mg/m^3 (verified) namely: MDE = ((0.12 x 7.33) + (0x 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 RRQWE gives a time-weighted average exposure value (TWAEV). During this period, he is exposed to a concentration of 0.15 mg/m^3. What is his time-weighted average exposure?

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

- ***Example 3***

An operator works for eight hours during the night on a process that exposes him intermittently to a regulated substance. Knowing bis 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 period (h)
22:00-24:00	Help in shop	0.1 (from exposure values for a group of full-time workers performing this task)	2
24:00 - 01:00	Office work	0	1
01:00 - 04:00	Work in cafeteria	0	3
04:00 - 06:00	Cleaning in shop	0.21 (measured)	2

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

MDE = ((0.10x2) + (0.21 x 2) + (0 x 4)) / 8 = 0.078 mg/m^3

- ***Example 4***

In a paint manufacturing plant, workers are exposed to solvents under the conditions described in Table 3. Are the workers overexposed to these solvents, which are all toxic to 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	425 560	3.0 2.0	750
Methyl ethyl ketone	20 40 60	5.0 2.0 1.0	50

Toluene = MDE = ((25x4) + (33x1.5) + (12x2.5))/8 = **22.5**
Acetone= MDE = ((425x3) + (560x2))/8 = **299**
Methyl ethyl ketone = MDE = ((20x5) + (40 x 2) + (60 x 1))/8 = 30

R_m = (22.5/50) + (299/750) + (30/50) = **1.44**

and unity (1.00) has been exceeded and the situation does not comply.

1.2.2 Application of the excursion limit

The RRQWE 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 summarizes 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 RRQWE gives a TWAEV of 100 mg/m^3 without specifying the STEV. A direct-reading instrument sampling in the worker's respiratory 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 mean daily exposure of this worker has been measured and that it was below the TWAEV.

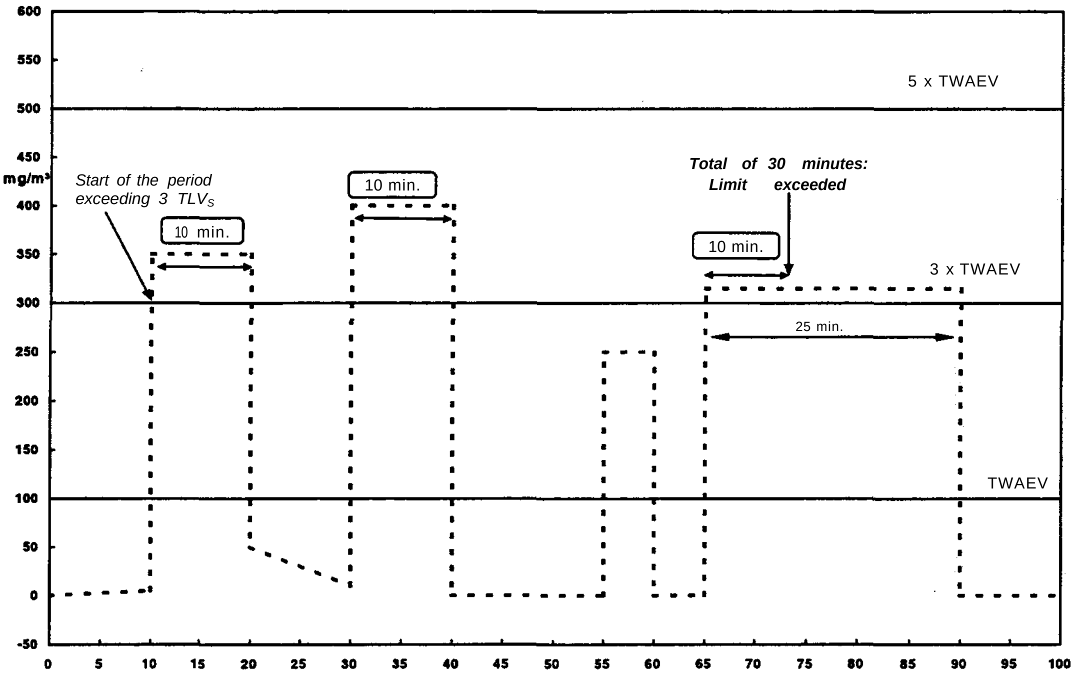


Figure 8- Example of the excursion limit being exceeded with total time

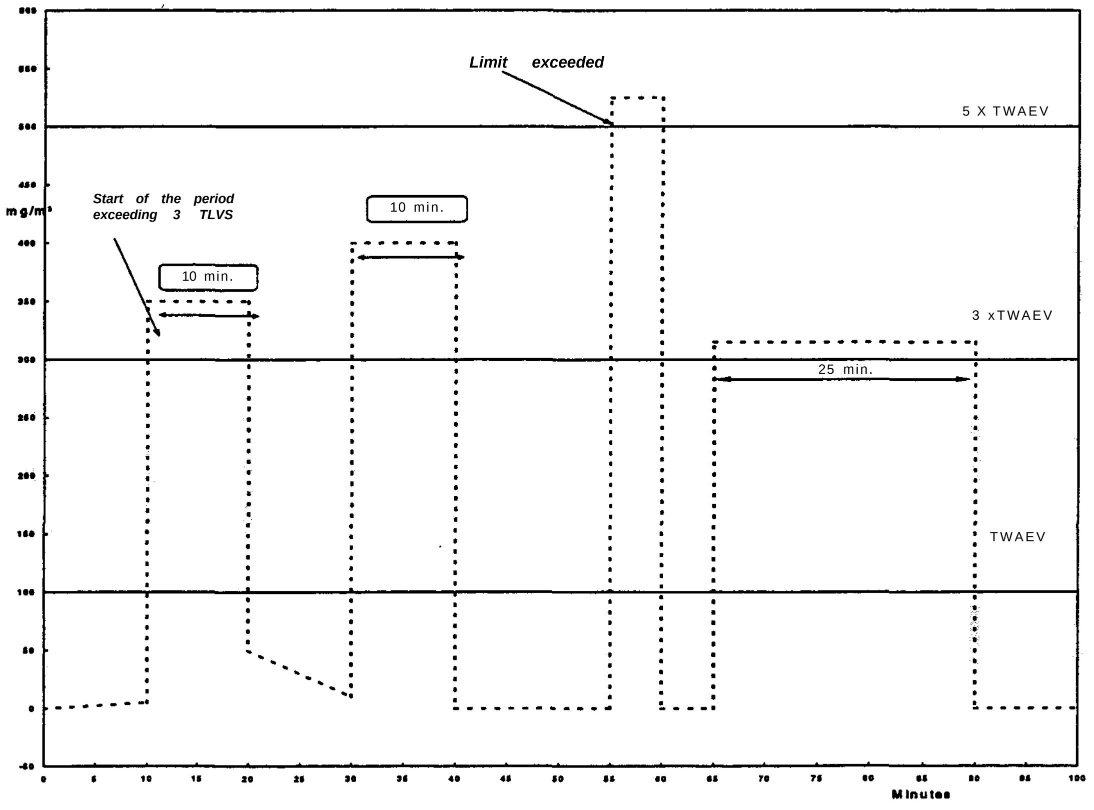


Figure 9- Example of the excursion limit being exceeded concentration by increase in concentration

Part 2 : Sampling instruments and techniques

Introduction

Once the measurement strategy for the chemical substances or biological agents in the workplace has been chosen, measuring instruments, techniques and methods that allow the objective to be met 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 vapors, aerosols (liquids, dusts and fumes), and microorganisms. The list of equipment required for sampling or detection is presented in Part 3. Other sections complete this part of the guide by providing information on process samples and sampling with pumps.

2.1 Gases and vapors

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.

Vapors 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 vapors. The most commonly used collecting mediums are sorbent tubes. Impingers, filters impregnated with reagents, and bags are also used for some compounds. (6)

2.1.1 Electronic direct-reading instruments

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

- amalgamation
- chemiluminescence
- combustion
- electrochemistry
- infrared spectrophotometry
- photoionisation

- *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 vapors 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 vapor in the air.

Table 4- Direct-reading instruments available at the IRSST

Contaminant (CAS.)	Instrument	Principle	Scale	Precision (%)	Response time (seconds)
Gases					
• Nitrogen dioxide (NO_2) 10102-4-0	Toxilog	Electrochemistry	0-20 ppm	±5	45
	Toxi Ultra				
• Nitrogen monoxide (NO) 10102-43-9	Toxilog	Electrochemistry	0-50 ppm	±5	45
	Toxi Ultra				
• Nitrogen protoxide (N_2O) 10024-97-2	B&K 1302	Infrared absorption + photoacoustic cell	> 0.05 ppm	±3	60
• Carbon dioxide (CO_2) 124-38-9	ADC	Infrared absorption	0-0.5 %	±2	15
	EGM		0-5%		30
	B&K 1302	Infrared absorption + photoacoustic cell	> 3 ppm	±3	60
• Carbon monoxide (CO) 630-08-0	Drager 190	Electrochemistry	0-999 ppm	±5	45
	Toxilog				
	Toxi Ultra				
	PHD Ultra				
	B&K 1302	Infrared absorption + photoacoustic cell	> 0.2 ppm	±3	60
Ammonia 7664-41-7	B&K 1302	Infrared absorption + photoacoustic cell	> 0.8 ppm	±3	60
Sulfur dioxide (SO_2) 7446-09-5	Toxilog	Electrochemistry	0-100 ppm	±5	45
Combustible gases	Scott	Combustion	0-100% LEL*	±5	60
	PHD Ultra				45
Formaldehyde 50-00-0	B&K 1302	Infrared absorption + photoacoustic cell	> 0.12 ppm	±3	60
Hydrogen 1333-74-0	TLV® Sniffer	Combustion	0-10 000 ppm	±5	60
Mercury	Jerome	Amalgamation	0-1 mg/m^3	±2	20
Ethylene Oxide d' 75-21-8	B&K 1302	Infrared absorption + photoacoustic cell	> 0.24 ppm	±3	60
Oxygen 7782-44-7	Scott	Electrochemistry	0-40%	±2	60
	PHD Ultra		0-40%		45
Ozone 10028-15-6	CSI	Chemiluminescence	0-1 ppm	±5	15
Hydrogen sulfide (H_2S) 7783-06-4	PHD Ultra	Electrochemistry	0-50 ppm	±5	45
	Toxi Ultra		0-25 ppm		
Vapors					
• Acetone 67-64-1	B&K 1302	Infrared absorption + photoacoustic cell	> 0.4 ppm	±3	60
• Styrene 100-42-5			>0.12 ppm		
• Total organics	HNU	Photoionisation	0-2000	±5	30

* LEL : Lower explosive limit

• *Chemiluminescence*

Certain chemical reactions emit energy in the form of light. The intensity of the light emitted is proportional to the concentration of the gas in the air. Ozone is measured using this principle when it reacts with ethylene. This reaction is specific.

- ***Combustion***

This principle is used to detect gases and vapors that bum in the presence of oxygen in the air. Combustible gases such as methane and ethane, vapors of organic solvents, and a few gases such as carbon monoxide, hydrogen and hydrogen sulfide, are examples of substances that can be detected using this principle. The air containing me gas circulates on a filament heated to a temperature above me mixture's ignition temperature. The heat of combustion changes the electrical resistance of the wire and this change is proportional to me concentration of me combustible gas/air mixture. Measuring instruments for combustible gases are calibrated in percentages of me 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 me most commonly used calibration gases. Instruments operating on this principle are not very specific.

- ***Electrochemistry***

Measuring instruments using electrochemistry analyze gases or vapors that can be oxidized or reduced by means of an electrical potential. An oxidation or reduction reaction is initiated at an electrode, using 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 me air. However, other substances with oxidation-reduction potentials below that of me targeted substance will interfere. Interference filters can be used to eliminate undesirable substances. They are available for carbon monoxide, nitric oxide and nitrogen dioxide analyzers. They are solid absorbents with a high affinity for the undesirable substances, allowing the gases or vapors for analysis to pass through. It is important that the saturation of these filters be regularly checked. The main interferences are specified in the user's manual for the instrument

- ***Infrared absorption spectrophotometry***

Instruments operating according to this principle can detect and measure the concentration of gases and vapors 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 substance to be determined in the air. It is important to note the strong absorption of water vapor molecules during infrared analysis. The B&K 1302 monitor detects organic compounds by photoacoustics, 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 interference such as water vapor.

- ***Photoionisation***

The available instrument is equipped with an 11.6 eV lamp that partially ionizes the organic compounds present, thus creating a current, which is measured. All the compounds that can be iononized at this energy are detected. This non-specific instrument is useful for detecting emission sources and as an exploration tool.

2.1.2 Colorimetric direct-reading devices

Colorimetric methods are among the simplest, quickest, and least costly. The operating principle for these devices is based on the fact that the intensity of the developing color 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-term measurement tubes operating by passive diffusion;
- chips containing capillary tubes and 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: the tube has been calibrated accordingly. It is therefore important, after having broken the ends of the tube and connecting it to the pump, to respect me time period necessary for the passage of the desired volume of air and me development of the reaction. Low concentrations can be evaluated by several strokes of the pump, following the manufacturer's instructions.

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

The newest system consists of a chip containing capillary tubes filled with a reactive substance. As with me above-mentioned devices, a colorimetric reaction occurs on contact with the pollutant, whose intensity is read not by the user but by an optical reader. The rate of coloration is also taken into consideration in calculating the concentration. The interaction between the optical reader and the different chips is done using the instructions included in the bar code found on the chip. Chips are available for 12 compounds. An optical reader is available on 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 (7).

2.1.3 Sampling media

2.1.3.1 Adsorbent tubes

Adsorbent tubes are used to collect samples in the gaseous and vapor state such as solvent vapors, certain gases and acids. They are glass tubes containing two sections of adsorbent substances. These tubes may contain activated charcoal, silica gel, alumina, 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 probably occurred and the results express a minimum concentration.

Pumps are calibrated before and after sampling. The tubes 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 airflow. The tube must be vertical to prevent channelling, which could 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 cool solvent free location* (without process samples or sampling equipment such *as jars containing toluene).* Shipment to the laboratory must take place as soon as possible to avoid a loss of adsorbed product.

For some mixtures of unknown composition, an individual sample must be sent for analysis by gas chromatography-mass spectrometry (GC-MS). In certain cases, a process sample is necessary to identify the components of the mixture to be analyzed.

For each series of samples, a blank tube is supplied. It is handled in the same way as the sample tubes, except that it is not used for sampling. For shipment of the process samples, consult section 2.4.

2.1.3.2 Passive diffusion monitors

Sampling with a passive diffusion monitor 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 solvent molecules by an adsorbent located in the bottom of the dosimeter.

The *sampling rate* for a solvent is expressed in mL/min. This parameter is both a function of the solvent 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 liter 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 10^0C results in a correction of 1.6%.

2.1.3.3 Impingers

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

Two types of impingers are used: the midget impinger and the 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 fritted tip impinger is used for more efficient collection of substances that are not very soluble in the collecting solution. In fact, the fritted glass forms currents of fine and dispersed bubbles, thus increasing the contact surface between the air flow and the absorbing medium, thus improving the absorption efficiency.

If the sampled air contains particles which 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. The trap that is most commonly used is an empty midget impinger.

Before sampling, the pump flow is calibrated to the recommended value. The calibration system includes a prefilter (if necessary), the sampling impinger(s) containing the appropriate volume of solution, the trap, and flexible tubing of the same dimensions as that used during sampling. 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.

Sampling is carried out at the recommended flow rate. For sampling with impingers, the flow rates must be respected at all times. The volumes (set such that at concentrations equal to the standards, the quantities collected provide a more precise determination) may vary. However, too large a 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 pump flow is measured and the impinger's openings are sealed with waxed wrapping film. All information relating to the sampling and pertinent to the determination must be noted: flow rate, time, temperature, pressure and interference.

For each series of samples, a blank impinger must be supplied. It is handled in the same way as the sample impingers (opening, sealing, transportation) except that it is not used for sampling.

The samples must be returned to the laboratory for analysis as quickly as possible in the shipping boxes supplied. If they cannot be shipped immediately to the laboratory, they must be stored in a refrigerator. However, any delay must be noted, as well as the handling of the samples, in order to ensure the validity of the results.

2.1.3.4 Sampling bags

Sampling bags are used to collect certain gases. The bags are made of different polymeric materials and are available in different volumes. 5-ply aluminized bags are made of polyethylene / polyamide / aluminum / vinylidene polychloride / glycol polyterephthalate; the sampling volumes are 2,5 and 10 litres. Phenomena of diffusion across, and adsorption by the walls of the bag affect the choice of material for a given substance and the sample's storage time (8).

When the workplace contains a significant concentration of dust in the air, 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 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 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.

2.1.3.5 Special cases for reactive substances

Some particularly unstable substances such as aldehydes and isocyanates must be stabilized during sampling. A judiciously selected chemical reagent is chosen for reaction with the substance to be determined, in order to form a stable non-volatile compound for sensitive and specific analysis in the laboratory. This reagent may be present on the adsorbent of the tubes, 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 and gases as well as vapors.

2.2 Aerosols

2.2.1 General definitions

An aerosol is defined as being 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 vapors or products of 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 several mechanisms such as dissolution. In addition, these particles can act on the body is many ways, producing allergenic or irritating 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.

2.2.1.1 Solid aerosols (dusts and fumes)

Dusts can be classified into two general groups: hazardous dusts and nuisance dusts (dusts with no known toxic effects). Nuisance dusts with no recognized toxic effects are not biologically inert. They can interfere with the mechanisms of clearing of airways (9). A permissible exposure value of 10 mg/m^3 applies to these nuisance dusts. The ACGIH also recommends a TLV® of 3 mg/m^3 (respirable fraction) to prevent these pulmonary effects.

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

Welding fumes cannot be easily classified. Their composition depends on the materials to be welded, the electrodes and the processes used. The standard for total dust (5 mg/m^3) applies if there are no toxic components present in the welding rod, the metals to be welded, or their coatings. When the 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.

2.2.1.2 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 by a sampling pump on a filtering membrane. Occasionally, this filter must be placed as quickly as possible in a stabilizing solution, as is the case for isocyanate prepolymers.

2.2.2 Experimental definitions

The locations where aerosol particles are deposited in the respiratory tract depend on their aerodynamic diameter. The health effects of the particles that enter the body by inhalation therefore depend on this parameter, but also the material they are made of, 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 the potential health risks of an aerosol 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 all of the respiratory tract and is applicable to particles presenting health risks independent of their deposition site. The *thoracic fraction* applies to the particles presenting a danger 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 can be related in theory to specific zones in the respiratory system, and have experimental definitions (9).

2.2.2.1 Inhalable fraction

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

Equation 12 *: Collection efficiency of inhalable dust sampler, E_i*

$$\boxed{E_i = 50\% * (1 + E^{-0,06 d_a})}$$

d_a *= Aerodynamic diameter*

A sampling device exists for evaluating this fraction (see sampling device section in section 2.2.3.1) 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 1 of the RRQWE gives permissible exposure values only for *total* dusts. It is recommended that fieldworkers who want to know the exposure to inhalable dusts contact me IRSST for a methodology that will enable mem to explore the possibility of establishing a factor for conversion between sampling systems for total dusts and for inhalable dusts.

2.2.2.2 Thoracic fraction

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

Equation 13 : Collection efficiency of thoracic dust sampler, E_t

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

d_a = *Aerodynamic diameter*
$x = Ln(da/\Gamma)Ln(\Sigma)$
Γ = 11.64 µm
Σ = 1.5
$F(x)$ = *Cumulative probability Junction of a standardized normal variable x*

2.2.2.3 Respirable fraction (respirable dust)

The respirable fraction corresponds to the mass of particles that is collected by a sampler whose collection efficiency curve (Er) 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 14 : *Collection efficiency of respirable dust sampler,* Er

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

d_a = *Aerodynamic diameter*
$x = Ln\,(da/\Gamma)Ln\,(\Sigma)$
Γ = 4.25 µm
Σ = 1.5
$F(x)$ = *Cumulative probability function of a standardized normal variable x*

For aerosols, the ACGIH and European permissible exposure values are expressed in relation to these three fractions: inhalable, thoracic and respirable. In Quebec, they still refer to two categories of dusts, namely total dusts and respirable dusts. Schedule 1 of the RRQWE refers to these categories. For each of the substances covered by a standard, the sampling method specifies a filtration device, and as needed, a selection device for satisfying these performance requirements.

2.2.2.4 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. However, 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. Thus, for solid or liquid particles, permissible exposure values are expressed in terms of total dusts.

2.2.3 Evaluation methods

Aerosol particles are generally sampled in the breathing zone or by stationary sampling using a personal high-flow 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. Although available, direct-reading instruments for aerosols are not considered as a reference method.

The pump flow rate must be checked before and after sampling. All information relating to sampling and necessary for 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. For each of the products covered by a standard, the sampling method specifies a sampling device, and as needed, a selection device for satisfying certain sampling requirements.

2.2.3.1 Sampling devices

Aerosols are generally collected by filtration on a membrane. The most common sampling device consists of a 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 strip of cellulose seals the joints between the three sections. The cassette must be sealed. If the different sections of a cassette can move, the seal is not total. Such a cassette should not be used.

Membranes or filters with different pore sizes and compositions are available. A membrane is selected in relation to the product 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. A blank cassette from the same batch of filters is kept for each series of samples. The blank is handled in the same way as the other cassettes, except that it is not used for sampling. 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. This filter consists of a capsule that is used to collect the dusts, in order to eliminate the loss of dust on the walls of the cassette during laboratory handling. Since the filter and its enclosure undergo gravimetric measurement, underestimation due to lost dust is practically eliminated.

An aerosol's inhalable fraction can be sampled with a sampling device with a 15-mm diameter orifice. This device can sample particles with aerodynamic diameters larger than those sampled by the conventional closed cassette. However, the concentrations obtained have no legal significance since permissible standards are for total dusts. However, measurement of inhalable dust should be promoted in a preventive context.

2.2.3.2 Selective devices

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

2.2.3.2.1 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.

The nylon cyclone has a cut point diameter of 4 µm and lets particles smaller than 10 µm pass through. It segregates respirable dusts such as those defined in equation 14 (section 2.2.2.3) according to current knowledge. This device has been designed to operate at an actual flow rate of 1.7 L/min and must be placed in series in front of the filter holder.

2.2.3.2.2 Cascade impactor

Cascade impactors classify particles of an aerosol into a specific number of portions between two aerodynamic diameters and allow the mass concentration of each of the portions to be known. They consist of several stages of impaction 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 flow of the air and reach the orifices of the following stage. The particles that cannot reach the next stage impact on the top of the following stage between its orifices. The tops of the impaction stages can be coated with silicone whose purpose is to make the particles adhere to the surface, or a filter can simply be placed on them that is specially cut for this purpose and that can be analyzed.

2.2.3.2.3 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 air flow upwards in the cylindrical section of the elutriator that is equal to the sedimentation rate of the particles with an aerodynamic diameter of 15 µm that carries them downwards. All particles smaller than this diameter will be carried by the air flow 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 fibers. It should be noted that this sampling of cotton is not carried out in the worker's breathing zone.

2.2.3.3 Direct-reading instruments

The conventional sampling methods for aerosols described above still remain the most reliable, despite the fact that instruments for direct reading of the concentration are now available on the market. Most of these devices that use different measuring principles such as gravimetric analysis and optical aerodynamic and mechanical properties and mobility in force fields (6), must be used with discernment in the context of an exploratory approach or in 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 difficult and costly.

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

2.3 Microorganisms (bioaerosols)

2.3.1 Introduction

Microorganisms are microscopic living things. They are present in all environments: water, soil, plants, animals, humans. In sufficient concentration, some may cause health problems. However, for most of them dose/effect relationships have not been established. In Quebec, there are no limit exposure values for microorganisms. They are therefore evaluated in a preventive context.

For an industrial hygiene study, the approach favored 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 m the air (10). The bioaerosols analyzed by the IRSST are heterotrophic aerobic bacteria, Gram negative bacteria and their endotoxins, and total molds. Some species or some genera can be specifically investigated. Comparison of species and concentrations at the measuring stations in relation to those in the outdoor air upwind is the basic parameter used to determine whether there is a site of proliferation. This comparison is particularly useful for molds. For heterotrophic aerobic bacteria, Gram negative bacteria and endotoxins, limit exposure values are proposed in the literature for some work environments.

Exceptionally, smears can be done on surfaces to locate sites of proliferation but the interpretation of such results is complex and can only be qualitative.

2.3.2 Sampling methods

Two sampling methods are available for bacteria and molds based on the concentrations of microorganisms expected in the work environment. For high concentration environments, meaning greater than 10 000 CFU/m^3 (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. The modified N-6 version of the impactor, consisting of a single impaction stage, is normally used. Microorganism sampling requires the use of a collecting medium capable of keeping the microorganisms alive. Impaction of the microorganisms is done on a nutritive medium containing agar. The composition of this agar varies with the group of microorganisms investigated. In general, Sabouraud dextrose or malt extract is used to isolate molds; bacteria are collected on trypticase soya or nutrient agar. Several other differential or selective media can be used, depending on the microorganisms investigated.

At the start of the sampling, the flow rate of the instrument is adjusted to 28 L/min using a flowmeter or a rotameter. It is checked at the end of the sampling in order to calculate the average flow rate necessary for the quantitative analysis. In general, in slightly contaminated environments such as office buildings, sampling is done over a two- to five-minute period. The 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.

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. 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. The relative humidity should also be noted. A blank must be produced for every 10 samples, or for each location if less than 10 samples are collected. The blank must be handled like all the other samples, but without being opened.

As previously mentioned, the smear technique can be used in exceptional cases for identifying the sites of contamination. The smear is done using a sterile swab that is rotated on the surface to be sampled. A 10-cm^2 surface must be covered with the swab for this sampling. The entire surface of the agar is then inoculated using the same principle of rotation. This method does not provide a quantitative analysis, but only a qualitative analysis.

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

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

2.3.2.1 *Warning*

- Agar must *never* come into 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 me air.
- Sampling must be repeated if mere is coughing or sneezing near the sampler.
- It is recommended that two samples be collected simultaneously.

2.3.3 Analytical methods

Two methods are available for evaluating bacteria and molds. 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, the species can be identified. 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 molds are identified by morphological observation.

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.

Due to the complexity and time required for bioaerosol identifications and endotoxin determinations, *a prior agreement must be arrived at with the person in charge of the IRSST microbiology laboratory.* For the same reasons, when the count is below 250 CFU/m^3, the species will not be identified.

2.4 Process samples

Samples from a process (commonly called process samples) are sent to the laboratory in the three following cases.

2.4.1 As a reference product

The substance is used as the calibrating solution. This is the case when mixtures of hydrocarbons such as VM & P naphtha, Stoddard solvent and rubber solvent, as well as mineral oil mists are analyzed (11).

In both these cases, the reference solutions are complex mixtures of hydrocarbons of variable composition. The mixture found in the workplace must be used as the calibrating solution, since it is the source of exposure.

For oil mists, the reference oil must be soluble in the chlorinated hydrocarbon used for preparing the standard solutions. In the case where the oil is emulsified in water, the original oil must be supplied. A volume of 25 mL is sufficient for the analysis.

2.4.2 Composition analysis

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

When a request for composition analysis is made to the laboratories, the following information must be provided: the type of industry, the nature of the process, the type of exposure, any exposure-related health problems, the suspected chemicals, and the safety data sheet when it involves a commercial substance.

2.4.2.1 Liquids

For organic solvents, analysis may be carried out using the solution, or preferably, saturated activated charcoal tubes, thus allowing the main volatile components of me mixture to be quantitatively determined by means of 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 a paint naphtha). This determination is carried out using a saturated tube or the solution.

For ion, pH and flash point determinations, the liquid solution is shipped.

To avoid contamination, liquid process samples must not be shipped in the same box as other samples and must be properly identified with the corresponding requisition number.

2.4.2.2 Process dusts ou sedimented dusts

For these dusts, the following analyses are possible:
- mineralogical and morphological characterizations;
- identification of the crystalline forms of silica: quartz, tridymite, cristobalite;
- metal identification;
- identification of fibrous substances, and estimation of fibre content.

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

2.4.3 Granulometric analysis of dust

Particle size is established from the passage of a known mass of dust into a nest of sieves. This is a flexible type of particle size analysis because it allows easy insertion or removal of the sieves and because the particle sizes containing the most pertinent size fractions for a user's specific problems can be easily obtained. The mass of dust necessary for this type of analysis is important. In order to be able to repeat an analysis at least twice, a mass of *at least 200 g* of dust must be available. Granulometric analysis is limited to large-diameter particles. It cannot be used to evaluate the inhalable, thoracic and respirable fractions.

2.5 Sampling system calibration

2.5.1 Sampling pumps

Sampling of an air contaminant requires not only a system that allows a given volume of air to be collected, but also a collecting medium and an analytical method. Pumps are the device most commonly used in industrial hygiene for sampling a known volume of air in order to determine the concentration of contaminants present.

Diaphragm pumps are the most common. They are equipped with a device consisting of one or more diaphragms made of a flexible material (metal, rubber or plastic). A mobile rod or a yoke moves the diaphragm which compresses the air in a chamber of given dimensions. An appropriate valve system displaces the air in the chamber. This type of device requires a surge chamber to regulate the flow. Since diaphragms can rupture, periodic maintenance is necessary.

In industrial hygiene, the pumps must commonly used are high or low flow personal pumps, and high volume pumps.

2.5.1.1 Personal pumps

Personal sampling pumps are classified into 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 on rechargeable (nickel-cadmium) acid gel batteries, which ensure at least 8 consecutive hours of operation.

There are constant mass flow pumps and constant volume flow pumps. Two principles are generally used to compensate for variations in flow. These are the critical orifice, where a mechanism maintains a constant pressure differential throughout the sampling, and a sensor that maintains a constant speed of rotation of the motor (constant volume flow rate) by varying the amperage of the motor. This situation considerably complicates the rules to be applied for flow correction in relation to the different temperature and pressure parameters during calibration and sampling.

To make it easier to interpret the corrective measures to apply in given situations, we will consider only constant volume flow pumps and constant mass flow pumps. For other cases of compensation mechanisms, correction curves will be used. *It is important to mention that the work is made much easier by calibrating the pump on the sampling site because it eliminates complex calculations.*

The use of a pump whose flow rate is not automatically controlled assumes that the variation in the flow rate is periodically checked. This variation occurs due to an increase in the pressure drop across the collecting medium or a decrease in the power supplied by the rechargeable batteries. Calibration at the start and checking at the end are necessary.

2.5.1.2 High volume portable pumps

High volume portable pumps are used to collect samples in a general environment when a significant amount of the substance is to be collected for analysis, or when a large sampling volume is necessary to collect sufficient contaminant when the air concentrations are very low.

Microorganism samplers and cotton elutriators use pumps capable of sampling at high flow rates. The necessary flow rate is 28.3 L/min for the Andersen sampler, and 7.4 L/min for the cotton elutriator. A critical orifice is used to maintain a constant flow for the cotton elutriator.

2.5.2 Calibrating the flow rate of sampling trains

Various devices are used for flow calibration. In industrial hygiene, three different devices are commonly used, namely the bubble flow meter (conventional burette or electronic version), the rotameter, and the mass flowmeter.

The sampling devices must be calibrated before and after sampling. The sampling train includes the components used in the field (pump, tube, cassette-filter unit, cyclone, etc.). The most common arrangement for calibrating the sampling train is illustrated in Figure 10.

When using a cyclone, the flow rate must be set at 1.7 L/min *under the actual sampling conditions.* The mathematical formulas necessary to adjust for variations in temperature and pressure are presented in the following section. If the variation in pump flow is greater than 5% of the initial flow rate, this must be taken into account in interpreting the sampling results.

2.5.3 Corrections for variations in temperature and/or pressure

Corrections must be made to take into account variations in volume in relation to the ambient temperature and pressure. Since the permissible concentration levels must always be converted to standard conditions of temperature (25^0C or 298°K) and pressure (760 mm Hg or 101.3 kPa), the corrections are made using the ideal gas laws:

Equation 15 : Ideal gas equation

$$\boxed{\frac{P_n V_n}{T_n} = \frac{P_s V_s}{T_s}}$$

P = Pressure
V = Volume
T = Temperature in ^{0}*K*
n = Standard conditions (298 °K and 760 mm Hg)
s = Sampling site conditions

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

Equation 16 :

$$\boxed{Q_n = Q_s \frac{P_s}{T_s} \frac{T_n}{P_n}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298 °K and 760 mm Hg)
s = Sampling site conditions

Figure 11 contains a diagram for identifying the correction equation to be applied. Also, a very simple utility program is available at the following Internet address:
http://www.irsst.qc.ca/htmfr/utilitaires/correct.htm.

Figure 10- Calibration of a sampling train

2.5.3.1 Using a bubble flow meter or a piston displacement meter

The bubble flow meter, the electronic bubble flow meter and the piston displacement meter are considered, for all practical purposes, as primary standards for flow rate calibration. For easier understanding, we will use two examples of constant flow pumps: the constant volume flow type and the constant mass flow type.

- ***Calibration on the sampling site***

(Constant volume flow pumps or constant mass flow pumps)

Equation 16 (section 2.5.3) is used to bring the flow rate to standard conditions. The actual flow rate is identical, regardless of whether constant volume or constant mass flow pumps are involved, since the conditions do not change from calibration to sampling, and a primary calibration system is used (bubble flow meter).

• ***Calibration outside the sampling site***
(Constant volume flow pumps)
The following equation is used where the sampling flow rate Q_s is replaced by the calibration flow rate Q_c, since they are identical, because the pump does not change its sampling speed, regardless of the sampling site:

Equation 17 *:*

$$\boxed{Q_n = Q_c \frac{P_s}{T_s} \frac{T_n}{P_n}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298 °K and 760 mm Hg)
s = Sampling site conditions
c = Calibration site conditions

• ***Calibration outside the sampling site***
(Constant mass flow pumps)
Since calibration is carried out using a bubble flow meter, the actual flow rate of the pump is noted at the calibration temperature. When this pump is installed on the sampling site, it will compensate to conserve a mass per unit of time (mass flow rate) equivalent to that established on the calibration site. This means that the parameters on the calibration site are necessary for correction to standard conditions. Equation 16 (section 2.5.3) therefore becomes:

Equation 18 *:*

$$\boxed{Q_n = Q_c \frac{P_c}{T_c} \frac{T_n}{P_n}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298°K and 760 mm Hg)
c = Calibration site conditions

2.5.3.2 Using a rotameter

A rotameter is a slightly tapered inverted vertical tube in which a float moves from top to bottom (metal or plastic bead, small cylinder, etc.). The kinetic energy of the air maintains the bead at a certain level which is proportional to the air flow in the rotameter tube. These devices must be calibrated against primary standards and are affected by changes in pressure and temperature. They can achieve a precision of 1 to 2% when correction curves are used. If the calibration curves are for temperatures other than standard conditions, flow rate correction is done using the following equation:

Equation 19 *:*

$$\boxed{Q_r = Q_m \sqrt{\frac{P_m T_r}{T_m P_r}}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
r =Site conditions (calibration)
m = Conditions of the rotameter calibration curve

Rotameters, however, are normally available with a laboratory produced correction curve where data are expressed at standard conditions of temperature and pressure.

• ***Calibration on the sample site***
(Constant volume or constant mass flow pumps)
For the two types of pumps, the rotameter reading must first be corrected for the effects of temperature and pressure. The actual flow is then obtained using equation 19.

The actual flow thus obtained is converted to standard conditions using equation 16 (section 2.5.3) above :

Equation 20 :

$$\boxed{Q_n = Q_s \frac{P_s}{T_s} \frac{T_n}{P_n}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298^{0}K and 760 mm Hg)
s = Sampling site conditions

Since $Q_r = Q_s$, $P_r = P_s$, $T_r = T_s$ as well as $P_m = P_n$ and $T_m = T_n$, equation 21 is obtained by substituting 19 into 20 :

Equation 21 :

$$\boxed{Q_n = Q_m \sqrt{\frac{P_s T_n}{T_s P_n}}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298 °K and 760 mm Hg)
m = Calibration conditions of manufacturer or laboratory
s = Sampling site conditions

- ***Calibration outside the sampling site***

(Constant volume flow pumps)
For constant volume flow pumps, the actual flow rate does not vary in going from the calibration site to the sampling site (constant diaphragm rate). Proceeding in two steps, me pump's actual flow rate on the calibration site must first be determined by making the corrections to the flow using equation 19. The flow is brought to standard conditions using equation 17 (section 2.5.3.1) taking care to use the sampling temperatures and pressures which are different from the calibration ones.

Since Qr = $Q_c = Q_s$, and P_r and T_r are equal to P_c and T_c, P_n and T_n can be substituted for P_n, and T_m these two equations combined, with simplification, give equation 22 below :

Equation 22 :

$$\boxed{Q_n = Q_m \sqrt{\frac{T_n T_c}{P_n P_c}} * \left(\frac{P_s}{T_s}\right)}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298 °K and 760 mm Hg)
m = Calibration conditions of manufacturer or laboratory (correction curve)
s = Sampling site conditions
c = Calibration site conditions

- ***Calibration outside the sampling*** *site*

(Constant mass flow pumps)
In this case, the same procedure is followed as in the first example, since only the calibration conditions have an effect on the flow rate. In fact, the pump, which will later be installed in the sampling environment, will compensate for changes in air density caused by temperature and pressure. These parameters will therefore have no effect on the air volume collected and converted to normal conditions. Equation 21 is used, with the calibration conditions replacing the sampling conditions, and producing equation 23 :

Equation 23 :

$$\boxed{Q_n = Q_m \sqrt{\frac{P_c T_n}{T_c P_n}}}$$

Q = Volumetric flow rate
P = Pressure
T = Temperature in °K
n = Standard conditions (298 °K and 760 mm Hg)
m = Calibration conditions of manufacturer or laboratory
c = Calibration site conditions

2.5.3.3 Using a mass flowmeter

The mass flowmeter operates according to a thermal compensation principle. The flowmeter's sensor consists of a heated wire that an electronic circuit tends to maintain at constant temperature under a cooling effect caused by a flow of air. This device has the advantage of giving a flow rate at standard conditions of the instrument, regardless of the temperature conditions. No correction is made, however, for variations in barometric pressure. It has the advantage of being easily transported in the field.

- ***Calibration on the sample site***

(Constant volume or constant mass flow pumps)
Since the mass flowmeter gives a flow value directly in units at standard conditions, there is no correction when the sampling and **calibration** are carried out at the same location.

- ***Calibration outside the sampling***

(Constant volume flow pumps)
In this case, the actual flow rate of the pump during calibration must first be known since the mass flowmeter provides a value at standard conditions. This volumetric flow rate will be the same during sampling because the pump maintains a constant volumetric flow regardless of the conditions of temperature and pressure. The equation is the following:

Equation 24 :

$$\boxed{Q_r = Q_{flowm}\frac{P_n}{T_n}\frac{T_c}{P_c}}$$

Q = *Volumetric flow rate*
P = *Pressure*
T = *Temperature in °K*
n = *Standard conditions (298 °K and 760 mm Hg)*
c = *Calibration site conditions*
flowm = *Mass flowmeter reading*
r = *Actual conditions*

During sampling, the effective flow rate will be the actual flow rate calculated using the previous equation. To convert the flow rate to standard conditions, 25 is applied :

Equation 25 :

$$\boxed{Q_n = Q_s\frac{P_s}{T_s}\frac{T_n}{P_n}}$$

Q = *Volumetric flow rate*
P = *Pressure*
T = *Temperature in °K*
n = *Standard conditions (298 °K and 760 mm Hg)*
s = *Sampling site conditions*

Equation 26 is obtained by combining equations 24 and 25. It calculates the flow rate at standard conditions in one step. Because a constant volume flow pump is used, Q_s can be replaced by Q_r making any possible simplifications.

Equation 26 :

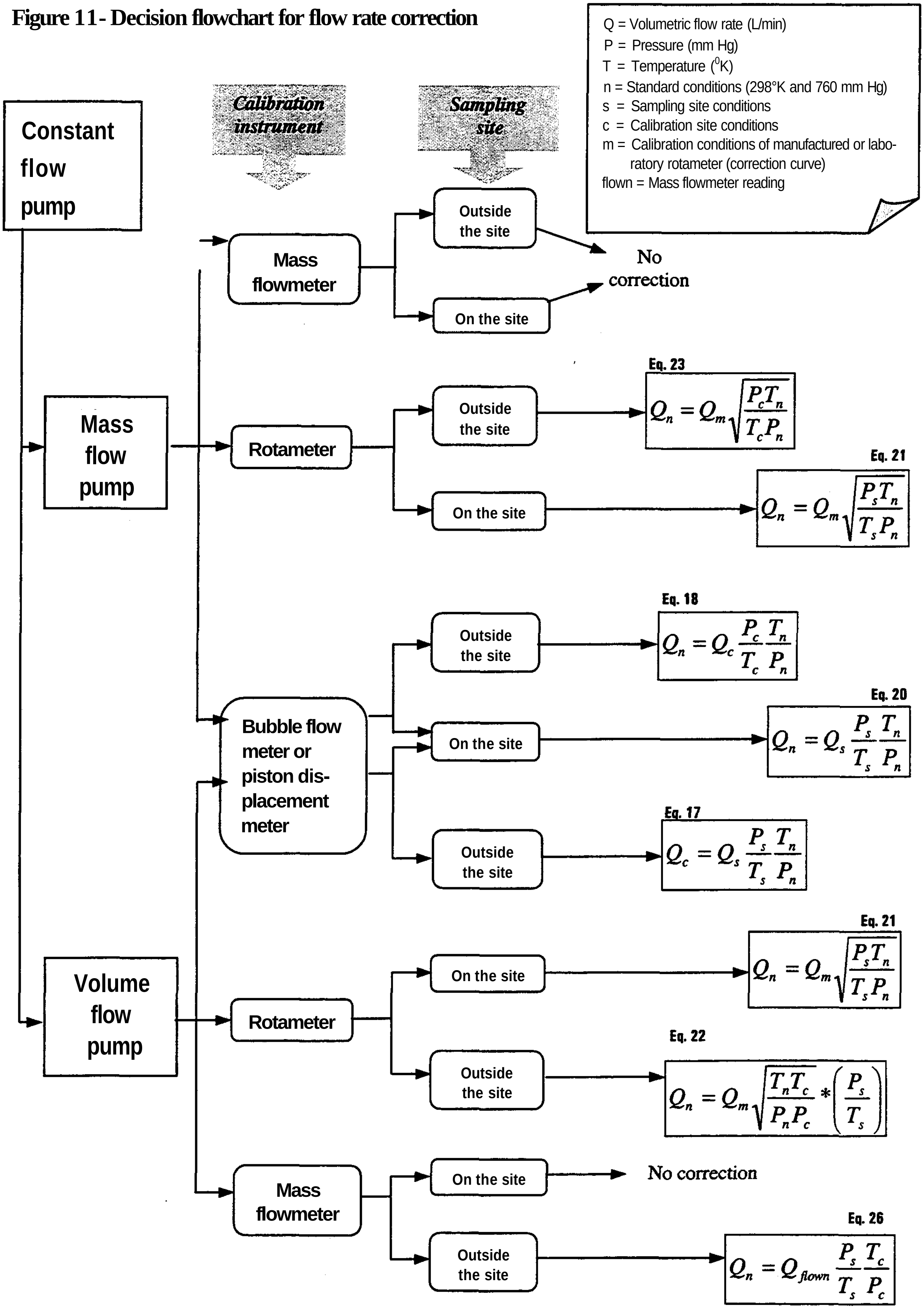
$$\boxed{Q_n = Q_{flowm}\frac{P_s}{T_s}\frac{T_c}{P_c}}$$

Q = *Volumetric flow rate*
P = *Pressure*
T = *Temperature in °K*
n = *Standard conditions (298 °K et 760 mm Hg)*
s = *Sampling site conditions*
c = *Calibration site conditions*
flowm = *Mass flowmeter reading*

- ***Calibration outside the sampling site***

(Constant mass flow pumps)
Since the pump is controlled by a mass device and the flowmeter operates according to the same principle, no correction needs to be made except for that for the calibration site and the sampling site.

Figure 11 - Decision flowchart for flow rate correction


Q = Volumetric flow rate (L/min)
P = Pressure (mm Hg)
T = Temperature (^{0}K)
n = Standard conditions (298°K and 760 mm Hg)
s = Sampling site conditions
c = Calibration site conditions
m = Calibration conditions of manufactured or laboratory rotameter (correction curve)
flown = Mass flowmeter reading

Part 3: Contaminant sampling and analysis

Introduction

The following section presents the sampling parameters and the analytical methods used in characterizing occupational exposure. The exposure standards or limit values referred to are those taken from the RRQWE (2). Information on the principles for using reference values is given in several publications including the annual book entitled *1999 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* from ACGIH (9).

3.1 Table of substances in the RRQWE and tables of substances analyzed by the IRSST

This part of the Sampling Guide contains three tables. The first table consists of green pages containing all of the substances in the RRQWE (668) and contains information On the IRSST methods or *other methods* that are recommended by the IRSST. The latter have been chosen by a review committee consisting of four chemists based on the literature available in 1994. The Operations Division has a file for each substance which contains a copy of the chosen method as well as some other methods that have not been selected. It is important to mention that no laboratory test has been carried out relating to the *recommended methods.* In this context, the implementation of these methods must undergo an appropriate analytical validation process. Most of the recommended methods originate from the following organizations: NIOSH (National Institute for Occupational Safety and Health) and OSHA (Occupational Safety and Health Administration). This is the list of the documents or Web sites that we have consulted.

- NIOSH Manual of Analytical Methods, second edition, Volumes 1 to 7, published from 1977-1980, Cincinnati, OH
- NIOSH Manual of Analytical Methods, third edition, published from 1984-1994, Cincinnati, OH http://www.cdc.gov/niosh/nmanm/nmammenu.html
- OSHA Analytical Methods Manual (Organic and Inorganic), published from 1985-1991, Salt Lake City, UT http://www.osha-slc.gov/html/dbsearch.html
- OSHA Chemical Information File, published in 1991, Salt Lake City, UT. http://www.osha-slc.gov/OCIS/toc_chemsamp.html

These documents may be consulted at the IRSST Operations Division.

The second table (blue sheets) is intended mainly for users of the IRSST Operations Division's analytical service. It presents the information on the contaminant evaluation methods that *are offered* within the scope of the analytical service.

Finally, the third table contains the same information as the second table but for a very limited number of substances, which, without being part of the RRQWE, are also offered within the scope of the IRSST's analytical service.

The information contained in these tables originates from a data base that is periodically updated. Its most recent version can be consulted at the following Web site:
http://www.irsst.qc.ca/htmfr/4_l.htm.

3.2 Description of the column titles in the tables

RRQWE name

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

CAS

This is the chemical's CAS number. This number *(Chemical Abstract Service Registry Number)* makes it easy to identify chemical substances, which sometimes have many synonyms. Note that in the case of families of substances (for example, soluble barium salts), no CAS has been given.

TWAEV / STEV / Ceiling (mg/m^3)

The two numbers in this column correspond to the time-weighted average exposure value (TWAEV) and me short-term exposure value (STEV), and the ceiling value (CEILING) as defined in me RRQWE.

Notation

This column contains me notations for percutaneous toxicity (T), carcinogenicity (Cl, C2 and C3) and simple asphyxiant (Ax).

Sampling device

This column contains a short description of me sampling equipment. The IRSST inventory number for the sampling device is also given in the second and third tables. The guide also contains a table describing this equipment, and containing such things as the IRSST inventory numbers.

Flow rate (L/min)

This is the recommended sampling flow rate. It is normally expressed in liters per minute.

TWAEV/STEV vol. (L)

These are the recommended sampling volumes for TWAEV and STEV evaluations. They are generally expressed in liters.

Principle

This column contains an acronym corresponding to the technique used in analyzing the contaminant Appendix 2 contains an acronym correspondence table.

Min. value fr/g)

This column contains the minimum amount reported (on the sampling device). In some cases, however, it is preferable to consult the analytical method to properly understand this value.

Desorption/digestion

This is the procedure used for digestion (metals) or desorption or extraction of the contaminant to be measured.

Reference

This is the supporting bibliographical reference for the method (for the first table only). In most cases where the analysis is not established in the IRSST laboratories, a NIOSH or OSHA method number or a reference (reference table, part 3) is given.

Remarks

This section contains all the information pertaining to sampling, analysis or analytical interferences.

3.3 Sampling parameters and analytical limitations

The sampling volumes and flow rates are determined in relation to the limits of quantification of the analytical methods, the collecting capacity of the various collecting mediums, and the characteristics of the sampling instruments. The minimum amount reported is used in determining the optimum sampling time.

It is important to emphasize that a maximum of 6 metals can be analyzed on a single filter. For solvents, the maximum number depends on whether or not there is chromatographic interference. In both cases, the "Remarks" column must not contain *"specific desorption " or "specific analysis ".*

3.4 Note concerning simple asphyxiants

It is important to mention a subtlety in the methods for simple asphyxiants. The applicable regulation stipulates that these substances must have concentrations such that the oxygen concentration in the air is not less than 19.5%. The methods suggested for simple asphyxiants are therefore based on the determination 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 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.***

Table of substances in RRQWE

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Acetaldehyde 322-1	*75-07-0*	180 270	C3	Orbo 23 tube #Supelco 2-0257	0.1	10	GC-MS	0.09	Toluene		The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance.
Acetic acid 195-2	*64-19-7*	25 37		Activated charcoal tube #SKC ST226-01	1	50	HPLC-UV	21.6	0,1 N sodium hydroxide		IRSST method 195-2 is for the specific analysis of acetic acid.
Acetic anhydride	*108-24-7*	21		Glass fiber filter #SKC FLT225-7 impregnated with 1-(2 pyridyl) piperazine (The filters must be impregnated in the laboratory.)	0.05	0.75	GC-NPD	0.51	Isopropanol: toluene (50:50)	OSHA 82	Ketene, acetyl chloride, isocyanates, hydrochloric acid, other anhydrides or any other compound that reacts with 1-(2 pyridyl) piperazine contained on the filter can cause interference during sampling.
Acetone 22-2	*67-64-1*	1780 2380		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	2 1.5	GC-FID	180	Carbon disulfide		
Acetone 39-A	*67-64-1*	1780 2380					DRI-PAD				The reported minimum value is of 1 mg/m^3 (0.4 ppm).
Acetone 555-1	*67-64-1*	1780 2380		3M Organic Vapor Monitor #3500			GC-FID	180	Carbon disulfide		The recommended sampling time is of 4 hours, although it may be variable.
Acetonitrile	*75-05-8*	67 101		Activated charcoal tube #SKC ST226-24	0.01-0.2	10	GC-FID	10	Benzene	NIOSH 1606	A desorption solvent other than benzene may be used.
Acetylene 9-C	*74-86-2*		Ax				DRI-EX				IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Acetylsalicylic acid	*50-78-2*	5		Glass fiber filter #SKC FLT225-7	1	100	HPLC-UV	0.2	Methanol: water (24:76) buffered to pH 5,0	Réf. 1 Réf. 2	An electrochemical detector or fluorescence detector may be used to improve analytical sensitivity. Acetylsalicylic acid hydrolyzes in the air to produce salicylic acid. It is therefore important that
Acrolein 326-1	*107-02-8*	0.23 0.69		Orbo 23 tube #Supelco 2-0257	0.1	10	GC-MS	0.02	Toluene		The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The tubes must be stored in the freezer before and after sampling. The use of an "Icepak" is not
Acry/amide	*79-06-1*	0.03	Pc C2	Glass fiber filter #SKC FLT225-16 in series with a silica gel tube #SKC ST226-10	1	120	GC-NPD	0.46	Methanol	OSHA 21	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	References	Remarks
Acrylic acid *79-10-7*	29	Pc	Two XAD-8 tubes in series #SKC ST226-30-8	0.1	24	HPLC-UV	0.99	Methanol: water (1:1)	OSHA 28	There is a possibility of polymerization in the presence of polymerization initiators in the atmosphere.
Acrylonitrile 147-2 *107-13-1*	4.3	Pc C2	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	20	GC-FID	8	N,N Dimethylacetamide containing propionitrile as an internal standard		Specific desorption must be carried out for this substance.
Aldrin *309-00-2*	0.25	Pc	Glass fiber filter #SKCFLT225-7 in series with an impinger #SKC IMP225 35 2 containing 15 mL of isooctane	0.2-1	18	GC-ECD	3	Isooctane	NIOSH 5502	
Allyl alcohol 169-1 *107-18-6*	4.8 9.5	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	2.5	Carbon disulfide		
Allyl glycidyl ether (AGE) *106-92-3*	23 47		XAD-7 tube #SKC ST226-30-11-07	0.2	5	GC^2 FID	5.6	Acetonitrile	Ref. 14	
Ally/propyl disulfide *2179-59-1*	12 18		Chromosorb-106 tube #SKC 226-110	0.2	10 3	GC-FPD		Trichloroethylene	OSHA IMIS0150	
Aluminum (as Al), Metal 11-2 *7429-90-5*	10		Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP	1.5	180	FAAS	20	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrate d nitric acid		The analytical results are expressed as total aluminium.
Aluminum [7429-90 5], (as All Alkyls (NOC)	2									By court order, the standard for this substance has been stayed in the United States pending the development of an analytical method. No supporting method is suggested for this substance. If a request is made to the IRSST, the analytical method could be developed and will have to be validated for the substance mentioned, based on the procedure described by the IRSST, which refers to the NIOSH protocol.
Aluminum [7429-90-5], (as Al), Pyro powders 48-1	5		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the sampling and desorption parameters (use of lithium borate) described in OSHA data sheet IMISA101 and the analytical conditions in IRSST method 11-2. The gravimetric method for dusts is by definition nonspecific.
Aluminum [7429-90 5], (as Al), Soluble salts 212-3	2		Polyvinyl chloride filter Gelman 66467	1.5	180	FAAS	20	Water at room temperature		Specific sampling must be carried out for this substance. The analytical results are expressed as total aluminium (soluble compounds).
Aluminum [7429-90 5], (as Al), Welding fumes 11-2	5		Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP	1.5	180	FAAS	20	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		To evaluate welding fumes, personal sampling must be carried out within the mask. Aluminium oxides formed while welding are not made soluble with the actual digestion method. The analytical results are expressed as total aluminium.
Aluminum oxide (as Al) (total dust) 48-1 *1344-28-1*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% crystalline silica.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
sec-Amyl acetate 272-1 *626-38-0*	665		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	335	Carbon disulfide		
Aniline *62-53-3*	7.6	Pc	Silica gel tube #SKC ST226-10	0.020.2	20	GC-FID	10	Ethanol: water (95:5) (ultrasonic bath)	NIOSH 2002	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
o-Anisidine *90-04-0*	0.5	Pc C3	XAD-2 tube #SKC ST226-30-05	0.51	225	HPLC-UV	0.35	Methanol	NIOSH 2514	
p-Anisidine *104-94-9*	0.5	Pc	XAD-2 tube #SKC ST226-30-05	0.5-1	225	HPLC-UV	0.35	Methanol	NIOSH 2514	
Antimony [7440-36-0], metal and compounds (as Sb) 55-2	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	10	Concentrated nitric acid.concentrated hydrochloric acid		Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
Antimony trioxide (as Sb) 55-2 *1309-64-4*	0.5	C3	Mixed cellulose ester filter Omega M-083700AF or Omega M-083700AFP	1.5	180	FAAS	10	Concentrated nitric acid, concentrated hydrochloric acid		Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
Antimony trioxide, production (as Sb) 55-2 *1309-64-4*	0.5	C2 RP	Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	10	Concentrated nitric acid, concentrated hydrochloric acid		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 #SKC FLT225-17-01	1.5-2	480	HPLC-UV	5	Methanol	NIOSH S276	
Argon 26-C *7440-37-1*		Ax				DRI-elec				Since argon is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26-C). The reported minimum value is 1% oxygen.
Arsenic [7440-38-2], metal and soluble compounds (as As)	0.2		Mixed cellulose ester filter #SKC FLT225-5	2	480	ET-AAS	0.003	Concentrated nitric acid	OSHA ID105	A mixed cellulose ester filter and a pad impregnated with sodium carbonate and glycerol in series with an activated charcoal tube must be used to minimize the interference of arsine and other volatile arsenic compounds. OSHA method ID-105 is for analyzing inorganic arsenic and can be adapted to metallic arsenic and its soluble compounds.
Arsenic trioxide, production *1327-53-3*		C2 RP	Mixed cellulose ester filter #SKC FLT225-5	2	480	ET-AAS	0.003	Concentrated nitric acid	0SHA ID105	A mixed cellulose ester filter and a pad impregnated with sodium carbonate and glycerol in series with an activated charcoal tube must be used to minimize the interference of arsine and other volatile arsenic compounds. OSHA method ID 105 is for analyzing inorganic arsenic and can be adapted to arsenic trioxide. There is no reference value for the standard, but the determination might be required by targeting the lowest limit of detection, given the carcinogenicity designation C2.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	References	Remarks
4-Aminodiphenyl	*92-67-1*		Pc C1	Cassette containing two glass fiber filters impregnated with sulfuric acid #SKC FLT225 7 (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.00068	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 93	The filters must be transferred and stored in water until analysis. Any compound that reacts with sulfuric acid and is collected on the filters can cause interference during sampling. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C1.
2-Aminoethanol 303-1	*141-43-5*	7.5 15		XAD 2 tube impregnated with 10% (w/w) 1-naphthylisothiocyanate (NIT) # SKC ST226-30-18	0.2	4	HPLC-UV	0.15	Acetonitrile		
2-Aminopyridine	*504-29-0*	2		Two Tenax-GC tubes in series #SKC ST226-35-02	0.01-0.2	12	GC-FID	2	Thermal desorption	NIOSH S158	
Amitrole	*61-82-5*	0.2	C3 RP	Glass midget impinger #SKC IMP 225-36-1 containing 10 mL of water	1	60	HPLC-UV			OSHA IMISA 176	A copy of the OSHA file is available in the IRSST files.
Ammonia 220-1	*7664-41-7*	17 24		Carbon bead tube #SKC ST226-29 pretreated with sulfuric acid	0.10-0.5	24 7.5	IC-CD	9.4	Demineralized water at room temperature		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 may cause interference. The analytical results are expressed as ammonia (NH3).
Ammonia 39-A	*7664-41-7*	17 24					DRI-PAD				The reported minimum value is 0.5 mg/m^3 (0.80 ppm).
Ammonium chloride fume	*12125-02-9*	10 20		Low ash polyvinyl chloride filter #SKC FLT225-8-01	2	960 30	IC-CD		Diaminopropionic acid monohydrochloride	IRSST 220-1 OSHA ID188	IRSST gravimetric method 48-1 is used. If the substance needs to be identified, a method must be developed using the sampling parameters and the sampling device in OSHA method 188 and the analytical conditions in IRSST method 220-1.
Ammonium chloride fume 48-1	*12125-02-9*	10 20		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the sampling parameters and device in OSHA method ID 188 and the analytical conditions in IRSST method 220-1. The gravimetric method for dusts is by definition nonspecific.
Ammonium perfluorooctanoate	*3825-26-1*	0.1		Mixed cellulose ester filter #Nuclepore 142789 in series with a glass midget impinger #SKC IMP225-36-1 containing methanol			GC-ECD			Réf.4 Réf. 5	
Ammonium sulfamate 48-1	*7773-06-0*	10		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the sampling parameters and device in OSHA method ID188 and the analytical conditions in IRSST method 220-1. The gravimetric method for dusts is by definition nonspecific.
n-Amylacetate 74-1	*628-63-7*	532		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	265	Carbon disulfide		

RRQWE	Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
	Arsine	***7784-42-1***	0.16		Mixed cellulose ester filter #SKC FLT225-5 and pad impregnated with sodium carbonate and glycerol in series with an activated charcoal tube #SKC ST226-01 (The pad must be impregnated in the laboratory.)	2	480	ET-AAS	0.003	Concentrated nitric acid	OSHA ID105	
243-1	***Asbestos, Actinolite***	***12172-67-7***	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter # Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
243-1	***Asbestos, Amosite***	***12172-73-5***	0.2 f/cc 1 f/cc	C1 **EM**	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The standard is applicable where the use of this product is permitted. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
243-1	***Asbestos, Anthophyllite***	***17068-78-9***	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
243-1	***Asbestos, Chrysotile***	***12001-29-5***	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
243-1	***Asbestos, Crocidolite***	***12001-28-4***	0.2 f/cc 1 f/cc	C1 **EM**	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The standard is applicable where the use of this product is permitted. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
243-1	***Asbestos, Tremolite***	***14567-73-8***	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	References	Remarks
Asphalt (petroleum) fumes 201-1	*8052-42-4*	5		Glass fiber filter pretreated in the laboratory #Millipore AP4003705 in series with an Orbo 42 tube #Supelco 2-0264	2	960	Grav	50	Benzene		The sampling device includes a cassette followed by a tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. Ten polycyclic aromatic hydrocarbons (PAH) are analyzed on the filter and tube.
Atrazine	*1912-24-9*	5		Tube of polyurethane foam (PUF) (Produced in the laboratory or #SKC ST226-126)	Maximum: 4	912	GC-ECD	0.092	Diethyl ether: hexane (75:25) (soxhlet)	Réf. 6	Before use, the polyurethane foam is cleaned with 5% diethyl ether in a soxhlet. An OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16 and a supercritical fluid extractor can be used.
Azinphosmethyl	*86-50-0*	0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	200	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris-(2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Barium, soluble compounds (as Ba) 57-1	*7440-39-3*	0.5		Polyvinyl chloride filter #Gelman 66467	1.5	180	FAAS	5	Demineralized water at room temperature		Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble baryum.
Barium sulfate (respirable dust) 48-1	*7727-43-7*	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Barium sulfate (total dust) 48-1	*7727-43-7*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Benomyl	*17804-35-2*	10		OVS (OSHA Versatile Sampler) tube with XAD-7 and glass fiber filter #SKC ST226-57	1	60	HPLC-UV		Acetonitrile	OSHA IMISB407	A copy of the OSHA file is available in the IRSST files.
Benzene 24-3	*71-43-2*	3 15.5	C1 RP	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	12 3	GC-FID	3	Carbon disulfide		The use of carbon disulfide with low benzene content is strongly recommended.
Benzidine (production)	*92-87-5*		Pc C1	Glass fiber filter #SKC FLT225-7 impregnated with sulfuric acid (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.031	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 65	The filter must be transferred to a container of water until analysis. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C1.
Benzo(a)pyrene 282-1	*50-32-8*	0.005	C2 RP	Pretreated glass fiber filter in the laboratory #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264	2	960	GC-MS	0.02	Benzene		The sampling device includes a cassette followed by a tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
p-Benzoquinone	*106-51-4*	0.44		XAD-2 tube #SKC ST226-30-04	0.2	24	HPLC-UV	4.1	Isopropanol: hexane (20:80)	NIOSH S181	Another desorption solvent and a reverse phase column can be used.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
Benzoyl peroxide *94-36-0*	5		Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-04	3	400	HPLC-UV		Methanol	NIOSH 5009 OSHA IMIS0335	At the end of sampling, the samples must be transferred to a container and stored in the refrigerator until analysis. NIOSH method 5009 is for analyzing benzoyl peroxide. The sampling conditions in OSHA data sheet IMIS0355 are used.
Benzyl chloride 253-1 *100-44-7*	5.2		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	2.7	Carbon disulfide		
Beryllium [7440-41-7], metal and compounds (as Be)	0.002	C2 RP	Mixed cellulose ester filter #SKC FLT225-5	1.4	40	ET-AAS	0.005	Nitric acid: sulfuric acid	NIOSH 7102	Calcium, potassium, sodium, and perchloric, phosphoric and hydrofluoric acids may cause interference.
Biphenyl *92-52-4*	1.3		Pretreated glass fiber filter #Millipore AP4003705 in series with an Orbo-43 tube #Supelco 2-0258 (The filters are previously heated to 400°C in the laboratory.)			GC-MS		Benzene	IRSST 219-1	The samples must be stored in the freezer until analysis. IRSST method 219-1 is for analyzing PAHs and does not specifically include biphenyl. A desorption solvent other than benzene can be used.
Bismuth telluride (as Bi2Te3), Se-doped 48-1	5		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Bismuth telluride (as Bi2Te3), Undoped 48-1 *1304-02-1*	10		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Borates, tetra, sodium salt, Anhydrous *1330-43-4*	1		Mixed cellulose ester filter #SKC FLT225-5	2	480	ICP		Deionized water	OSHA ID125G OSHA IMIS0374	Other boron compounds can cause interference during the analysis. OSHA method ID125G is for the analysis of metals and metal particulates and can be adapted to boron. The desorption conditions in OSHA data sheet IMIS0374 are used.
Borates, tetra, sodium salt, Decahydrate *1303-96-4*	5		Mixed cellulose ester filter #SKC FLT225-5	2	480	ICP		Deionized water	OSHA IMIS0375 OSHA ID125G	Other boron compounds can cause interference during the analysis. OSHA method ID125G is for the analysis of metals and metal particulates and can be adapted to boron. The desorption conditions in OSHA data sheet IMIS0375 are used.
Borates, tetra, sodium salt, Pentahydrate *12045004*	1		Mixed cellulose ester filter #SKC FLT225-5	2	480	ICP		Deionized water	OSHA IMIS0376 OSHA ID125G	Other boron compounds may cause interference during the analysis. OSHA method ID125G is for the analysis of metals and metal particulates and can be adapted to boron. The desorption conditions in OSHA data sheet IMIS0376 are used.
Boron oxide 48-1 *1303-06-2*	10		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.

Table of substances in RRQWE

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Boron tribromide ***10294-33-4***	10		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of a solution of 0,003 M sodium bicarbonate and 0,0024 M sodium carbonate	1	**5**	IC-CD	0.9		OSHA ID108 OSHA IMIS0381	The bromide and bromate ions are analyzed. The sampling method is carried out using information from OSHA data sheet data sheet IMI0381 while the analysis follows the protocol of OSHA method ID108. Nitrous ions, chlorides, chlorates and iodates may cause interference.
Boron trifluoride ***7637-07-2***	2.8		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10mL of 0,1 N ammonium fluoride	**1**	100	SE			OSHA IMIS0382	The samples must be stored in plastic containers. A copy of the OSHA house file is available in the IRSST files. Nitrates, bromides, acetates, carbonates, fluorides, chlorides, hydroxides and sulfides may cause interference.
Bromacil ***314-40-9***	10		Glass midget impinger #SKC IMP 225 36-1 containing 15 mL of ethylene glycol	**1**	**50**	HPLC-UV			OSHA IMISB708	A copy of the OSHA file is available in the IRSST files.
Bromine ***7726-95-6***	0.66 2		Silver membrane filter #SKC FLT225-1802	0.3-1	72	IC-CD	1.6	6 mM sodium thiosulfate	NIOSH 6011	Hydrogen sulfide, hydrochloric and hydrobromic acids may cause interference during the analysis.
Bromine pentafluoride ***7789-30-2***	0.72		Mixed cellulose ester filter #SKC FLT 225-5 in series with a cellulose support #SKC FLT225-27 pretreated with sodium carbonate. (The support must be treated in the laboratory.)	**1-2**	250	SE		The mixed cellulose ester filter undergoes fusion in sodium hydroxide. The filter and the support are then dissolved separately in water and TISAB (total ionic strength activity buffer).	NIOSH 7902	NIOSH method 7902 is for analyzing fluorine in the aerosol and gaseous form and can be adapted to bromine pentafluoride. Ferric ions, hydroxides, silicates and aluminum may cause interference during the analysis.
Bromoform ***75-25-2***	5.2	**Pc**	Activated charcoal tube #SKC ST226-01	0.01-0.2	10	GC-FID	10	Carbon disulfide	NIOSH 1003	
Bromotrifluoromethane **181-1** ***75-63-8***	6090		Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01	Maximum: 0.05	**1**	GC-FID	305	Carbon disulfide		The bromotrifluoromethane must be sampled specifically in reason of the sampling device used.
1,3-Butadiene **171-1** ***106-99-0***	22	C2 **EM**	Activated charcoal tube impregnated with TBC #SKC ST226-73	Maximum: 0.075	10	GC-FID	**4.4**	Carbon disulfide		Butadiene-1,3 must be sampled specifically in reason of the sampling device used.
Butane **182-1** ***106-97-8***	1900		Mylar sampling bag #Calibrated Instruments Inc. IC-5		**1**	GC-FID				IRSST method 182-1 is for analyzing total hydrocarbons (C1 to C4). This method is currently in revaluation. Please contact the laboratory's Customer service department to learn of its availability.
Butane **9-C** ***106-97-8***	1900					DRI-EX				IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
2-Butoxyethanol **94-2** ***111-76-2***	121	**Pc**	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	**10**	GC-FID	27	methylene chloride: methanol (95:5)		Specific desorption must be carried out for this substance.
n-Butylacetate **77-1** ***123-86-4***	713 950		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 **3**	GC-FID	71	Carbon disulfide		

Table of substances in RRQWE

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	References	Remarks
sec-Butyl acetate **274-1** ***105-46-4***	950		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	**10**	GC-FID	475	Carbon disulfide		
ter-Butyl acetate **275-1** ***540-88-5***	950		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	475	Carbon disulfide		
n-Butyl acrylate ***141-32-2***	52		Activated charcoal tube #SKC ST226-73 impregnated with 4-tert-butylcatechol	0.05	**12**	GC-FID	17	Carbon disulfide	OSHA IMIS0450	**A** copy of the OSHA file is available in the IRSST files.
n-Butyl alcohol **90-1** ***71-36-3***	 152	**Pc**	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	**81**	Carbon disulfide		
sec Butyl alcohol **276-2** ***78-92-2***	303		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	65	Carbon disulfide		
ter-Butyl alcohol **277-1** ***75-65-0***	303 455		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 **3**	GC-FID	150	Carbon disulfide		
ter-Butylchromate (as Cr03) ***1189-85-1***	 0.1	**Pc**	Polyvinyl chloride filter #Gelman 60714 and polyethylene container			IC-VIS		Sodium hydroxide: sodium carbonate: water (2:3:95)	IRSST 271-1	IRSST method 271-1 is for analyzing chromium VI which does not specifically include tert-butyl chromate.
n-Butylglycidyl ether (BGE) ***2426-08-6***	133		XAD-7 tube #SKC ST226-30-11-07	0.2	**5**	GC^2 FID	33	methylene chloride	Réf. 14	
n-Butyl lactate ***138-22-7***	30		Activated charcoal tube #SKC ST226-01	0.2	10	GC-FID		Methylene chloride: methanol (95:5)	OSHA IMIS0478	Carbon disulfide can be used as desorption solvent.
Butyl mercaptan ***109-79-5***	**1.8**		Chromosorb-104 tube #SKC ST226-109	0.01-0.05	1.5	GC-FPD	**3**	Acetone	NIOSH 2525	A photoionization detector can be used.
n-Butylamine ***109-73-9***	 15	**Pc**	Silica gel tube impregnated with sulfuric acid #SKC ST226-53	1	**15**	GC-FID	12	Methanol: water (50:50)	NIOSH S138	A nitrogen and phosphorus detector and a capillary column can be used to improve analytical sensitivity and chromatographic separation, respectively.
o-sec-Butylphenol ***89-72-5***	31	**Pc**	XAD-7 tube #SKC ST226-95	0.1	10	HPLC-UV		Methanol	OSHA IMISB705	
p-tert-Butyltoluene ***98-51-1***	61 122		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	**1**	Carbon disulfide	NIOSH 1501	Alcohols, ketones, ethers and halogenated hydrocarbons may cause interference.
Cadmium [7440-43-9], dusts and salts (as Cd) 19-2	0.05	C2 **EM**	Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	0.5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total cadmium.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
Cadmium oxide, Fume (as Cd) **19-2** ***1306-19-0***	0.05	**C2** **EM**	Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	**0.5**	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total cadmium.
Cadmium oxide, Production (as Cd) **19-2** ***1306-19-0***	0.05	**C2** **RP**	Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	**5.5**	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total cadmium.
Calcium carbonate **48-1** ***1317-65-3***	10 Pt		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals must be analized	1.5	180	Grav	**50**			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Calcium cyanamide ***15662-7***	**0.5**		Mixed cellulose ester filter #Nuclepore 142789 or 141679			FAAS		Concentrated nitric acid, then nitric acid: perchloric acid (2:1)	IRSST 1-1	IRSST method 1-1 is for analyzing calcium, which does not specifically include calcium cyanamide.
Calcium hydroxide 1-1 ***1305-62-0***	**5**		Mixed cellulose ester filter Omega M-083700AF ou Omega M-082500AFP	1.5	180	FAAS	**5**	Concentrated nitric acid, then nitric acid: perchloric acid (2:1)		Specific sampling must be carried out for this substance. The analytical results are expressed as total calcium.
Calcium oxide **1-1** ***1305-78-8***	**2**		Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP	1.5	180	FAAS	**5**	Concentrated nitric acid, then nitric acid: perchloric acid (2:1)		Specific sampling must be carried out for this substance. The analytical results are expressed as total calcium.
Calcium silicate (synthetic) (total dust) **48-1** ***1344-95-2***	10 Pt		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Calcium sulfate (respirable dust) **48-1** ***7778-18-9***	5 Pr		Cyclone in series with a polyvinyl chloride filter Omega P08370K or mixed cellulose ester filter Omega M-083700AF if metals must be analysed	1.7	180	Grav	25			The actual flow rate must be adjusted at the sampling site conditions. Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Calcium sulfate (total dust) **48-1** ***7778-18-9***	10 Pt		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals must be analysed	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Camphor (synthetic) **83-1** ***76-22-2***	12 19		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	20 3	GC-FID	12	Carbon disulfide: methanol (99:1)		Specific desorption must be carried out for this substance.
Caprolactam, Dust ***105-60-2***	**1** **3**		OVS (OSHA Versatile Sampler) tube with XAD 7 and glass fiber filter #SKC ST226-57	1	100 15	HPLC-UV			OSHA IMIS 0523	
Caprolactam, Vapour ***105-60-2***	**20** **40**		OVS (OSHA Versatile Sampler) tube with XAD-7 and glass fiber filter #SKC ST226-57	1	100 15	HPLC-UV			OSHA IMIS 0524	

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	References	Remarks
Captafol	*2425061*	0.1	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKCST226-30-16	1	240	GC-ECD				
Captan 48-1	*133-06-2*	5		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25		OSHA IMIS0529	Additional information is available in Info-Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMIS0529. The gravimetric method for dusts is by definition nonspecific.
Carbaryl	*63-25-2*	5		OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	60	HPLC-UV	1.6	Acetonitrile	OSHA 63	
Carbofuran	*1563-66-2*	0.1		Tube of polyurethane foam (PUF) (Produced in the laboratory or #SKC ST226-126)	3.9	900	GC-ECD	0.091	Diethyl ether: hexane (75:25) (soxhlet)	Réf.6	Before use, the polyurethane foam is cleaned with 5% diethyl ether in a soxhlet.
Carbon black 48-1	*1333-86-4*	3.5		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. If the required analysis is for one or more substances adsorbed by carbon black, the standards and methods corresponding to these substances must be followed. The quantitative method for dusts is by definition nonspecific.
Carbon dioxide 34-C	*124-38-9*	9000 54000					DR-IR				The reported minimum value is 18 mg/m^3 (10 ppm).
Carbon dioxide 39-A	*124-38-9*	9000 54000					DRI-PAD				The reported minimum value is of 5.4 mg/m^3 (3 ppm).
Carbon disulfide	*75-15-0*	12 36	Pc	Activated charcoal tube #SKC ST226-01 preceded by a drying tube	0.01-0.2	6	GC-FPD	20	Toluene	NIOSH 1600	The samples must be stored in the refrigerator until analysis. A photoionization detector can be used.
Carbon monoxide 3-B /30B	*630-08-0*	40 230					DRI-elec				The reported minimum value is 1.1 mg/m^3 (1 ppm).
Carbon monoxide 115-1	*630-08-0*	40 230		Mylar sampling bag #Calibrated Instruments Inc. IC-5		5	IRnd				The reported minimum value is 0.2 ppm. This method is currently under revaluation. Please contact the laboratory Customer service department to learn of its availability.
Carbon monoxide 39-A	*630-08-0*	40 230					DRI-PAD				The reported minimum value is of 0.2 mg/m^3 (0.2 ppm).
Carbon tetrabromide	*558-13-4*	1.4 4.1		XAD-4 tube #SKC ST226-93	0.2	10 3	GC-ECD		Toluene	IRSST 157-2 OSHA IMIS0565	A method must be developed using the conditions described in OSHA data sheet IMIS0565. IRSST method 157-2 for analyzing carbon tetrachloride can be used, and can be adapted to carbon tetrabromide.
Carbon tetrachloride 157-2	*56-23-5*	31	Pc C2	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	15	GC-FID	25	Carbon disulfide		

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota- tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe- rences	Remarks
Carbonyl fluoride *353-50-4*	5.4 13		Mixed cellulose ester filter #Nuclepore 142789 (37 mm) in series with a polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide			SE			IRSST 164-1	IRSST method 164-1 is for analyzing hydrofluoric acid and can be adapted to carbonyl fluoride.
Catechol *120-80-9*	23	Pc	XAD-7 tube #SKC ST226-95			HPLC-UV		Methanol	OSHA 32	OSHA method 32 is for analyzing phenol and cresol and can be adapted to catechol.
Cellulose (paper fibres) (total dust) 48-1 *9004-34-6*	10 Pt		Polyvinyl chloride filter with capsule (Accu-Cap)	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Cesium hydroxide *21351-79-1*	2		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS		Water	OSHA ID121	The addition of potassium ions may hinder the ionization of cesium in the flame. The presence of other cesium compounds and some strong acids may cause interference during the analysis.
Chlordane *57-74-9*	0.5	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	480	GC-ECD	31	Toluene	OSHA 67	A supercritical fluid extractor can be used if desorption proves difficult.
Chlorinated camphene *8001-35-2*	0.5 1	Pc C3	Mixed cellulose ester filter #SKC FLT2255	1	15	GC-ECD	0.14	Petroleum ether	NIOSH S67	Chlorinated camphene represents a group of chlorinated compounds which implies that the corresponding chromatogram consists of a series of peaks. Pesticides such as aldrin, parathion, dieldrin, PCBs and DDT may cause interference during the analysis.
Chlorinated diphenyl oxide *55720-99-5*	0.5		Mixed cellulose ester filter #SKC FLT225-5	0.5-1.5	90	GC-ELD	0.2	Isooctane	NIOSH 5025	The sampling device is appropriate for sampling hexachlorinated derivatives but may prove inadequate for mono- and dichlorinated derivatives with a higher vapor pressure.
Chlorine *7782-50-5*	3 9		Silver membrane filter #SKC FLT225-1802	0.3-1	15	IC-CD	0.6	6 mM sodium thiosulfate	NIOSH 6011	The filter must be cleaned in the laboratory before use.
Chlorine dioxide *10049-04-4*	0.28 0.83		Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of a buffered solution of 0.02% potassium iodide	0.5	120 7.5	IC-CD	1.2		OSHA ID202	High concentrations (> 100 µg/mL) of chlorides may cause interference during the analysis.
Chlorine trifluoride *7790-91-2*	0.38		Polyethylene impinger containing 10 mL of 0,1 N sodium hydroxide			SE			IRSST 41-1	IRSST method 41-1 is for analyzing fluorides and can be adapted to chlorine trifluoride.
Chloroacetaldehyde *107-20-0*	3.2		Silica gel tube #SKC ST226-15GWS	0.050.2	3	GC-ECD	0.1	Acetonitrile	NIOSH S11	The samples must be stored in the freezer until analysis.
Chloroacetone *78-95-5*	3.8	Pc	Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 222	IRSST method 22-2 is for analyzing acetone which does not specifically include chloroacetone.
alpha-Chloroacetophenone *532-27-4*	0.32		Two Tenax-GC tubes in series #SKC ST226-35-02	0.2	12	HPLC-UV		Methanol	OSHA IMIS0618	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
Chloroacetyl chloride *79-04-9*	0.23 0.69	Pc	Tenax-GC tube impregnated with 9 ((N-methylamino) methyl) anthracene (MAMA) (The filters must be impregnated in the laboratory.)	0.1	5	HPLC-Flu		Toluene	Réf.8	
Chlorobenzene *108-90-7*	345		Activated charcoal tube #SKC ST226-01	0.01-0.2	10	GC-FID	10	Carbon disulfide	NIOSH 1003	
o-Ch/orobenzylidene malononitrile *2698-41-1*	0.39	Pc	Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-01 in series with a Tenax-GC tube #SKC ST226-35-07	1.5	90	HPLC-UV	0.3	Methylene chloride: hexane (20:80)	NIOSH P&CAM304	
Chlorobromomethane *74-97-5*	1058		Activated charcoal tube #SKC ST226-01	0.010.2	5	GC-FID	10	Carbon disulfide	NIOSH 1003	
Chlorodifluoromethane 153-1 *75-45-6*	3540		Activated charcoal tube #SKC ST226-09	Maximum: 0.05	3	GC-FID	525	Benzyl alcohol		Chlorodifluoromethane must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Chlorodiphenyl (42% chlorine) *534-69-21-9*	1	Pc C2	Glass fiber filter #SKC FLT225-16 in series with a Florisil tube #SKC ST226-39	0.05-0.2	40	GC-ECD	0.03	Hexane	NIOSH 5503	PCB chromatograms must be interpreted with care (consult MENVIQ as needed). DDT, DDE, chlorinated pesticides and sulfur compounds of petroleum products may cause interference.
Chlorodiphenyl (54% chlorine) *11097-69-1*	0.5	Pc C2	Glass fiber filter #SKC FLT225-16 in series with a Florisil tube #SKC ST226-39	0.05-0.2	40	GC-ECD	0.03	Hexane	NIOSH 5503	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 26-2 *67-66-3*	24.4	C2 RP	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	15	GC-FID	22	Carbon disulfide		
Chloromethyl methyl ether *107-30-2*		C1 RP	Two glass fritted tip impingers #SKC IMP226 35 2 containing a methanol solution of the salt of 2,4,6-trichlorophenol	0.5	50	GC-ECD	0.04	Extraction of the sampling solution in hexane	OSHA 10	There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C1.
his (Chloromethyl) ether *542-88-1*	0.0047	C1 RP	Two glass fritted tip impingers #SKC IMP226-35-2 containing a methanol solution of the salt of 2,4,6-trichlorophenol.	0.5	50	C-ECO	0.04	Hexane	OSHA 10	
1-Chloro-1-nitropropane *600-25-9*	10		Chromosorb-108 tube #SKC 226 113 (The tube must be washed with dichloromethane and ethyl acetate before sampling.)	0.2	12	GC-FID		Ethyl acetate	NIOSH S211	An electron capture detector can be used.
Chloropentafluoroethane *76-15-3*	6320		Activated charcoal tube #SKC ST226-01	0.05	2.5	GC-FID		Carbon disulfide	OSHA IMISC135	An activated charcoal tube of larger dimensions can be used.
Chloropicrin *76-06-2*	0.67		Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of isopropanol	1	120	GC-ECD			OSHA IMIS0675 Réf.7	The reference article complements OSHA data sheet IMIS0675 concerning the analysis.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
B-Chloroprene *126-99-8*	36	Pc	Activated charcoal tube #SKC ST226-01	0.01-0.05	3	GC-FID	30	Carbon disulfide	NIOSH 1002	
3-Chloropropene (allyl chloride) *107-05-1*	3 6		Activated charcoal tube #SKC ST226-01	0.01-1	100	GC-FID	10	Benzene	NIOSH 1000	
o-Chlorostyrene *2039-87-4*	283 425		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	NIOSH 1003	NIOSH method 1003 is for analyzing halogenated hydrocarbons, which does not specifically include o-chlorostyrene.
o-Chlorotoluene *95-49-8*	259		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	NIOSH 1003	NIOSH method 1003 is for analyzing halogenated hydrocarbons, which does not specifically include ochlorotoluene.
Chlorpyrifos *2921-88-2*	0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD 2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	40	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Chromite ore processing (chromate) (as Cr) 271-1	0.05	C1 RP	Polyvinyl chloride filter Omega P-50370K and polyethylene container	1.5	360	IC-VIS	0.2	Sodium hydroxide: sodium carbonate: water (2:3:95)		The filter must be handled with plastic tweezers and transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment (#2625) is available at the IRSST.
Chromium (metal) 3-2 *7440-47-3*	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AF	1.5	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total chromium.
Chromium (II) compounds (as Cr) 3-2	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total chromium.
Chromium (III) compounds (as Cr) 3-2	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total chromium.
Chromium (VI) compounds, Certain water insoluble (as Cr) 271-1	0.05	C1 RP	Polyvinyl chloride filter Omega P-50370K and polyethylene container	1.5	360	IC-VIS	0.02	Sodium hydroxide: sodium carbonate: water (2:3:95)		The filter must be handled with plastic tweezers and transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VII (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST.
Chromium (VI) compounds, Water soluble (as Cr) 271-1	0.05		Polyvinyl chloride filter Omega P-50370K and polyethylene container	1.5	360	IC-VIS	0.02	Sodium hydroxide: sodium carbonate: water (2:3:95)		The filter must be handled with plastic tweezers and transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). The use of this method is not adapted to processes that produce mists containing Cr VI (i.e. electrolytic plating); in this case, method #3-2 for total chromium is recommended. Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
Chromyl chloride *14977-61-8*	0.16									Sampling must not be done with an impinger containing water because chromyl chloride reacts violently in the presence of water. No supporting method is suggested for this substance. However, the development of an analytical method using electrothermic atomic absorption spectroscopy can be considered.
Chrysene 307-1 *218-01-9*		C2 RP	Pretreated glass fiber filter in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264	2	960	GC-MS	0.02	Benzene		In the sampling train, the cassette comes first followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Clopidol 48-1 *2971-90-6*	10		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Coal dust (less than 5% crystalline silica) (respirable dust) 48-1 *53570-85-7*	2 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Coal dust (more than 5% crystalline silica) (quartz respirable dust) 56-3 *53570-85-7*	0.1 Pr		Cyclone in series with a silver membrane filter from Selas	1.7	800	XRD	15			This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Coal dust (more than 5% crystalline silica) (quartz respirable dust) 78-1 *53570-85-7*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	FTIR	6			
Coal dust (more than 5% crystalline silica) (quartz respirable dust) 206-2 *53570-85-7*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	XRD	6			
Coal tar pitch volatiles, as benzene solubles 201-1 *65996-93-2*	0.2	C1 RP	Pretreated glass fiber filter in the laboratory #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264	2	960	Grav	50	Benzene		The sampling device includes a cassette followed by a tube. The samples must be stored in the freezer until analysis. The tubes and filters must be shipped together. The result of gravimetric analysis is used to establish compliance with the standard. Ten polycyclic aromatic hydrocarbons (PAHs) are determined on the filter and the tube.
Cobalt [7440-48 4], metal dust and fume (as Co) 2-3	0.05		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total cobalt.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
Cobalt hydrocarbonyl (as Co) *16842-03-8*	0.1		Mixed cellulose ester filter Nuclepore 142789 or 141679			FAAS		Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	IRSST 23	IRSST method 2-2 is for analyzing cobalt and can be adapted to cobalt hydrocarbonyl. Other cobalt compounds may cause interference during the analysis.
Cobalt tetracarbonyl fas Co) *10210-68-1*	0.1		Mixed cellulose ester filter #Nuclepore 142789 or 141679			FAAS		Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	IRSST 2-3	IRSST method 2-2 is for analyzing cobalt and can be adapted to cobalt tetracarbonyl. Other cobalt compounds may cause interference during the analysis.
Copper [7440-50-8], Dust and mists (as Cu) 4-3	1		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total copper.
Copper [7440-50-8], Fume (as Cu) 4-3	0.2		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total copper.
Corundum (Emery) (total dust) 48-1 *1302-74-5*	10 Pt		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Cotton dust, raw 48-1	0.5		Vertical elutriator and polyvinyl chloride filter Gelman 66467	7.4	450	Grav	25			Sampling must be carried out with the cassette open. Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Cresol (all isomers) 172-1 *1319-77-3*	22	Pc	Silica gel tube #SKC ST226-10	Maximum: 0.2	20	GC-FID	22	Acetone		Cresols must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Crotonaldehyde *4170-30-3*	5.7		Cassette containing two glass fiber filters impregnated with 2,4 dinitrophenylhydrazine (DNPH) and phosphoric acid #SKC FLT225-7 (The filters must be impregnated in the laboratory.)	0.1	6	HPLC-UV	0.56	Extraction with acetonitrile	OSHA 81	Any compound (e.g., some aldehydes and ketones) that reacts with dinitrophenylhydrazine can cause interference during sampling.
Crufomate *299-86-5*	5		OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD		Toluene: acetone (90:10)	NIOSH 5600	NIOSH method 5600 is for analyzing organophosphate pesticides and can be adapted to crufomate®. A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Cumene 159-1 *98-82-8*	246	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	86	Carbon disulfide		
Cyanamide *420-04-2*	2		XAD-2 tube impregnated with 10% (w/w) 1-naphthylisothiocyanate (NIT) #SKCST226-30-18	0.1	10	HPLC-UV		Dimethylformamide	OSHA 60	

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value N)	Desorption Digestion	Refe-rences	Remarks
Cyanides (as Cn) 40-1	*57-12-5*	5	Pc	Glass midget impinger #SKC IMP 225-36-1 containing 10 mL of 0,1 N sodium hydroxide	1.5	30	SE	6.5			Sample is stable for 5 days. Contact the laboratory to confirm the arrival of samples. Wipe samples for cyanides can be carried out and the required equipment is available at the IRSST. S-, C1-, 1- and Br- ions and Cd, Cu, Zn, Ag, Ni and Hg will cause interference.
Cyanogen	*460-19-5*	21		XAD 2 tube impregnated with 10% (w/w) 2(hydroxymethyl) piperidine #SKC ST226-117	0.2	12	GC-NPD		Toluene	OSHA IMIS0800	
Cyanogen chloride	*506-77-4*	0.75		XAD-2 tube impregnated with 10% (w/w) 2(hydroxymethyl) piperidine) #SKC ST226-117	0.2	1	GC-NPD		Toluene	OSHA IMISC146	
Cyclohexane 194-1	*110-82-7*	1030		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	3	GC-FID	160	Carbon disulfide		
Cyclohexanol 134-1	*108-93-0*	206	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	100	Carbon disulfide		
Cyclohexanone 135-1	*108-94-1*	100	Pc	Chromosorb-106 tube #SKC ST226-110	Maximum: 0.2	10	GC-FID	20	Carbon disulfide		Cyclohexanone must be sampled specifically in reason of the sampling device used.
Cyclohexene	*110-83-8*	1010		Activated charcoal tube #SKC ST226-01	0.2	7	GC-FID	1	Carbon disulfide	NIOSH 1500	
Cyclohexylamine	*108-91-8*	40		Silica gel tube #SKC ST226-14	0.2	10	GC-FID	60	1.0 N sulfuric acid	NIOSH P&CAM221	
Cyclonite	*121-82-4*	1.5	Pc	Glass fiber filter #SKC FLT225-7	1	120	HPLC-UV		Acetonitrile	OSHA IMIS2224 Réf. 10	A Tenax-GC tube should be used if cyclonite is present in the air as vapor.
Cyclopentadiene	*542-92-7*	203		Chromosorb-104 tube impregnated with 20% (w/w) maleic anhydride (available from SKC on special order)	0.01-0.05	3	GC-FID	10	Ethyl acetate	NIOSH 2523	
Cyclopentane	*287-92-3*	1720		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 144-2	IRSST method 144-2 is for analyzing n-pentane and can be adapted to cyclopentane.
Cyhexatin	*13121-70-5*	5		Glass fiber filter #SKC FLT225-7 in series with an XAD-2 tube #SKC ST226-30	1-1.5	300	ET-AAS	1	Acetic acid: acetonitrile (0.1:99.9) (ultrasonic bath)	IRSST 48-1 NIOSH 5504	High performance liquid chromatography is used prior to the analysis with atomic absorption spectrometry in order to separate the cyhexatin and the other organic tin compounds. IRSST gravimetric method 48-1 can also be used.
2,4-D	*94-75-7*	10	C2 EM	glass fiber filter, binderless #SKC FLT225-7	1-3	100	HPLC-UV	150	Methanol	NIOSH 5001	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
DDT (Dichlorodiphenyltrichloroethane) *50-29-3*	1	C3	Glass fiber filter #SKC FLT225-7	1.5	90	GC-ELD		Isooctane	NIOSH S274	An electron capture detector can be used.
Decaborane *17702-41-9*	0.25 0.75	Pc	Mixed cellulose ester filter #SKC FLT225-5			ICP		Sulfuric acid and hydrogen peroxide	OSHA ID125G	OSHA method ID-125G is for analyzing metallic elements and compounds and can be adapted to decaborane.
Demeton® *8065-48-3*	0.11	Pc	XAD-2 tube #SKC ST226-30-05 and glass fiber filter #SKC FLT225-5	0.1-1	200	GC-FPD	0.1	Toluene (soxhlet extraction)	NIOSH 5514	An OSHA OVS sampling device #SKC ST226-58 and a supercritical fluid extractor can be used.
Disecoctyl phthalate 309-1 *117-81-7*	5 10	C3	Cellulose nitrate filter Whatman 7188 003	1.0	30 15	HPLC-UV	1.7	Acetonitrile: water (70:30)		Store in refrigerator after sampling.
2,6 Di-tert-butyl-p-cresol *128-37-0*	10		Silica gel tube #SKC ST226-10	0.2	10	GC-FID	0.1	Carbon disulfide: methanol (95:5)	NIOSH P&CAM 226	
Diacetone alcohol 133-1 *123-42-2*	238		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	46	Carbon disulfide: isopropanol (95:5)		Specific desorption must be carried out for this substance.
Diazinon® 228-1 *333-41-5*	0.1	Pc	Supelco ORB0 49P tube, # 2-350	0.2-1	480	GC-NPD	2	Toluene: acetone (90:10), containing an internal standard (tr butylphosphate)		
Diazomethane *334-88-3*	0.34		XAD 2 tube impregnated with octanoic acid #SKC ST226-23	0.2	10	GC-FID		Carbon disulfide	NIOSH 2515	
Diborane *19287-45-7*	0.11		Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-02 in series with charcoal tube impregnated with an oxidizer #Barnabey-Cheney Co. 580-20 (soon available from SKC)	0.5-1	120	ICP	1	Hydrogen peroxide: water (3:97) (ultrasonic bath)	NIOSH 6006	Boron is determined using DC plasma atomic emission spectrometry; however, a plasma source induced by radio frequencies can also be used. The use of borosilicate glass is to be avoided.
1,2-Dibromoethane *106-93-4*	155	Pc C2	Activated charcoal tube #SKC ST226-01GWS	0.020.2	25	GC-ECD	0.01	Benzene: methanol (99:1) (v/v)	NIOSH 1008	The samples must be stored in the refrigerator until analysis. A flame ionization detector and carbon disulfide as desorption solvent can be used.
Dibutyl phosphate *107-66-4*	8.6 17		Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-01	1-3	180	GC-FPD	70	Desorption in acetonitrile followed by derivatization with N,0 bis(trimethylsilyl) trifluoroacetamine	NIOSH 5017	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Dibutyl phthalate 308-1 *84-74-2*	5		Cellulose nitrate filter Whatman 7188 003	1.0	30	HPLC-UV	1.5	Acetonitrile: water (70:30)		Store in refrigerator after sampling.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
2-N-Dibutylaminoethanol *102-81-8*	14	Pc	XAD-2 tube or glass fiber filter impregnated with 1-naphthylisothiocyanate (NIT) #SKC ST226-30 18 or #SKC FLT225-07 (The tube or the filter must be impregnated in the laboratory.)			HPLC-UV		Acetonitrile	Réf.11	The method in the reference article is for analyzing monoethanolamine and diethanolamine and can be adapted to 2-N-dibutylaminoethanol.
1,3-Dichloro -5,5 dimethyl hydantoin *118-52-5*	0.2 0.4								Réf. 12	A method must be developed based on the conditions described in the reference article.
Dichloroacetylene *7572-29-4*	 0.39		Activated charcoal tube #SKC ST226-01	0.2	1	GC-FID		Carbon disulfide	OSHA IMIS0865	
o-Dichlorobenzene 62-1 *95-50-1*	 301	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	150	Carbon disulfide		
p-Dichlorobenzene 37-1 *106-46-7*	450 660	C3	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	225	Carbon disulfide		
3,3' Dichlorobenzidine *91-94-1*		Pc C2	Glass fiber filter #SKC FLT225-7 impregnated with sulfuric acid (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.04	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 65	The samples must be stored in water in the refrigerator and analyzed as soon as possible. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2.
Dichlorodifluoromethane 152-1 *75-71-8*	4950		Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01	Maximum: 0.05	10	GC-FID	743	Benzyl alcohol		Dichlorodifluoromethane must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
1,1-Dichloroethane *75-34-3*	400		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 173-1	IRSST method 173-1 is for analyzing 1,2-dichloroethane and can be adapted to 1,1-dichloroethane.
1,2-Dichloroethane 173-1 *107-06-2*	4 8	C2 EM	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	20 10	GC-FID	8.1	Benzyl alcohol		A specific desorption must be carried out for this substance.
Dichloroethyl ether *111-44-4*	29 58	Pc	Activated charcoal tube #SKC ST226-01	0.01-1	15 2	GC-FID	10	Carbon disulfide	NIOSH 1004	
7,1-Dichloroethylene *75-35-4*	4		Activated charcoal tube #SKC ST226-01	0.01-0.2	5	GC-FID	7	Carbon disulfide	NIOSH 1015	
1,2-Dichloroethylene 174-1 *540-59-0*	793		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	3	GC-FID	120	Carbon disulfide		

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Dichlorofluoromethane 185-2 *75-43-4*	42		Two activated charcoal tubes #SKC ST226-09 in series	Maximum: 0.05	3	GC-FID	12.8	Benzyl alcohol		Dichlorofluoromethane must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
1,1-Dichloro- 1-nitroethane *594-72-9*	12		Activated charcoal tube #SKC ST226-38	0.01-1	17	GC-FID	10	Carbon disulfide	NIOSH 1601	
1,2-Dichloropropane *78-87-5*	350 508		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID		Carbon disulfide	NIOSH S95	
Dichloropropene (cis and trans) *542-75-6*	4.5	Pc C3	Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	NIOSH 1003	The method is for analyzing halogenated hydrocarbons and can be adapted to dichloropropene.
2,2-Dichloropropionic acid *75-99-0*	5.8		Silica gel tube #SKC ST 226-10	0.2	10	HPLC-UV		Deionized water	OSHA IMISD176	
1,2 Dichloro-1,1,2,2-tetrafluoroethane 186-1 *76-14-2*	6990		Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01	Maximum: 0.05	3	GC-FID	1050	Carbon disulfide		Dichloro-1,2 tetrafluoro-1,1,2,2 ethane must be sampled specifically in reason of the sampling device used. IRSST method 186-1 is for the specific analysis of 1,2 dichloro 1,1,2,2 tetrafluoroethane.
Dichlorvos *62-73-7*	0.9	Pc	OVS (OSHA Versatile Sampler) tube with XAD 2 and glass fiber filter #SKC ST226-30-16	1	480	GC-FPD	1.9	Toluene	OSHA 62	A supercritical fluid extractor can be used if the desorption proves difficult. A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Dicrotophos *141-66-2*	0.25	Pc	OVS (OSHA Versatile Sampler) tube with XAD 2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	200	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Dicyclopentadiene 242-1 *77-73-6*	27		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	20	GC-FID	30	Carbon disulfide		
Dicyclopentadienyl iron *102-54-5*	10		Mixed cellulose ester filter #SKC FLT225-5			FAAS		Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	IRSST 48-1 IRSST 6-2	IRSST method 6-2 is for analyzing 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. Other iron compounds may cause interference during the analysis.
Dieldrin *60-57-1*	0.25	Pc	Glass fiber filter #SKC FLT225-7	1.5	180	GC-ELD		Isooctane	NIOSH S283	An electron capture detector can be used.
Diethanolamine *111-42-2*	13		Glass fiber filter #SKC FLT225-7 impregnated with 1-naphthylisothiocyanate (The filters must be impregnated in the laboratory.)	0.2	5	HPLC-UV		Acetonitrile	OSHA IMIS D129 Réf. 11	A method is now being developed at the IRSST for this substance. It is based on the article by Levin et al. but it uses an XAD-2 tube impregnated with 1-naphthylisothiocyanate in place of the filter as sampling device.
Diethyl ether 28-1 *60-29-7*	1210 1520		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	3 3	GC-FID	72	Carbon disulfide		

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Diethyl ketone	*96-22-0*	705		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 253	A carbosieve III, Ambersorb or silica gel tube can be used. IRSST method 25-2 is for analyzing methyl ethyl ketone and can be adapted to diethyl ketone.
Diethyl phthalate 310-1	*84-66-2*	5		Cellulose nitrate filter Whatman 7188-003	1.0	30	HPLC-UV	1.6	Acetonitrile: water (70:30)		Store in refrigerator after sampling.
Diethylamine	*109-89-7*	30 75		XAD-7 tube impregnated with 10% 7-chloro-4 nitrobenzo-2-oxa-1,3 diazote #SKC ST226-96	0.2	10	HPLC-UV	1.6	Tetrahydrofuran: 7chloro-4-nitrobenzo 2 oxa 1,3 diazole (95:5)	OSHA 41	Tubes are stable for a period of two months. A fluorescence detector can be used.
2-Diethylaminoethanol	*100-37-8*	48	Pc	Silica gel tube #SKC ST226-10 04	0.2	24	GC-FID		0.2 N hydrochloric acid in a solution of methanol: water (4:1)	OSHA IMIS 0920	The tubes are transferred to the desorption solution at the end of sampling.
Diethylene triamine	*111-40-0*	4.2	Pc	XAD 2 tube impregnated with 10%(w/w)1-naphthylisothiocyanate (NIT) #SKC ST226-30-18	0.010.1	10	HPLC-UV	0.16	Dimethylformamide (ultrasonic bath)	NIOSH 2540	Other primary and secondary amines may react with NIT and reduce the sampling capacity of the tube.
Difluorodibromomethane	*75-61-6*	858		Two activated charcoal tubes in series #SKC ST226-01	0.010.2	10	GC-FID	400	Isopropanol	NIOSH 1012	Carbon disulfide may cause interference during the analysis.
Diglycidyl ether (DGE)	*2238-07-5*	0.53		XAD 7 tube #SKC ST226-30-11-07			GC^2 FID		methylene chloride	Réf. 14	The method in the reference article allows four glycidyl ethers to be analyzed and can be adapted to diglycidyl ether.
Diisobutyl ketone 252-1	*108-83-8*	145		Activated charcoal tube #SKC ST226-01	Maximum: 1.0	100	GC-FID	28.3	Carbon disulfide		
Diisopropyl ether	*108-20-3*	1040 1300		Activated charcoal tube #SKC ST226-01	0.05	3	GC-FID		Carbon disulfide	NIOSH S368	
Diisopropylamine	*108-18-9*	21	Pc	Glass midget impinger #SKC IMP225 36 1 containing 10 mL of 0.1 N sulfuric acid	1	120	GC-FID		Before analysis, the impinger solution is neutralized with 0.3 N sodium hydroxide.	NIOSH S141	
Dimethyl carbamoyl chloride	*79-44-7*		C2 RP	Tenax-GC tube (The tube is prepared in the laboratory and must be activated at 300^{0}C for 20 minutes in a nitrogen atmosphere.)	0.2	48	GC-Hall	0.01	Thermal desorption	Réf. 9	It is preferable that the tubes be used immediately after activation treatment. A nitrogen and phosphorus detector or an electron capture detector can be used. There is no reference value for the standard, but the determination could be required by targeting the lowest limit of detection possible, given the carcinogenicity designation C2.
Dimethyl sulfate	*77-78-1*	0.52	Pc C2	Porapak P tube #SKC ST226-114	0.01-0.2	12	GC-ELD	0.25	Diethyl ether	NIOSH 2524	A flame ionization detector can be used.
N,N-Dimethylacetamide	*127-19-5*	36	Pc	Activated charcoal tube #SKC ST226-01			GC-NPD		Acetone	OSHA 66	OSHA method 66 is for analyzing N,N-dimethylformamide and can be adapted to N,N-dimethylacetamide.
Dimethylamine	*124-40-3*	18		XAD-7 tube impregnated with 10% (w/w) 7-chloro 4 nitrobenzo 2 oxa-1.3 diazole #SKC ST226-96	0.2	10	HPLC-UV	0.43	Tetrahydrofuran: 7chloro-4-nitrobenzo-2oxa-1,3 diazole (95:5)	OSHA 34	Tubes are stable for a period of two months. A fluorescence detector can be used.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
N,N Dimethyl aniline *121-69-7*	25 50	Pc	Silica gel tube #SKC ST226-10	0.02-1	38	GC-FID	10	Ethanol: water (95:5) (ultrasonic bath)	NIOSH 2002	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
N.NDimethylformamide 148-1 *68-12-2*	30	Pc C2	Silica gel tube #SKC ST226-10	Maximum: 0.2	5	GC-FID	7.5	Carbon disulfide		N.N-dimethylformamide must be sampled specifically in reason of the sampling device used.
1,1-Dimethylhydrazine *57-14-7*	1.2	Pc C2	Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of 0.1 N hydrochloric acid	Maximum: 1	100	Colo	2		NIOSH S143	Other hydrazines, stannous or ferrous ions, zinc, sulfur dioxide, hydrogen sulfide and hydrogen peroxide may cause interference during the analysis.
Dimethylphthalate 311-1 *131-11-3*	5		Cellulose nitrate filter Whatman 7188 003	1.0	30	HPLC-UV	1.8	Acetonitrile: water (70:30)		Store in refrigerator after sampling.
Dinitolmide *148-01-6*	5		Glass fiber filter #SKC FLT225-7	1	240	HPL-CUV		Acetonitrile water (85:15)	OSHA IMIS0985	
Dinitro-ortho-cresol *534-52-1*	0.2	Pc	Mixed cellulose ester filter #SKC FLT225-5 in series with a glass fritted tip impinger #SKC IMP225-36-2 containing 10 mL of ethylene glycol	1.5	180	HPLC-UV	3	Before analysis, a volume of 5 mL of 2 propanol is added to the contents of the impinger.	NIOSH S166	The filter is added to the contents of the impinger at the end of sampling.
Dinitrobenzene (all isomers) *100-25-4*	1	Pc	Mixed cellulose ester filter #SKC FLT225-5 in series with a glass fritted tip impinger #SKC IMP225 36-2 containing 10 mL of ethylene glycol	1.5	90	HPLC-UV		Before analysis, a volume of 5 mL of methanol is added to the contents of the impinger.	NIOSH S214	The filter is added to the contents of the impinger at the end of sampling.
Dinitrotoluene *25321-14-6*	1.5	Pc	Mixed cellulose ester filter #SKC FLT225-5 in series with a glass fritted tip impinger #SKC IMP225-36-2 containing 10 mL of ethylene glycol	1.5	90	HPLC-UV		Before analysis, a volume of 5 mL of methanol is added to the contents of the impinger.	NIOSH S215	The filter is added to the contents of the impinger at the end of sampling. An OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16 can be used.
Dioxane 160-2 *123-91-1*	90	Pc C3	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	20	Carbon disulfide		
Dioxathion *78-34-2*	0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	480	GC-FPD		Toluene	OSHA IMIS2740	
Diphenylamine *122-39-4*	10		Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	HPLC-UV	1	Methanol	OSHA 78	The samples must be stored in the refrigerator until analysis.
Diquat *231-36-7*	0.5		Glass fiber filter #SKC FLT225-7	1	120	HPLC-UV		0.1 N hydrochloric acid	OSHA IMIS2681 Réf. 13	A method must be developed based on the sampling conditions described in OSHA data sheet IMIS2681 and the analytical conditions in the reference article.
Disulfiram *97-77-8*	2		Glass fiber filter #SKC FLT225-7	1	120	HPLC-UV			OSHA IMIS2682	The samples must be analyzed as soon as possible.

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Disulfoton	*298-04-4*	0.1		OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	40	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Diuron	*330-54-1*	10		Tube of polyurethane foam (PUF) (Produced in the laboratory or #SKC ST226-126)	Maximun: 4		HPLC-UV		Diethyl ether: hexane (75:25) (v/v) (soxhlet)	Réf. 6	Before use, the polyurethane foam is cleaned with 5% diethyl ether in a soxhlet. An OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16 and a supercritical fluid extractor can be used.
Divinyl benzene	*1321-74-0*	53		Activated charcoal tube #SKC ST226-73 impregnated with 4-tert-butylcatechol	0.05	12	GC-FID	6	Toluene	OSHA 89	
Emery (total dust) 48-1	*12415-34-8*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Endosulfan	*115-29-7*	0.1	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	60	GC-ECD			OSHA IMIS2425	
Endrin	*72-20-8*	0.1	Pc	Mixed cellulose ester filter #SKC FLT225-5 in series with a Chromosorb 102 tube #SKC ST226-104	0.5-1	120	GC-ECD	20	Toluene	NIOSH 5519	A supercritical fluid extractor can be used if desorption proves difficult.
Enflurane 339-1	*13838-16-9*	566		Activated charcoal tube series #SKC ST226-01	Maximum: 0.2	5	GC-FID		Carbon disulfide		Since a specific analysis is recommended, no other substance may be sampled simultaneously. Enflurane standards have limited availability because this anesthetic agent is practically no longer used in Quebec.
Epichlorohydrin 223-2	*106-89-8*	7.6	Pc C2	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	20	GC-FID	9	Carbon disulfide		Since a specific analysis is recommended, no other substance may be sampled simultaneously.
EPN	*2104-64-5*	0.5	Pc	Glass fiber filter #SKC FLT225-7	1-2	120	GC-FPD	0.002	Isooctane	NIOSH 5600 NIOSH 5012	The filters are transferred to a container at the end of sampling. A nitrogen and phosphorus detector can be used to improve analytical sensitivity. NIOSH method 5600 (organophosphate compounds) can also be used.
Ethane 9C	*74-84-0*		Ax				DRI-EX				Method IRSST 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Ethion	*563-12-2*	0.4	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	40	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
2-Ethoxyethanol (EGEE) 137-2	*110-80-5*	18	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	6	GC-FID	5.4	Acetonitrile: ethanol (95:5)		Specific desorption must be carried out for this substance.
2-Ethoxyethyl acetate (EGEEA) 207-2	*111-15-9*	27	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	15	Carbon disulfide		

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Ethyl acetate 21-2	*141-78-6*	1440		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	6	GC-FID	80	Carbon disulfide		
Ethyl acrylate 319-1	*140-88-5*	20 61	C3	Activated charcoal tube #SKC ST226-73 impregnated with 4-tert butylcatechol (TBC)	0.05	12	GC-FID	12	Carbon disulfide		Ethyl acrylate must be sampled specifically because of the sampling device used.
Ethyl alcohol 91-2	*64-17-5*	1880		Activated charcoal tube #SKC ST226-01	Maximum: 0.05	1	GC-FID	95	Carbon disulfide		
Ethyl sec-amyl ketone	*541-85-5*	131		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 265-2	IRSST method 265-1 is for analyzing methyl isoamyl ketone and can be adapted to ethyl sec-amyl ketone.
Ethyl benzene 250-1	*100-41-4*	434 543		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	43.3	Carbon disulfide		
Ethyl bromide	*74-96-4*	891 1110		Activated charcoal tube #SKC ST226-01	0.01-0.2	4	GC-FID	20	Isopropanol	NIOSH 1011	
Ethyl butyl ketone	*106-35-4*	234		Activated charcoal tube #SKC ST226-01	0.010.2	25	GC-FID	500	Carbon disulfide: methanol (99:1)	NIOSH 1301	
Ethyl chloride	*75-00-3*	2640		Two activated charcoal tubes in series #SKC ST226-09	0.01-0.05	3	GC-FID	10	Carbon disulfide	NIOSH 2519	
Ethyl formate	*109-94-4*	303		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	50	GC-FID		Carbon disulfide	NIOSH S36	
Ethyl mercaptan	*75-08-1*	1.3		Glass fiber filter #SKC FLT225-7 impregnated with a solution of 5% (w/w) mercuric acetate (The filters must be impregnated in the laboratory.)	0.2	20	GC-FPD		Methylene chloride: 25% hydrochloric acid (5:20)	OSHA IMIS1220	
Ethyl silicate	*78-10-4*	85		XAD-2 tube #SKC ST226-30-04	0.05	9	GC-FID		Carbon disulfide	NIOSH S264	
Ethylamine	*75-04-7*	18		XAD-7 tube impregnated with 10% (w/w) 7-chloro-4-nitrobenzo-2-oxa-1,3 diazole (NBD chloride) #SKC ST226-96	0.2	10	HPLC-UV	0.29	Tetrahydrofuran: 7 chloro-4-nitrobenzo 2 oxa 1,3 diazole (95:5)	OSHA 36	Tubes are stable for a period of two months. The use of a fluorescence detector is suggested.
Ethylene 9C	*74-85-1*		Ax				DRI-EX				IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Ethylene chlorohydrin	*107-07-3*	3.3	Pc	Activated charcoal tube #SKC ST226-38	0.010.2	20	GC-FID	3	Isopropanol: carbon disulfide (5:95)	NIOSH 2513	An electron capture detector can be used, in which case a substitute for carbon disulfide must be found.

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Ethylene glycol (vapour and mist) 258-1 *107-21-1*	127		Glass fiber filter with a silica gel tube	Maximum: 0.2	10	GC^2-FID	50	Water containing an internal standard (1,6-hexanediol)		Ethylene glycol must be sampled specifically because of the sampling device used and of the specific desorption solvant. The application range and the precision must be reviewed taking into account the TLV lowering.
Ethylene glycol dinitrate *628-96-6*	1.24	Pc	Tenax-GC tube #SKC ST 226-35 03	0.2-1	15	GC-ECD	0.6	Ethanol	NIOSH 2507	The ethylene glycol dinitrate standard may be difficult to obtain. A high concentration of 2-hydroxyethyl nitrate (ethylene glycol mononitrate) may cause interference.
Ethylene imine *151-56-4*	0.88	Pc	Glass midget impinger #SKC IMP 225-36-2 containing 1,2-napthoquinone 4 sulfonate (Folin reagent)	0.2	50	HPLC-UV	0.3	Extraction of the sampling solution by chloroform	NIOSH P&CAM 300	Propylene imine, 2-bromo-methylamine and ammonia may cause interference during the analysis.
Ethylene oxide 39-A *75-21-8*	1.8	C2 RP				DRI-PAD				The reported minimum value is 0.43 mg/m^3 (0.24 ppm).
Ethylene oxide 81-2 *75-21-8*	1.8	C2 RP	Activated charcoal tube #SKC ST226-36	Maximum: 0.2	5	GC-FID	22.5	Benzyl alcohol		Ethylene oxide must be sampled specifically in reason of the sampling device used and of the specific desorption solvant. This method is not very well adapted to the new TLV for ethylene oxide (1994).
Ethylenediamine *107-15-3*	25		XAD-2 tube impregnated with 10%(w/w)1-naphthylisothiocyanate(NIT) #SKC ST226-30-18	0.010.1	10	HPLC-UV	0.9	Dimethylformamide (ultrasonic bath)	NIOSH 2540	Other primary and secondary amines may react with 1-naphthylisothiocyanate and reduce the sampling capacity of the tube.
Ethylidene norbornene *16219-75-3*	25									By court order, the standard for this substance has been stayed in the United States pending the development of an analytical method. No supporting method is suggested for this substance. If a request is made to the IRSST, the analytical method could be developed and will have to be validated for the substance mentioned, based on the procedure described by the IRSST, which refers to the NIOSH protocol.
N-Ethylmorpholine *100-74-3*	24	Pc	Silica gel tube #SKC ST226-10	Maximum: 0.2	10	GC-FID		0.1 M sulfuric acid	NIOSH S146	A capillary column and a nitrogen and phosphorus detector can be used to improve chromatographic separation and analytical sensitivity, respectively.
Fenamiphos *22224-92-6*	0.1	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	200	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Fensulfothion *115-90-2*	0.1		OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	200	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Fenthion *55-38-9*	0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58			GC-FPD	200	Toluene: acetone (90:10)	NIOSH 5600	NIOSH method 5600 is for analyzing organophosphate pesticides and can be adapted to fenthion. A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Ferbam *14484-64-1*	10		OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	480	HPLC-UV			OSHA IMIS1263	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Ferrovanadium (dust) ***12604-58-9***	1 3		Mixed cellulose ester filter #Nuclepore 142789 or 141679			FAAS		Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	NIOSH 7300 OSHA ID125G IRSST 6-2	IRSST method 6-2 is for analyzing iron and can be adapted to ferrovanadium. OSHA method ID125G and NIOSH method 7300 can also be used for determining vanadium by ICP.
Fibres, Artificial Vitreous Mineral Fibres, Refractory fibres (ceramic or others) 243-1	1 f/cc	C3	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a carboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Fibrous glass, continuous filament fibres (total dust) 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fibres, Artificial Vitreous Mineral Fibres, Fibrous glass, microfibres 243-1	1 f/cc		Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Glass wool 243-1	2 f/cc	C3	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Rock wool 243-1	1 f/cc	C2 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Slag wool 243-1	1 f/cc	C2 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Fibres, Natural Mineral Fibres, Wollastonite 243-1	*13983-17-0*	1 f/cc		Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Natural Mineral Fibres, Attapulgite 243-1	*12174-11-7*	1 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Natural Mineral Fibres, Erionite 244-1	*66733-21-9*		C1				PLM				A quantity of 1 to 10 g of bulk sample must be supplied to the laboratory. The use of this substance is prohibited. The reported minimum value is less than 1%.
Fibres, Organic Synthetic Fibres, Carbon and graphite fibres, total dust 48-1		10 Pt		P-08370K		180	Grav	25			Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fibres, Organic Synthetic Fibres, Carbon and graphite fibres, respirable dust 48-1		5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fibres, Organic Synthetic Fibres, Para-aramide fibres (Keytar®, Twaron®) 243-1		1 f/cc		Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Organic Synthetic Fibres, Po/yolefin fibres 48-1		10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fluorides (as F) 41-1	*16984-48-8*	2.5		Polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide	2.0	40	SE	9.5			

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Fluorine	***7782-41-4***	0.2		Mixed cellulose ester filter #Nuclepore 142789 (37 mm) in series with a polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide			SE			IRSST 164-1	IRSST method 164-1 is for analyzing hydrofluoric acid and can be adapted to fluorine.
Fonofos	***944-22-9***	0.1	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	40	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Formaldehyde 295-1	*50-00-0*	3	C2 EM	XAD-2 tube impregnated with HMP	Maximum: 0.1	25	GC-NPD	2	Toluene containing 2,4,6 collidine as an internal standard.		XAD-2 tubes #2188 impregnated with HMP (hydroxymethyl piperidine) are used for quantitative analysis of formaldehyde. These tubes must be stored in the freezer before and after sampling. IRSST method 295-1 is for the specific analysis of formaldehyde. A method for volatile aldehydes is also available at IRSST (329-1).
Formaldehyde 39-A	*50-00-0*	3	C2 EM				DRI-PAD				The reported minimum value is 0.18 mg/m^3 (0.12 ppm).
Formaldehyde 329-1	*50-00-0*	3	C2 EM	Orbo 23 tube #Supelco 2-0257	0.1	10	GC-MS	3	Toluene		Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Formamide	*75-12-7*	18	Pc	Silica gel tube #SKC ST226-10	0.1	10	GC-NPD		Methanol	OSHA IMIS1292	
Formic acid	***64-18-6***	9.4 19		Two Chromosorb 103 tubes in series #SKC ST226-108	0.050.2	24	IC-CD	2	Water	NIOSH S173	NIOSH is studying the possibility of using silica gel to improve the breakthrough capacity. The use of a polytetrafluorocarbon (teflon) filter may be considered to minimize interferences.
Furfural 328-1	***98-01-1***	7.9	Pc	Orbo 23 tube #Supelco 2-0257	0.1	10	GC-MS	0.11	Toluene		Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Furfuryl alcohol 87-2	***98000***	40 60	Pc	Porapak Q tube #SKC ST226-115	Maximum: 0.05	6 0.75	GC-FID	4.7	Acetone		Furfuryl alcohol must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Gasoline 304-1	***8006-61-9***	890 1480	C3	Activated charcoal tube #SKC ST226-01	0.2	10 3	GC-FID	450	Carbon disulfide		IRSST method 80-1 is for analyzing Stoddard solvent (mixture of hydrocarbons from C9 to C12) and can be adapted to gasoline (mixture of hydrocarbons from C4 to C12).
Germanium tetrahydride	*7782-65-2*	0.63		Activated charcoal tube #SKC ST226-01.	0.2	48	ET-AAS			OSHA IMIS1360	A mixed cellulose ester filter can be used in front of the activated charcoal tube to eliminate the germanium compounds present as dust.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Glutaraldehyde 283-1	*111-30-8*	0.82		Two glass fiber fitters #SKC ST227-5 impregnated with 2,4-dinitrophenylhydrazine (DNPH) and phosphoric acid.	1	15	HPLC-UV	0.27	Acetonitrile		Open cassette sampling The sampling device must be refrigerated before and after sampling.
Glycerin (mist) 48-1	*56-81-5*	10		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The analysis can also be carried out by using IRSST method 51-2 for mineral oil mists. The gravimetric method for dusts is by definition nonspecific.
Glycidol	*556-52-5*	76		Activated charcoal tube #SKC ST226-01	0.01-1	50	GC-FID		Tetrahydrofuran	NIOSH 1608	
Grain dust (oat, wheat barley) (total dust) 48-1		4 Pt		Polyvinyl chloride filter, with capsule (Accu-Cap)	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Graphite (natural) (respirable dust) 48-1	*7782-42-5*	2.5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03,9202 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Graphite (synthetic, except fibres) (total dust) 48-1	*7440-44-0*	10 Pt		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Gypsum (respirable dust) 48-1	*13397-24-5*	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Gypsum (total dust) 48-1	*13397-24-5*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Hafnium	*7440-58-6*	0.5		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS	50	Hydrofluoric acid: nitric acid: ammonium fluoride (0.1 M) (4:4:92)	OSHA ID121	Fluorine and other hafnium compounds may cause interference during the analysis.
Halothane 266-2	*151-67-7*	404		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	5	GC-FID	41	Carbon disulfide		Since a specific analysis is recommended, no other substance may be sampled simultaneously.
Helium 26-C	*7440-59-7*		Ax				DRI-elec				Since helium is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26-C). The reported minimum value is 1% oxygen.
Heptachlor	*76-44-8*	0.5	Pc	Chromosorb-102 tube #SKC ST226-104	1	60	GC-ECD		Toluene	NIOSH S287	An OVS (OSHA Versatile Sampler) tube composed of XAD-2 and glass fiber filter (#SKC ST226-30-16) can be used.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
n-Heptane 142-1 *142-82-5*	1640 2050		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	4 3	GC-FID	320	Carbon disulfide		
Hexachlorobutadiene *87-68-3*	0.21	Pc C2	XAD-2 tube #SKC ST226-30-04	0.050.2	3	GC-ECD	0.02	Hexane	NIOSH P&CAM 307	
Hexachlorocyclopentadiene *77-47-4*	0.11		Porapak T tube #SKC ST226-116	0.05 0.2	3	GC-ECD	5	Hexane (ultrasonic bath)	NIOSH 2518	
Hexachloroethane *67-72-1*	9.7	Pc	Activated charcoal tube #SKC ST226-01	0.01-0.2	10	GC-FID	0.1	Carbon disulfide	NIOSH 1003	Other halogenated hydrocarbons may cause interference during the analysis.
Hexachloronaphthalene *1335-87-1*	0.2	Pc	Mixed cellulose ester filter #SKC FLT225-5	1	30	GC-ECD		Hexane	NIOSH S100	
Hexafluoroacetone *684-16-2*	0.68	Pc								By court order, the standard for this substance as been stayed in the United States pending the development of an analytical method. No supporting method is suggested for this substance. If a request is made to the IRSSL the analytical method could be developed and will have to be validated for the substance mentioned, based on the procedure described by the IRSST, which refers to the NIOSH protocol.
Hexamethyl phosphoramide *680-31-9*		Pc C2	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	480	GC-FPD		Toluene: acetone (90:10)	NIOSH 5600 R6f. 15	The reference article is for analyzing urinary hexamethylphosphoramide and can be adapted to the hexamethylphosphoramide in air. However, the sampling conditions from NIOSH method 5600 (organophosphate pesticides) are used. There is no reference value for the standard, but a determination could be required targeting the lowest limit of detection possible, given the carcinogenicity designation C2.
Hexamethylene diisocyanate 234-2 *822-06-0*	0.034	EM	Glass fiber filter * #Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700	1	15	HPLC-UV-Flu	0.041	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 234 2 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 224-3. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^0C and then impregnated with (Nmethyl-amino-methyl)-9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^0C, before and after sampling. If possible, hardener must also be sent.
Hexamethylene diisocyanate 224-3 *822-06-0*	0.034	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700	1	15	HPLC-UV-Flu	0.026	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 224-3 give the vapour fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 234-2. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^0C and then impregnated with (N-methyl-amino-methyl) 9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^0C, before and after sampling. If possible, hardener must also be sent.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
n-Hexane 141-2	*110-54-3*	176		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	4	GC-FID	15	Carbon disulfide		
Hexane (other isomers)		1760 3500		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 141-2	IRSST method 141-2 is for analyzing normal hexane and can be adapted to isomers of this substance.
sec-Hexylacetate	*108-84-9*	295		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	NIOSH 1450	NIOSH method 1450 allows the analysis of esters and may be adapted for the analysis of secondary hexyl acetate.
Hexylene glycol	*107-41-5*	121		Activated charcoal tube #SKC ST226-01	0.2	1	GC-FID		Methylene chloride: methanol (95:5)	OSHA IMIS1389	
Hydrazine 346-1	*302-01-2*	0.13	Pc C2	Two glass fiber filters #Gelman 66208, impregnated with sulfuric acid	1	240	HPLC-UV		Sodium phosphate buffer with EDTA		
Hydrogen 9C	*1333-74-0*		Ax				DRI-EX				IRSST method 9-C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Hydrogen 47-A	*1333-74-0*		Ax				DRIelec				Refer to the note about simple asphyxiants at the beginning of the tables. The reported minimum value is of 0.2 mg/m^2 (2 ppm).
Hydrogen bromide 211-1	*10035-10-6*	9.9		Treated silica gel tube SKC 226 10-03	0.2	48	IC-CD	10	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate		Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Hydrogen chloride 211-1	*7647-01-0*	7.5		Treated silica gel tube SKC 226-10-03	0.2	15	IC-CD	5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate		Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Hydrogen cyanide 40-1	*74-90-8*	11	Pc	Mixed cellulose ester filter Omega M-083700AF in series with a glass midget impinger #SKC IMP225 36-1 containing 10 mL of 0.1 N sodium hydroxide	0.2	12	SE	6.8			The filter is thrown away after sampling. Hydrocyanic acid in sodium hydroxide is stable for one week. Contact the laboratory to confirm the arrival of the samples. Cyanide particles retained on the filter may release hydrocyanic acid in the presence of high humidity. Furthermore, S-, C1-, 1, Br- ions and Cd, Cu, Zn, Ag, Ni and Hg will cause interference.
Hydrogen fluoride fas F) 164-1	*7664-39-3*	2.6		Mixed cellulose ester filter Omega M-083700AF in series with a polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide	1.5	90	SE	10			The filter is thrown away after sampling.
Hydrogen peroxide	*7722-84-1*	1.4		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 to 15 mL of 0.0012 M titanium oxysulfate	1	100	Polaro	14		OSHA ID126SG	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Hydrogen selenide (as Se) *7783-07-5*	0.16		Glass fritted tip impinger #SKC IMP 225-36-2 containing deionized water	1	480	ET-AAS			OSHA ID105 OSHA IMIS1475	OSHA method ID-105 is for analyzing inorganic arsenic and can be adapted to hydrogen selenide. The sampling conditions in OSHA data sheet IMIS1475 are used. Other selenium compounds may cause interference during the analysis.
Hydrogen sulfide 7-B *7783-06-4*	14 21					DRI-elec				The reported minimum value is 1.4 mg/m^3 (1 ppm).
Hydrogenated terphenyls *61788-32-7*	4.9		Glass fiber filter #SKC FLT225-7			GC-FID		Carbon disulfide	NIOSH S27	NIOSH method S27 is for analyzing o-terphenyl and can be adapted to hydrogenated terphenyls.
Hydroquinone 156-1 *123-31-9*	2		Mixed cellulose ester filter Omega M-083700AF (37 mm) and a container filled with 1 % acetic acid (#919).	1.5	90	HPLC-UV	18			The sampling method is for the aerosol form of hydroquinone. If sampling is done above 20 ^{0}C, the temperature must be noted on the analysis request form accompanying the samples. Hydroquinone is unstable on the filter and must be stabilized. Immediately after sampling, the filter must be placed in a jar containing 1% acetic acid supplied by the laboratory.
2-Hydroxypropyl aerylate *999-61-1*	2.8	Pc	XAD 2 tube #SKC ST226-30-06	Maximum: 0.25	3	GC-FID		Carbon disulfide	IRSST 85-2	A larger tube may be used. IRSST method 85-2 is for analyzing methyl methacrylate and can be adapted to 2-hydroxypropyl acrylate.
Indene *95-13-6*	48		Chromosorb 106 tube #SKC 226-110	0.2	10	GC-FID		Carbon disu fide	OSHA IMIS1500	
Indium [744074-6] and compounds (as In)	0.1		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS	0.5	Nitric acid	OSHA ID121	Other types of digestion can be considered, based on the indium compounds present in the sample. An excess of aluminum, magnesium, copper, zinc or phosphate may cause interference during the analysis.
Iodine *7553-56-2*	1		Activated charcoal tube #SKC ST226-67 impregnated with an alkali metal hydroxide	0.5	7.5	IC-ECD	0.28	0.02 M sodium nitrate	OSHA ID177	
Iodoform *75-47-8*	10		Glass fiber filter #SKC FLT225-7 in series with an XAD-4 tube #SKC ST226-93	0.1	10	GC-ECD		Carbon disulfide: benzene (50:50)	OSHA IMIS1517	A flame ionization detector can be used.
Iron pentacarbonyl (as Fe) *13463-40-6*	0.23 0.45		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of a mixture of hydrochloric acid (3%): iodine-potassium iodide (12-KI) (1:1)	1	960	Colo			OSHA IMIS 1521	
Iron salts, soluble (as Fe)	1		Mixed cellulose ester filter #Nuclepore 142789 or 141679	1.5	180	FAAS		Water	IRSST 6-2 OSHA ID121	Desorption of the sample is carried out using the procedure in OSHA method ID-121. IRSST method 6-2 is for analyzing total iron and can be adapted to soluble iron compounds.
Iron trioxide, dust and fume (as Fe) 6-2 *1309-37-1*	5		Mixed cellulose ester filter Omega M-083700AF or Omega M082500AFP	1.5	180	FAAS	50	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total iron.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Isoamylacetate 273-1 *123-92-2*	532		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	260	Carbon disulfide		
Isoamyl alcohol *123-51-3*	361 452		Activated charcoal tube #SKC ST226-01	0.01-0.2	10	GC-FID	10	Isopropanol: carbon disulfide (5:95)	NIOSH 1402	The samples must be stored in the freezer until analysis.
Isobutyl acetate 249-1 *110-19-0*	713		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	70	Carbon disulfide		
Isobutyl alcohol 278-1 *78-83-1*	152		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	75	Carbon disulfide		
Isooctyl alcohol *26952-21-6*	266	Pc	Activated charcoal tube #SKC ST226-01			GC-FID		Isopropanol: carbon disulfide (5:95)	NIOSH 1402	The samples must be stored in the freezer until analysis. NIOSH method 1402 is for analyzing alcohols, and does not specifically include isooctyl alcohol.
Isophorone 96-1 *78-59-1*	 28		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	12	GC-FID	15	Carbon disulfide		
Isophorone diisocyanate 230-1 *4098-71-9*	0.045	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSIZ50WP03700	1	15	HPLC-UV-Flu	0.033	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 230-1 give the vapour fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 240-1. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N-methylamino-methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1(2methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4°C, before and after sampling. If possible, hardener must also be sent.
Isophorone diisocyanate 240-1 *4098-71-9*	0.045	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700	1	15	HPLC-UV-Flu	0.015	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 240-1 give the aerosol fraction in terms of monomeres. This method is always carried out concomitantly to method 230-1. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N-methyl-amino-methyl) 9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
Isopropoxyethanol *109-59-1*	106	Pc	Activated charcoal tube #SKC ST226-01	0.1	10	GC-FID		Methylene chloride: methanol (95:5)	OSHA IMISI118	
Isopropyl acetate 279-1 *108-21-4*	1040 1290		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	475	Carbon disulfide		

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Isopropylalcohol 93-1 *67-63-0*	985 1230		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	3 3	GC-FID	30	Carbon disulfide		
Isopropyl glycidyl ether (IGE) *4016-14-2*	238 356		Activated charcoal tube #SKC ST226-01	0.2	5	GC^2-FID	61	methylene chloride	Réf. 14	
Isopropylamine *75-31-0*	12 24		Glass fritted tip impinger #SKC IMP 226-36-2 containing 10 mL of 0.05 M sulfuric acid	Maximum: 1	100	GC-FID			NIOSH S147	Tubes impregnated with 1-naphthylisocyanate (NIT) can also be used.
N-Isopropylaniline *768-52-5*	11	Pc	Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	HPLC-UV	1	Methanol	OSHA 78	
Kaolin (total dust) 48-1 *1332-58-7*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Ketone *463-51-4*	0.86 2.6		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of a hydroxylammonium chloride solution	1	50	Colo	10		NIOSH S92	An impinger containing toluene and placed ahead of the main impinger can minimize the interference of the acetic anhydride. Any compound containing an RCO group such as esters, acid chlorides and anhydrous acids may cause interference.
L.P.G. (Liquified petroleum gas) *68476-85-7*	1800					DRI-EX			OSHA IMIS 1803	Colorimetric tubes #SKC DT810-100A can be used.
Lead and inorganic compounds, dusts and fumes (as Pb) 13-2 *7439-92-1*	0.15		Mixed cellulose ester filter Omega M083700AF or Omega M082500AFP	1.5	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total lead.
Lead arsenate (as Pb3(As04)2) *3687-31-8*	0.15		Mixed cellulose ester filter #SKC FLT225-5			ET-AAS		Concentrated nitric acid	OSHA ID105	A mixed cellulose ester filter and a pad impregnated with sodium carbonate and glycerol in series with an activated charcoal tube must be used to minimize the interference of arsine and other volatile arsenic compounds. OSHA method ID-105 is for analyzing inorganic arsenic and can be adapted to lead arsenate. Other arsenic compounds may cause interference during the analysis.
Lead chromate (as Cr) 271-1 *7758-97-6*	0.012	C2 RP	Polyvinyl chloride filter Omega P-50370K and polyethylene container	1.5	360	IC-VIS	0.2	Sodium hydroxide: sodium carbonate: water (2:3:95)		The filter must be handled with plastic tweezers and be transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST.
Lead tetraethyl (as Pb) *78-00-2*	0.05	Pc	XAD-2tube #SKC ST226-30-04	0.01-1	120	GC-PID	0.1	Pentane	NIOSH 2533	
Lead tetramethyl (as Pb) *75-74-1*	0.05	Pc	XAD-2 tube #SKC ST226-30-04	0.010.2	24	GC-PID	0.4	Pentane	NIOSH 2534	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Lindane *58-89-9*	0.5	Pc	Glass fiber filter #SKC ST225-7 in series with a glass midget impinger #SKC IMP225-36-1 containing 15 mL of isooctane	0.2-1	90	GC-ECD	3		NIOSH 5502	The level of isooctane in the impinger must be frequently checked since this substance evaporates easily during sampling.
Lithium hydride *758-067-8*	0.025		Mixed cellulose ester filter SKC FLT2255	2	960	FAAS	0.0075	Deionized water	OSHA ID121	Precautions must be taken when the lithium hydride is dissolved in water, considering the reactive nature of this compound.
Magnesite (total dust) 48-1 *546-93-0*	10 Pt		Polyvinyl chloride filter Omega P-08370K or mixed cellulose filter Omega M-083700AF if metals are required.	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Magnesium oxide fume fas Mg) 8-2 *1309-48-4*	10		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total magnesium.
Malathion 228-1 *121-75-5*	10	Pc	Supelco tube 0RB0 49P, # 2-350	0.2-1	60	GC-NPD	15	Toluene: acetone (90:10), containing an internal standard (tributylphosphate)		
Maleic anhydride *108-31-6*	1		Two glass fiber filters #SKC FLT225-7 impregnated with veratrylamine. (The filters must be impregnated in the laboratory.)	0.5	60	HPLC-UV	33	Acetonitrile: dimethylsulfoxide (90:10)	OSHA 86	The samples must be stored in the refrigerator until analysis. Isocyanates, hydrochloric acid and aldehydes may cause interference during sampling.
Manganese (as Mn), Fume 7-3 *7439-96-5*	1 3		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180 22.5	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total manganese.
Manganese [7439 96-5] (as Mn), Dust and compounds 7-3	5		Mixed cellulose ester filter Omega M 083700AF ou Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total manganese.
Manganese cyclopentadienyl tricarbonyl (as Mn) *12079-65-1*	0.1	Pc	Mixed cellulose ester filter #SKC FLT225-5 in series with a glass fritted tip impinger #SKC IMP225-36-2 containing 15 mL of isopropanol	1	480	ET-AAS			OSHA IMIS1622	
Manganese methyl cyclopentadienyl tricarbonyl (as Mn) *12108-13-3*	0.2	Pc	Mixed cellulose ester filter #SKC FLT225-5 in series with a glass fritted tip impinger #SKC IMP225 36 2 containing 15 mL of isopropanol	1	480	ET-AAS			OSHA IMIS1767	
Manganese tetroxide 7-3 *1317-35-7*	1		Mixed cellulose ester filter Omega M 083700AF ou Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total manganese.

Table of substances in RRQWE

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (Ljmin)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Mercury [7439 97-6], Alkyl compounds (as Hg)	0.01 0.03	Pc								By court order, the standard for this substance as been stayed in the United States pending the development of an analytical method. No supporting reference is suggested for this substance.
Mercury [7439 97-6], All forms except alkyl (as Hg), vapour 2-A	0.05	Pc				DRI-Am				A direct-reading instrument (by amalgamation) can be used for determining the mercury in vapor form. The lower limit of quantification is 3 µg/m^3 expressed as mercury.
Mercury [7439-97-6] (as Hg) , Aryl and inorganic compounds	0.1	Pc	Mixed cellulose ester filter #SKC FLT225-5	2	10	CV-AAS	0.01	Digestion with concentrated nitric acid and 5 M sulfuric acid, followed by addition of potassium permanganate and hydroxylamine hydrochloride. Then, reduction of mercury with tin dichloride.	IRSST 2-A OSHA I0140 OSHA ID145	A Hydrar or Hopcalite tube and OSHA method ID-140 *or* a direct-reading instrument (by amalgamation) and IRSST method 31 A can be used for determining mercury in the vapor form.
Mesityloxide *141-79-7*	40		Activated charcoal tube #SKC ST226-01	0.2	25	GC-FID	50	Carbon disulfide: methanol (99:1)	NIOSH 1301	
Methacrylic acid *79-41-4*	70		Florasil tube #SKC ST226-39	1	60	IC-CD	60	Water: 1 N sulfuric acid (500:1)	Réf. 3	Acyl chloride may cause interference.
Methane 9C *74-828-*		Ax				DRI-EX				Method IRSST 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Methane 182-1 *74-82-8*		Ax	Mylar sampling bag #Calibrated Instruments Inc. IC-5		5	GC-FID				IRSST method 182-1 is for analyzing total hydrocarbons (C1 to C4). Refer to the note about simple asphyxiants at the beginning of the tables. This method is currently under revaluation. Please contact the laboratory Customer service department to learn of its availability.
Methomyl *16752-77-5*	2.5		OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	60	HPLC-UV		Acetonitrile	OSHA IMIS1644	
Methoxychlor *72-43-5*	10		Glass fiber filter #SKC FLT225-7	1.5	100	GC-ELD		Isooctane	NIOSH S371	
2-Methoxyethanol (EGME) 138-3 *109-86-4*	16	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	9.6	Acetonitrile ethanol (95:5)		Specific desorption must be carried out for this substance.
2-Methoxyethyl acetate (EGMEA) 139-2 *110-49-6*	24	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	15	Carbon disulfide		
4-Methoxyphenol *150-76-5*	5		XAD-7 tube #SKC ST226-95	0.1	24	HPLC-UV		Methanol	OSHA IMISM329	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Methyl acetate 136-1 *79-20-9*	606 760		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	7 3	GC-FID	215	Carbon disulfide		
Methyl acetylene *74-99-7*	1640		Tedlar sampling bag #SKC SB231-05	0.01-0.05	3	GC-FID	12		NIOSH S84	
Methyl acetylene-propadiene mixture (MAPP) *59355-75-8*	1640 2050		Tedlar sampling bag #SKC SB231-05	0.05	3	GC-FID	0.01		NIOSH S85	The availability of MAPP standards must be verifed. The sample is analyzed for its total hydrocarbon content; any substance that can be detected by a flame ionization detector may cause interference.
Methyl acrylate 146-2 *96-33-3*	35	Pc	Activated charcoal tube #SKC ST226-73 impregnated with 4-tertbutylcatechol (TBC)	0.05	12	GC-FID	10	Carbon disulfide		Methyl acrylate must be sampled specifically in reason of the sampling device used.
Methyl alcohol 92-2 *67-56-1*	262 328	Pc	Silica gel tube #SKC ST226-10	Maximum: 0.1	3 1.5	GC-FID	60	Water		Methanol must be sampled specifically in reason of the sampling device used and of the specific desorption solvant. Specific desorption must be carried out for this substance.
Methyl amyl alcohol 205 1 *108-11-2*	104 166	Pc	Activated charcoal tube #SKC ST226-01	0.2	5 3	GC-FID	25	Carbon disulfide		
Methyl n-amyl ketone 316-1 *110-43-0*	233		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	49	Carbon disulfide		
Methyl bromide *74-83-9*	19	Pc	Two activated charcoal tubes in series #SKC ST226-38-02	0.01-1	11	GC-FID	10	Carbon disulfide	NIOSH 2520	
Methyl n-butyl ketone *591-78-6*	20	Pc	Activated charcoal tube #SKC ST226-01	0.01-0.2	10	GC-FID	20	Carbon disulfide	NIOSH 1300	
Methyl chloride *74-87-3*	103 207	Pc	Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01	0.01-0.1	1.5	GC-FID	10	Methylene chloride	NIOSH 1001	
Methyl chloroform 100-1 *71-55-6*	1910 2460		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	6 3	GC-FID	57	Carbon disulfide		
Methyl 2-cyanoacrylate *137-05-3*	9.1 18		XAD 7 tube impregnated with phosphoric acid /SKC ST226-98	0.1	12	HPLC-UV	0.56	Phosphoric acid: acetonitrile (2:98)	OSHA 55	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 #SKC ST226-30-05 in series with a mixed cellulose ester filter #SKC FLT225-5			GC-FPD	0.1	Toluene	NIOSH 5514	NIOSH method 5514 is for analyzing demeton® and can be adapted to methyl demeton.
Methyl ethyl ketone (MEK) 25-3 *78-93-3*	150 300		Anasorb 747 tube #SKC ST226-81	Maximum: 0.2	10 3	GC-FID	30	Carbon disulfide		An activated charcoal tube 100/150 mg (#2120) may be used if the samples are refrigerated immediately after sampling and desorbed as quickly as possible after their arrival at the laboratory. This alternative is recommended if other organic substances must be analyzed simultaneously on the same sample.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Methyl ethyl ketone peroxide *1338-23-4*	 1.5		XAD-4 tube #SKC ST226-93	1	15	HPLC-UV	4.51	Isopropanol	OSHA 77	The samples must be stored in the refrigerator until analysis.
Methyl formate *107-31-3*	246 369		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	NIOSH S36	NIOSH method S36 is for analyzing ethyl formate and can be adapted to methyl formate.
Methyl hydrazine *60-34-4*	 0.38	Pc C2	Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of 0.1 M hydrochloric acid	1.5	20	Colo	0.7	Reaction with phosphomolybdic acid	NIOSH S149	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	Activated charcoal tube #SKC ST226-01	0.01-1	53	GC-FID	10	Toluene	NIOSH 1014	An electron capture detector can be used to improve analytical sensitivity.
Methyl isoamyl ketone 265-2 *110-12-3*	234		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	98	Carbon disulfide		
Methyl isobutyl ketone 132-3 *108-10-1*	205 310		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	40	Carbon disulfide		
Methyl isocyanate *624-83-9*	0.047	Pc	XAD-7 tube impregnated with 1-(2 pyridyl) piperazine (1-2PP) #SKC ST226-94 (The tubes must be impregnated in the laboratory.)	0.05	15	HPLC-UV	0.07	Acetonitrile	0SHA 54	The samples must be stored in the refrigerator until analysis. The use of a fluorescence detector is also suggested. Anhydrides, amines, alcohols and carboxylic acids may cause interference during sampling.
Methyl isopropyl ketone *563-80-4*	705		Activated charcoal tube #SKC ST226-01			GC-FID		Carbon disulfide	IRSST 132-3	IRSST method 132-3 is for analyzing methyl isobutyl ketone and can be adapted to methyl isopropyl ketone.
Methyl mercaptan *74-93-1*	0.98		Glass fiber filter #SKC FLT225-7 impregnated with a solution of 5% (w/v) mercuric acetate (The filters must be impregnated in the laboratory.)	0.2	20	GC-FPD	1.1	Methylene chloride: 25% hydrochloric acid (5:20 v/v)	OSHA 26	Hydrogen sulfide, dimethyl sulfide, dimethyl disulfide, water vapor and propylene may cause interference during the analysis.
Methyl methacrylate (monomer) 85-2 *80-62-6*	410		Anasorb 727 tube #SKC ST226-75	Maximum: 0.25	3	GC-FID	19	Carbon disulfide		Methyl methacrylate must be sampled specifically in reason of the sampling device used.
Methyl parathion *298-00-0*	0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226 58	0.2-1	240	GC-FPD	40	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Methyl propyl ketone 178-1 *107-87-9*	530		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	110	Carbon disulfide		
Methyl silicate *681-84-5*	6		XAD-2 tube #SKCST226-30-04			GC-FID		Carbon disulfide	NIOSH S264	NIOSH method S264 is for analyzing ethyl silicate and can be adapted to methyl silicate.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
alpha-Methyl styrene 177-2 *98-83-9*	242 484		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	3 3	GC-FID	15	Carbon disulfide		
Methylacrylonitrile *126-98-7*	2.7	Pc	Activated charcoal tube #SKC ST226-01			GC-FID	1	Acetone: carbon disulfide (2:98) (v/v)	NIOSH 1604	NIOSH method 1604 is for analyzing acrylonitrile and can be adapted to methylacrylonitrile.
Methylal *109-87-5*	3110		Activated charcoal tube #SKC ST226-01	0.01-0.2	2	GC-FID	100	Hexane	NIOSH 1611	
Methylamine *74-89-5*	13		XAD-7 tube impregnated with 10% (w/w) 7-chloro-4-ni1robenzo-2 oxa 1,3 diazole (chloride of NBD) #SKC ST226-96	0.2	10	HPLC-Flu	0.35	Tetrahydrofuran: 7 chloro-4 nitrobenzo 2-oxa-1,3 diazole (95:5)	OSHA 40	Tubes are stable for a period of two months. A UV/VIS detector can be used.
N-Methylaniline *100-61-8*	2.2	Pc	Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of 0.05 M sulfuric acid	Maximum: 1	100	GC-FID		Addition of sodium hydroxide to the impinger solution	NIOSH 2002 NIOSH S153	A nitrogen and phosphorus detector and the sampling device mentioned in NIOSH method 2002 can be used to improve analytical sensitivity and eliminate the use of an impinger.
Methylcyclohexane 175-1 *108-87-2*	1610		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	4	GC-FID	320	Carbon disulfide		
Methylcyclohexanol 176-1 *25639-42-3*	234		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	140	Carbon disulfide		
o-Methylcyclohexanone *583-60-8*	229 344	Pc	Porapak Q tube #SKC ST226-115	0.010.05	3	GC-FID	90	Acetone	NIOSH 2521	
Methylene chloride 27-2 *75-09-2*	174	C2 EM	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	3	GC-FID	27	Carbon disulfide		
4,4'-Methylene bis (2-chloroaniline) 337-1 *101-14-4*	0.22	Pc C2	Glass fiber filter #SKC FLT-225-7 impregnated with 0.26 N sulfuric acid	2	240	HPLC-UV	2.74	0.1 N potassium hydroxide solution in methanol.		In the 4 hours following the sampling, the filter must be transfered in a jar containing 4 mL of 0.1 N hydroxide potassium solution in methanol. The numbers on the jar and on the sampling cassette must be the same. Samples are stable at 20^0C for 60 days.
Methylene his (4-cyclohexylisocyanate) *5124-30-1*	0.054	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MISI Z50WP03700			HPLC-UV-Flu		For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	IRSST 234-2 IRSST 2243	*The glass fiber filters are heated to 400^0C and then impregnated with (N methyl -amino-methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2-methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^0C. If possible, hardener must also be sent.

Table of substances in RRQWE

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
4,4' Methylene dianiline 289-1 *101-77-9*	0.81	Pc C2	Glass fiber filter #SKC FLT225 7 impregnated with 0.26 N sulfuric acid	1-2	100	HPLCUV	0.12	0.1 N sodium hydroxide: methanol		In the 4 hours following the sampling, the filter must be transfered in a jar containing 4 mL of 0.1 N hydroxide potassium solution in methanol. The numbers on the jar and on the sampling cassette must be the same. Samples are stable at 20 ^{0}C for 60 days. Methylene bis (4 phenyl isocyanate) (MDI) may cause interference during sampling.
Methylene bis (4-phenyl isocyanate) (MDI) 238-1 *101-68-8*	0.051	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter MISI Z50WP03700	1	15	HPLC-UV-Flu	0.041	For the glass fiber filter, solution of dimethyiformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 238-1 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 237-2. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N-methyl-amino-methyl) 9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
Methylene bis (4-phenyl isocyanate) IMDI) 237-2 *101-68-8*	0.051	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700	1	15	HPLCUV-Flu	0.036	For the glass fiber filter, solution of dimethyiformamide: acetonitrile buffered to pH 3 For the teflnn filter, acetic anhydride: acetonitrile		The results of method 237-2 give the vapor fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 238-1. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N-methyl-amino-methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1(2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
Metribuzin *21087-64-9*	5		OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30 16	1	240	GC-FPD			OSHA IMISA 175	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Mica (respirable dust) 48-1 *12001-26-2*	3 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Mineral oil (mist) 51-2 *8012-95-1*	5 10		Mixed cellulose ester filter Omega M-083700AF	1.5	100	FTIR	24	Carbon tetrachloride		Undiluted mineral oil must be supplied as reference. Sampling must be carried out with open cassette. The reference oil must be soluble in a halogenated solvent. The lower limit of quantification may vary in fonction of the oil used. Cigarette smoke may cause interference.
Molybdenum [7439-98-7] (as Mo), Soluble compounds 213-1	5		Polyvinyl chloride filter Gelman 66467	1.5	180	FAAS	50	Hot water		Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble molybdenum.
Molybdenum [7439-98-7] (as Mo), Insoluble compounds 73-1	10		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	FAAS	50	Concentrated nitric acid, then nitric acid: hydrochloric acid (1:4)		Specific sampling must be carried out for this substance. The analytical results are expressed as total molybdenum.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Monocrotophos *6923-22-4*	0.25	Pc	OVS (OSHA Versatile Sampler) tube with XAO 2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPO	400	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Morpholine *110-91-8*	71	Pc	Silica gel tube #SKC ST226-10	Maximum: 0.2	20	GC-FID	70	0.005 M sulfuric acid	NIOSH S150	Specific desorption must be carried out for this substance.
Naled *300-76-5*	3	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16			GC-FPD		Toluene	OSHA 62	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. OSHA method 62 is for analyzing chlorpyrifos, dichlorvos, malathion and parathion and can be adapted to naled (dibrom®).
Naphthalene 09-1 *91-20-3*	52 79		Activated charcoal tube #SKC ST226-01	Maximum: 1.0	200 15	GC-FID	500	Carbon disulfide		Since a specific analysis is recommended, no other substance may be sampled simultaneously.
B-Naphthylamine *91-59-8*		C1 RP	Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	GC-FID	0.0006	Desorption in water. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 93	At the end of sampling, the filters must be transferred and stored in a container of water. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C1.
Neon 26-C *7440-01-9*		Ax				DRI-elec				Since neon is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26-C). The reported minimum value is 1% oxygen.
Nickel, Metal 10-2 *7440-02-0*	1		Mixed cellulose ester filterOmega M-083700AF ou Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total nickel.
Nickel [744002-0] Insoluble compounds (as Nil 10-2	1		Mixed cellulose ester filter Omega M-083700AF ou Omega M-082500AFP	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total nickel.
Nickel [7440-02-0], Soluble compounds fas Ni) 214 2	0.1		Polyvinyl chloride filter #Gelman 60714	1.5	180	FAAS	2	Hot water		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		Charcoal tube with low nickel content (decontaminated) (not available from SKC) (The tubes are washed with 3% nitric acid and then activated by heating to 600⁰C for 90 minutes.)	0.050.2	40	ET-AAS	0.01	3% nitric acid (ultrasonic bath)	NIOSH 6007 Réf. 16	The use of mixed cellulose ester prefilter minimizes the interference from other nickel compounds present as dust.
Nickel sulfide roasting, fume and dust (as Ni) 48-1	1	C1 RP	Polyvinyl chloride filter Omega P-08370K	1.5	180	FAAS	2			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Nicotine 233 1	*54-11-5*	0.5	Pc	XAD-2 tube #SKC ST226 30 04	1.0	100	GC-NPD	0.5	Ethyl acetate containing diphenylamine as an internal standard		Nicotine must be sampled specifically in reason of the sampling device used and of the specific desorption solvant. Additional information is available in Info-Labo 89-01.
Nitrapyrin	*1929-82-4*	10 20		OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	480	HPLC-UV			OSHA IMIS0684	Determination using gas phase chromatography with electron capture detector is also suggested.
Nitric acid 211-1	*7697-37-2*	5.2 10		Treated silica gel tube SKC 226 1003	0.2	48 3	IC-CD	5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate		Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable 21 days at 25°C. All acid salts may cause positive interference.
p-Nitroaniline	*100-01-6*	3	Pc	Mixed cellulose ester filter #SKC FLT225-5	1.5	90	HPLC-UV	50	Isopropanol	NIOSH S7	
Nitrobenzene	*98-95-3*	5	Pc	Silica gel tube #SKC ST226-10	0.01-1	55	GC-FID	20	Methanol (ultrasonic bath)	NIOSH 2005	
p-Nitrochlorobenzene	*100-00-5*	0.64	Pc	Silica gel tube #SKC ST226-10	0.01-1	50	GC-FID	0.1	Methanol (ultrasonic bath)	NIOSH 2005	An electron capture detector can be used to improve analytical sensitivity.
4-Nitrodiphenyl	*92-93-3*		Pc C1	Glass fiber filter #SKC FLT225-16 in series with a silica gel tube #SKC ST22647	0.2	50	GC-FID	0.05	Isopropanol	NIOSH P&CAM 273	There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C1.
Nitroethane	*792-4-3*	307		Two XAD-2 tubes in series #SKC ST22630-2	0.010.05	3	GC-FID		Ethyl acetate	NIOSH 2526	At the end of sampling, the front and back sections of each tube must be separated to avoid migration of nitroethane during storage.
Nitrogen 26-C	*7727-37-9*		Ax				DRIelec				Since azote is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 260. The reported minimum value is 1% oxygen.
Nitrogen dioxide 30-B	*10102-44-0*	5.6					DRI-dec				The reported minimum value is 0.9 mg/m^3 (0.5 ppm).
Nitrogen monoxide 06-A	*10102-43-9*	31					DRI-elec				The reported minimum value is 1.2 mg/m^3 (0.5 ppm).
Nitrogen trifluoride	*7783-54-2*	29					DRI-IR			OSHA IMIS1907	
Nitroglycerin (NG) 84-1	*55-63-0*	1.86	Pc	Tenax tube #SKC ST226-3503	1.0	15	GC-ECD	3	Ethanol		Nitroglycerine must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Nitromethane	*75-52-5*	250		Chromosorb-106 tube #SKC 226 110	0.010.05	3	GC-NPD		Ethyl acetate	NIOSH 2527	A flame photometric detector and carbon disulfide as desorption solvent can be used, given the high standard for nitromethane.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
1-Nitropropano 312-1	*108-03-2*	91		Chromosorb-106 tube #SKC ST226-110	Maximum: 0.05	2	GC-FID	4	Carbon disulfide		
2-Nitropropane 30-2	*79-46-9*	36	C2 RP	Chromosorb-106 tube #SKC ST226 110	Maximum: 0.05	2	GC-FID	14	Carbon disulfide		
N-Nitrosodimethylamine	*62-75-9*		Pc C2	ThermoSorb/N tube	1	75	G-TEA	0.01	Methylene chloride: methanol (75:25)	OSHA 27	The samples must be stored in the refrigerator until analysis. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2.
Nitrotoluene (all isomers)	*88-72-9*	11	Pc	Silica gel tube #SKC ST226-10	0.01-0.2	20	GC-FID	8	Methanol (ultrasonic bath)	NIOSH 2005	
Nitrous oxide 39-A	*10024-97-2*	90					DRI-PAD				The reported minimum value is 0.09 mg/m^3 (0.05 ppm).
Nonane 306-1	*111-84-2*	1050		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	4	GC-FID	210	Carbon disulfide		
Octachloronaphthalene	*2234-13-1*	0.1 0.3	Pc	Mixed cellulose ester filter #SKC FLT225-5	1	30	GC-ECD		Hexane	NIOSH S97	
Octane 143-1	*111-65-9*	1400 1750		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	4 3	GC-FID	290	Carbon disulfide		
Osmium tetroxide (as Os)	*20816-12-0*	0.0016 0.0048		Mixed cellulose ester filter #SKC FLT225 5 in series with a glass fritted tip impinger #SKC IMP225 36 2 containing 15 mL of distilled water	1	480 15	ICP		Sulfuric acid, hydrogen peroxide, hydrochloric acid	OSHA ID125G OSHA IMIS1960	Method ID-125G is for analyzing metallic elements and compounds and can be adapted to osmium tetroxide. The sampling device and parameters in OSHA data sheet IMISI960 are used.
Oxalic acid	*144-62-7*	1 2		Mixed cellulose ester filter #SKC FLT225-5	2	960 30	IC-CD		0.01 M sodium carbonate	OSHA IMIS1970	The filter must be transferred to a tightly sealed container at the end of sampling. A copy of the OSHA file is available in the IRSST files.
Oxygen difluoride	*7783-41-7*	0.11									By court order, the standard for this substance as been stayed in the United States pending the development of an analytical method. No supporting method is suggested for this substance. If a request is made to the IRSST, the analytical method could be developed and will have to be validated for the substance mentioned, based on the procedure described by the IRSST, which refers to the NIOSH protocol.
Ozone 05-A	*10028-15-6*	0.2					DRI-Chi				The reported minimum value is 0.008 mg/m^3 (0.004 ppm).
Paraffin wax, fume 48-1	*8002-74-2*	2		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMIS2000. The gravimetric method for dusts is by definition nonspecific.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Paraquat, respirable particulates *4685-14-7*	0.1		Polytetrafluorocarbon (teflon) filter #SKC FLT225 17 01	1-4	90	HPLC-UV	10	Water	NIOSH 5003	The use of a fluorescence detector is also suggested to increase analytical sensitivity.
Parathion 228-1 *56-38-2*	0.1	Pc	Supelco ORBO 49P tube, # 2-350	0.2-1	480	GC-NPD	2	Toluene: acetone (90:10), containing an internal standard (tributylphosphate)		
Particulates Not Otherwise Classified (PNOC) (total dust) 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,9202 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Pentaborane *19624-22-7*	0.013 0.039		Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of deionized water	1	480 15	ICP			OSHA IMIS1986 OSHA ID125G	OSHA method ID-125G is for analyzing metallic elements and compounds and can be adapted to pentaborane. The sampling conditions in OSHA data sheet IMIS1986 are used.
Pentachloronaphthalene *1321-64-8*	0.5	Pc	Glass fiber filter #SKC FLT225-7 and glass midget impinger #SKC IMP226-36-1 containing 15 mL of isooctane	1.3	250	GC-ELD		Isooctane	NIOSH S96	
Pentachlorophenol 46-1 *87-86-5*	0.5	Pc C2	Mixed cellulose ester filter Omega M083700AF (37 mm) in series with a glass fritted tip impinger #SKC IMP225-36-2 containing 15 mL of ethylene glycol	1.5	180	HPLC-UV	9			The filter must be added to the contents of the impinger at the end of sampling.
Pentaerythritol 48-1 *115-77-5*	10		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,9202 and 98-06. The gravimetric method for dusts is by definition nonspecific.
n-Pentane 144-2 *109-66-0*	350		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	4	GC-FID	21	Carbon disulfide		
Perchloroethylene 1402 *127-18-4*	339 1357	C3	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	68	Carbon disulfide		
Perchloromethyl mercaptan *594-42-3*	0.76					DR-IR			OSHA IMIS2030	
Perchloryl fluoride *7616-94-6*	13 25		Mixed cellulose ester filter #Nuclepore 142789 (37 mm) in series with a polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide			SE			IRSST 164-1	The filter is thrown away after sampling. IRSST method 164-1 is for analyzing hydrofluoric acid and can be adapted to perchloryl fluoride.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Perlite (respirable dust) 48-1 *83969-76-0*	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info-Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Perlite (total dust) 48-1 *83969-76-0*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Phenol 12 4 *108-95-2*	19	Pc	Glass midget impinger #SKC IMP 225-36-1 containing 15 mL of 0.1 N sodium hydroxide	1	15	HPL-CUV	6.2			
Phenothiazine *92-84-2*	5	Pc	Glass fiber filter #SKC FLT225 7	1	100	GC-NPD			OSHA IMIS2041	Phenothiazine is soluble in ether and hot acetic acid and is very soluble in benzene.
Phenyl ether, vapour *101-84-8*	7 14		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	7	Carbon disulfide	NIOSH S72	
Phenyl glycidyl ether (PGE) *122-60-1*	6.1	C3	XAD 7 tube #SKC ST226 30-11-07	0.2	5	HPLC-UV	1.5	Acetonitrile	Réf. 14	
Phenyl mercaptan *108-98-5*	2.3		Glass fiber filter #SKC FLT225-7 impregnated with a solution of 5% (w/v) mercuric acetate (The filters must be impregnated in the laboratory.)	0.2	20	GC-FID		Desorption in 25% hydrochloric acid, then extraction in toluene.	OSHA 26	The samples must be protected from light until analysis.
p-Phenylenediamine *106-50-3*	0.1	Pc	Two glass fiber filters #SKC FLT225 7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	HPLC-UV	0.044	Extraction with aqueous EDTA	OSHA 87	
Phenylhydrazine *100-63-0*	0.44	Pc C2	Silica gel tube #SKC ST226 42 impregnated with sulfuric acid (The tubes must be impregnated in the laboratory.)	0.2	96	GC-FID		Desorption in water. Then, derivatization with 2-furaldehyde and sodium acetate, followed by extraction with ethyl acetate.	NIOSH P&CAM248	
n-Phenyl-B-naphthylamine *135-88-6*		C2 RP	Wipe sample with glass fiber filter #SKC W225-2401			HPLC-UV			OSHA IMISN606	The use of a fluorescence detector is also suggested. There is no reference value for the standard, but the determination could be required by targeting the lowest limit of detection possible, given the carcinogenicity designation C2.
Phenylphosphine *638-21-1*	0.23									By court order, the standard for this substance as been stayed in the United States pending the development of an analytical method. No supporting method is suggested for this substance. If a request is made to the IRSST, the analytical method could be developed and will have to be validated for the substance mentioned, based on the procedure described by the IRSST, which refers to the NIOSH protocol.
Phorate *298-02-2*	0.05 0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226 58	0.2-1	240	GC-FPD	0.04	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Phosdrin *7786-34-7*	0.09 0.27	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	0.2	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Phosgene *75-44-5*	0.4		XAD-2 tube impregnated with 10% (w/w) 2-(hydroxymethyl) piperidine #SKC ST226-117	1	240	GC-NPO	3.4	Toluene	OSHA 61	
Phosphine *7803-51-2*	0.42 1.4		Humidifier tube in front of a glass tube containing carbon beads impregnated with potassium hydroxide #SKC ST226-31	0.050.15	36 4.5	IC-CD	1.2	30% hydrogen peroxide	OSHA ID 180	The humidifier tube can be replaced by a filter. In this case, only the glass tube containing carbon beads impregnated with potassium hydroxide (#SKC ST226-32) is used. Phosphite salts soluble in water may cause interference.
Phosphoric acid 211-1 *7664-38-2*	1 3		Treated silica gel tube SKC 226-10 03	0.2	48 3	IC-CD	2.5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate		Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Phosphorus (yellow) *7723-14-0*	0.1		Tenax-GC tube #SKC ST 226-35-03	0.01-0.2	100	GC-FPD	0.005	Xylene	NIOSH 7905	A filter can be used if the phosphorus is present in the air in particulate form.
Phosphorus oxychloride *10025-87-3*	0.63		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of a solution of 0.003 M sodium carbonate and 0.024 M sodium bicarbonate	1	240	IC-CD			IRSST 211-1 OSHA IMIS2094	The sampling method is carried out according to the information in OSHA data sheet IMIS2094 while the analysis follows the protocol of IRSST method 211-1.
Phosphorus pentachloride *10026-13-8*	0.85		Low ash polyvinyl chloride filter #SKC FLT225-8-01 in series with a glass fritted tip impinger #SKC IMP225-36-2 containing 15 mL of deionized water	0.2	48	IC-CD			OSHA IMIS2091 IRSST 211-1	The use of stainless steel filter support (#SKC SCN225-26) is suggested. The filter is thrown away after sampling. The sampling method is carried out according to the information in OSHA data sheet IMIS2091 while the analysis follows the protocol of IRSST method 211-1.
Phosphorus pentasulfide *1314-80-3*	1 3		Low ash polyvinyl chloride filter #SKC FLT225-801	12	120	IC-CD		5 N sodium hydroxide, 3% hydrogen peroxide	OSHA ID128SG	
Phosphorus trichloride *7719-12-2*	1.1 2.8		Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of deionized water	0.2	100 3	IC-CD			IRSST 211-1 OSHA IMIS2093	The sampling method is carried out according to the information in OSHA data sheet IMIS2093 while the analysis follows the protocol of IRSST method 211-1.
Phthalic anhydride 82-1 *85-44-9*	6.1		Mixed cellulose ester filter Omega M-083700AF	1.5	100	HPLC-UV	60	Water		
m-Phthalodinitrile *626-17-5*	5		Activated charcoal tube #SKC ST226-01	0.2	20	GC-NPD		Acetone	OSHA IMIS2015	
Picloram 48-1 *1918-02-1*	10		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav				Additional information is available in Info Labo 91-03,9202 and 98-06. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMIS2017. The gravimetric method for dusts is by definition nonspecific.
Picric acid *88-89-1*	0.1	Pc	Mixed cellulose ester filter #SKC FLT2255	1.5	180	HPLC-UV	0.01	Methanol: water (70:30)	NIOSH S228	The method is not applicable for analyzing samples in vapor form.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Pindone *83-26-1*	0.1		Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-01 in series with a Tenax-GC tube #SKC ST226 35 03	1	200	HPLC-UV		Methanol	OSHA IMIS2125	The front section of the tube and the filter are transferred to a container at the end of sampling.
Piperazine dihydrochloride 48-1 *142-64-3*	5		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03, 92-02 and 98-06. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMISP155. The gravimetric method for dusts is by definition nonspecific.
Plaster of Paris (respirable dust) 48-1 *26499-65-0*	5 Pr		Cyclone in series with a polyvinyl chloride filter Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03,9202 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Plaster of Paris (total dust) 48-1 *26499-65-0*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Platinum, Metal *7440-06-4*	1		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS	50	Hydrochloric acid: nitric acid (82:18) (microwave digestion)	OSHA ID121	The use of a nitrous oxide and acetylene flame may minimize the interference.
Platinum [7440064], Soluble salts (as Pt)	0.002		Mixed cellulose ester filter #SKC FLT225-5	1.5-2	100	ET-AAS		Deionized water	OSHA ID130SG	
Polytetrafluoroethylene decomposition products *9002-84-0*			Mixed cellulose ester filter #SKC FLT225-5 in series with a polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide			SE			IRSST 41-1	There is no specific standard for this compound due to the complexity of the matrix and the various decomposition products of PTFE. However, the identification of one of the decomposition products (e.g., carbonyl fluoride) may allow the standard associated with this substance to be applied. IRSST method 41-1 is for analyzing fluorides and can be adapted to certain decomposition products of polytetrafluoroethylene.
Portland cement (respirable dust) 48-1 *65997-15-1*	5 Pr		Cyclone in series with a polyvinyl chloride filter Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted at the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Portland cement (total dust) 48-1 *65997-15-1*	10 Pt		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Potassium hydroxide 288-1 *1310-58-3*	2		Polyvinyl chloride filter #Gelman 60714	1.5	180	FAAS	12.5	Demineralized water at room temperature		A specific sampling must be carried out for this substance. The analytical results are expressed as potassium (soluble compounds).
Propane 182-1 *74-98-6*	1800		Mylar sampling bag #Calibrated Instruments Inc. IC-5		5	GC-FID				IRSST method 182-1 is for analyzing total hydrocarbons (C1 to C4). This method is currently in revaluation. Please contact the laboratory's Customer service department to learn of its availability.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Propane 9C	*74-98-6*	1800					DRI-EX				IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Propane sultone	*1120-71-4*		C2 RP	Diffusion denuder whose walls are impregnated with 2-mercaptobenzothiazole (sodium salt)			HPLC-UV			Réf. 17	There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2.
Propargyl alcohol	*107-19-7*	2.3	Pc	Activated charcoal tube #SKC ST226 38 03 impregnated with hydrobromic acid	0.05	6	GC-ECD	0.01	Toluene	OSHA 97	
B-Propiolactone	*57-57-8*	1.5	C2 RP								No supporting reference is suggested for this substance.
Propionic acid	*79-09-4*	30		Activated charcoal tube #SKC ST226-01			HPLC-UV		0.1 N sodium hydroxide	IRSST 195-2	IRSST method 195-2 is for analyzing acetic acid and can be adapted to propionic acid.
Propoxur (baygon)	*114-26-1*	0.5		Tube of polyurethane foam (PUF) (Produced in the laboratory or #SKC ST226-126)	2.5	20	GC-ECD	0.002	Diethyl ether: hexane (75:25) (v/v) (soxhlet)	Réf. 6	Before use, the polyurethane foam tube is cleaned with 5% diethyl ether in a soxhlet. An OVS (OSHA Versatile Sampler) tube #SKC ST226 30-16 and a supercritical fluid extractor can be alternatives in the use of the sampling device referred to and the soxhlet, respectively.
n-Propyl acetate 168-1	*109-60-4*	835 1040		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	420	Carbon disulfide		
n-Propyl alcohol 93-1	*71-23-8*	492 615	Pc	Activated charcoal tube #SKC ST226#01	Maximum: 0.2	10 3	GC-FID	250	Carbon disulfide		
n-Propyl nitrate	*627-13-4*	107 172		Activated charcoal tube #SKC ST226 01	Maximum: 1	70	GC-FID		Carbon disulfide	NIOSH S227	
Propylene 9C	*115-07-1*		Ax				DRI-EX				IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Propylene glycol dinitrate	*6423-43-4*	0.34	Pc	Tenax-GC tube #SKC ST 226-35-03			GC-ECD		Ethanol	NIOSH 2507	NIOSH method 2507 is for analyzing nitroglycerine and ethylene glycol dinitrate, and can be adapted to propylene glycol dinitrate. The propylene glycol dinitrate standard may be difficult to obtain.
Propylene glycol monomethyl ether 334-1	*107-98-2*	369 553		Activated charcoal tube #SKC ST226-01	0.2	10	GC-FID	74	Methylene chloride: Methanol (95:5)		Specific desorption must be carried out for this substance.
Propylene imine	*75-55-8*	4.7	Pc C2	Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of Folin reagent (1,2-naphthoquinone 4 sulfonate)			HPLC-UV		Extraction with chloroform	NIOSH P&CAM 300	NIOSH method P&CAM300 is for analyzing ethylene imine and can be adapted to propylene imine.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Propylene oxide *75569*	48	C2 EM	Anasorb 747 tube #SKC ST226-81	0.1	5	GC-FID	83	Carbon disulfide	OSHA 88	The samples must be stored in the freezer until analysis. OSHA expects that the standard will eventually drop to 2.4 mg/m^3; this method has already been validated in relation to this new standard.
Pyrethrum *8003-34-7*	5		OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKCST226-30-16	1	60	GC-ECD	2.99	Toluene	OSHA 70	
Pyridine 199-1 *110-86-1*	16		Activated charcoal tube #SKC ST22601	Maximum: 0.2	5	GC-NPD	4	Methylene chloride		Pyridine must be sampled specifically in reason of the sampling device used and of the specific desorption solvent.
Resorcinol *108463*	45 90		XAD-7 tube #SKC ST226-95	0.1-1	24 15	HPLC-UV			OSHA IMIS2221	
Rhodium [7440-16-6], Metal and insoluble compounds (as Rh)	0.1		Mixed cellulose ester filter #SKC FLT225-5	1.5	720	ET-AAS		Fusion with sodium bisulfite	OSHA IMIS2223 NIOSH S188	NIOSH method S188 is for analyzing metallic rhodium (fumes and dusts) and can be adapted to insoluble rhodium compounds. The sample digestion conditions in OSHA data sheet IMIS2223 are used. The addition of sodium bisulfate eliminates the interference of some cations.
Rhodium [7440-16-6], Soluble compounds (as Rh)	0.001		Mixed cellulose ester filter #SKC FLT225-5	2	960	ET-AAS		Deionized water	OSHA IMIS2225 NIOSH S189	The sampling method is carried out according to the information in OSHA data sheet IMIS2225 while the analysis follows the protocol of NIOSH method S189.
Ronnel *299-84-3*	10		OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	40	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Rosin core solder pyrolysis products (as Formaldehyde)	0.1									No supporting reference is suggested for this substance.
Rotenone *83794*	5		Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-01	1-3	100	HPLC-UV	4	Acetonitrile	NIOSH 5007	
Rouge (total dust) 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in InfoLabo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Rubber solvent (Naphtha) 154-1 *8030-30-6*	1570		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	800	Carbon disulfide		A process sample must be supplied.
Selenium and compounds (as Se) *7782-49-2*	0.2		Mixed cellulose ester filter #SKC FLT225-5	2	960	ET-AAS		Nitric acid: hydrochloric acid	OSHA ID121	Other types of digestion can be considered, based on the selenium compounds present in the sample. Large quantities of nickel, cobalt, iron, copper, manganese and lead may cause interference.
Selenium hexafluoride (as Se) *7783-79-1*	0.16					DR-HR			OSHA IMIS2231	

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Sesone *136-78-7*	10		Mixed cellulose ester filter #SKC FLT225-5	1-1.5	90	Colo	24	Desorption in water with methylene blue added and formation of a colored complex. Then, extraction in chloroform.	NIOSH S356	Sulfates, sulfonates, carboxylates, phosphates, organic phenols, cyanates, chlorides, nitrates, inorganic thiocyanates and amines may cause interference during the analysis.
Silica, Amorphous, Diatomaceous earth (uncalcined) (total dust) 48-1 *61790-53-2*	6 Pt		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav				Additional information is available in InfoLabo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silica, Amorphous, gel (total dust) 48-1 *63231-67-4*	6 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in InfoLabo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silica, Amorphous, precipitated (total dust) 48-1 *1343-98-2*	6 Pt		Polyvinyl chloride filter #0mega P08370K	1.5	180	Grav	25			Additional information is available in InfoLabo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silica, Crystalline, Cristobalite (respirable dust) 206-2 *14464-46-1*	0.05 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	1000	XRD	6			
Silica, Crystalline, Cristobalite (respirable dust) 56-3 *14464-46-1*	0.05 Pr		Cyclone in series with a silver membrane filter from Selas	1.7	1000	XRD				This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used. The reported minimum value is undetermined.
Silica, Crystalline, fused (respirable dust) 56-3 *60676860*	0.1 Pr		Cyclone in series with a silver membrane filter from Selas	1.7	800	XRD	15			This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Silica, Crystalline, fused (respirable dust) 206-2 *60676-86-0*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	XRD	6			
Silica, Crystalline, fused (respirable dust) 78-1 *60676-860*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	FTIR	6			
Silica, Crystalline, Quartz (respirable dust) 78-1 *14808-60-7*	0.1 Pr	C2 EM	Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	FTIR	6			

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Silica, Crystalline, Quartz (respirable dust) 56-3 *14808-60-7*	0.1 Pr	C2 EM	Cyclone in series with a silver membrane filter from Selas	1.7	800	XRD	15			This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Silica, Crystalline, Quartz (respirable dust) 206-2 *14808-60-7*	0.1 Pr	C2 EM	Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	XRD	6			
Silica, Crystalline, Tridymite (respirable dust) 206-2 *15468-32-3*	0.05 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	1000	XRD				The reported minimum value is undetermined.
Silica, Crystalline, Tridymite (respirable dust) 56-3 *15468-32-3*	0.05 Pr		Cyclone in series with a silver membrane filter from Selas	1.7	1000	XRD				This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used. The reported minimum value is undetermined.
Silica, Crystalline, Tripoli (respirable dust) 206-2 *1317-95-9*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	XRD	6			
Silica, Crystalline, Tripoli (respirable dust) 56-3 *1317-95-9*	0.1 Pr		Cyclone in series with a silver membrane filter from Selas	1.7	800	XRD	15			This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Silica, Crystalline, Tripoli (respirable dust) 78-1 *1317-95-9*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	800	FTIR	6			
Silicon (total dust) 48-1 *7440-21-3*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silicon carbide (non fibrous) (total dust) 48-1 *409-21-2*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silicon tetrahydride *7803-62-5*	6.6		Glass fritted tip impinger #SKC IMP 225-36-2 containing 15 mL of 0.01 N potassium hydroxide	1	480	ICP			OSHA ID125G OSHA IMIS2237	The samples must be stored in plastic containers and shipped as soon as possible. OSHA method ID-25G is for analyzing total silicon and can be adapted to silicon tetrahydride. The sampling conditions in OSHA data sheet IMIS2237 are used.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Silver [7440 22-4], Soluble compounds (as Ag)	0.01		Mixed cellulose ester filter #Nuclepore 142789 or 141679			ET-AAS		Water	IRSST 20-3	IRSST method 20-3 is for analyzing total silver and can be adapted to soluble silver compounds.
Silver, Metal 20-3 *7440-22-4*	0.1		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP	1.5	180	ET-AAS	0.05	Concentrated nitric acid		Specific sampling must be carried out for this substance. The analytical results are expressed as total silver.
Soapstone (respirable dust) 48-1 *14378-12-2*	3 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Soapstone (total dust) 48-1 *14378-12-2*	6 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Sodium azide *26628-22-8*	0.3		Low ash polyvinyl chloride filter #SKC FLT225-8-01 in series with a silica gel tube #SKC ST226-55	1	5	IC-VIS	0.015	Solution of 0.9 mM sodium carbonate and 0.9 mM of sodium bicarbonate	OSHA ID211	OSHA method ID211 is for the simultaneous determination of sodium azide (NaN3) and hydrazoic acid (HN3) since sodium azide converts into hydrazoic acid on contact with moisture. Hydrazoic acid is the molecular species responsible for toxic effects in humans.
Sodium bisulfite *7631-90-5*	5		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS		Deionized water	IRSST 48 1 OSHA 10121 Réf. 18	OSHA method ID121 is for the elementary analysis of sodium and can be adapted to sodium bisulfite. IRSST gravimetric method 48-1 can also be used if the composition of the sample is known. The addition of an ionization suppressant to the sample is suggested (see the reference book).
Sodium fluoroacetate *62-74-8*	0.05 0.15	Pc	Mixed cellulose ester filter #SKC FLT225-5-01	1.52	480	IC-CD	1	Deionized water	NIOSH S301	
Sodium hydroxide 287-1 *1310-73-2*	2		Polyvinyl chloride 5 µm filter Gelman 66467	1.5	180	FAAS	25	Demineralized water at room temperature		A specific sampling must be carried out for this substance. The analytical results are expressed as sodium (soluble compounds).
Sodium metabisulfite *7681-57-4*	5		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS		Deionized water	IRSST 48-1 OSHA 10121 Réf. 18	OSHA method ID121 is for the elementary analysis of sodium. IRSST gravimetric method 48-1 can also be used if the composition of the sample is known. The addition of an ionization suppressant to the sample is suggested (see the reference book).
Starch (total dust) 48-1 *9005-25-8*	10 Pt		Polyvinyl chloride filter Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystaline silica.
Stibine (as Sb) *7803-52-3*	0.51		Silica gel tube #SKC ST226-10-02 impregnated with mercuric bichloride	0.01-0.2	50	FAAS		Concentrated hydrochloric acid	NIOSH 6008 IRSST 55-2	IRSST method 55-2 is for analyzing antimony and can be adapted to stibine. The sampling conditions in NIOSH method 6008 are used.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Stoddard solvent 80-1	*8052-41-3*	525		Activated charcoal tube #SKC ST22601	Maximum: 0.2	10	GC-FID	275	Carbon disulfide		A process sample must be supplied.
Strychnine	*57-24-9*	0.15		Glass fiber filter #SKC FLT225 7	1-3	180	HPLC-UV	0.8	Solution of 1-heptane sulfonic acid: acetonitrile: water buffered to pH 3.5	NIOSH 5016	
Styrene (monomer) 31-3	*100-42-5*	213 426	Pc C3	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	5 3	GC-FID	27	Carbon disulfide		
Styrene (monomer) 39A	*100-42-5*	213 426	Pc C3				DRI-PAD				The reported minimum value is of 0.5 mg/m^3 (0.12 ppm).
Styrene (monomer) 318-1	*100-42-5*	213 426	Pc C3	3M Organic Vapor Monitor #3500			GC-FID	27	Carbon disulfide		The recommended sampling time is of 4 hours, although it may be variable.
Subtilisins (Proteolytic enzymes as 100% pure crystalline enzyme)	*1395-21-7*	0.00006		Glass fiber filter #SKC FLT225 7	800	48000	Colo			OSHA IMIS9220	
Sucrose 48-1	*57-50-1*	10		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific.
Sulfotep	*3689-24-5*	0.2	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58			GC-FPD		Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. NIOSH method 5600 is for analyzing organophosphate compounds and can be adapted to Sulfotep. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
Sulfur dioxide 8-B	*7446-09-5*	5.2 13					DRI-elec				The reported minimum value is 1.3 mg/m^3 (0.5 ppm).
Sulfur dioxide	*7446-09-5*	5.2 13		Anasorb 747 tube (Bed of impregnated activated charcoal) #SKC ST226-80	0.1	12 1.5	IC-CD		15 mM sodium hydroxide in 0.3 N hydrogen peroxide	IRSST 211-1 OSHA ID200	IRSST method 211-1 is for analyzing inorganic acids and can be adapted to sulfur dioxide. The sampling device in OSHA method ID200 is used. Other sulfates, sulfuric acid, and sulfur trioxide (gas) may cause interference. The use of a polytetrafluorocarbon (teflon) prefilter may minimize the interference resulting from the sulfuric acid.
Sulfur hexafluoride	*2551-62-4*	5970		Sampling bag #SKC SB231-05	0.01-0.05	3	GC-TCD	1.5		NIOSH S244	
Sulfur monochloride	*10025-67-9*	5.5		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of deionized water	1	30 5	IC-CD			OSHA IMIS2320 IRSST 211-1	IRSST method 211-1 is for analyzing inorganic acids and can be adapted to sulfur monochloride. The sampling conditions in OSHA data sheet IMIS2320 are used.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Sulfur pentafluoride	*5714-22-7*	0.1									By court order, the standard for this substance as been stayed in the United States pending the development of an analytical method. No supporting method is suggested for this substance. If a request is made to the IRSST, the analytical method could be developed and will have to be validated for the substance mentioned, based on the procedure described by the IRSST, which refers to the NIOSH protocol.
Sulfur tetrafluoride	*7783-60-0*	0.44		Mixed cellulose ester filter #Nuclepore 142789 in series with a polyethylene impinger containing 10mL of 0.1 N sodium hydroxide			SE			IRSST 164-1	The filter is thrown away after sampling. IRSST method 164-1 is for analyzing hydrofluoric acid and can be adapted to sulfur tetrafluoride.
Sulfuric acid 211-1	*7664-93-9*	1 3		Treated silica gel tube SKC 226-10-03	0.2	48	IC-CD	2.5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate		Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Sulfuryl fluoride	*2699-79-8*	21 42		Activated charcoal tube #SKC ST226-16	0.1	24	IC-CD	9.6	Desorption in water with 0.04 M sodium hydroxide added	R6f. 19	
Sulprofos	*35400-43-2*	1		OVS (OSHA Versatile Sampler) tube with XAD-2 and quartz filter #SKC ST226-58	0.2-1	240	GC-FPD	60	Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. Tributyl phosphate, tris (2-butoxyethyl) phosphate, tricresyl phosphate and triphenyl phosphate may cause interference during the analysis.
2,4,5-T	*93-76-5*	10	C2 EM	Glass fiber filter, binderless #SKC FLT225-7	1-3	100	HPLC-UV	150	Methanol	NIOSH 5001	
Talc, fibrous 243-1		1 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100	0.5-16	400	PCOM				Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2.
Talc, non fibrous (respirable dust) 48-1	*14807-96-6*	3 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K	1.7	180	Grav	25			The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Tantalum [7440-257], metal and oxide dusts (as Ta) 48-1		5		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Tellurium and compounds (as Te)	*13494-80-9*	0.1		Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS		Nitric acid: hydrochloric acid	OSHA ID121	Copper may cause interference during the analysis.
Tellurium hexafluoride (as Te)	*7783-80-4*	0.1		Mixed cellulose ester filter #SKC ST225-5 in series with an activated charcoal tube #SKC ST226-01	1.1	390	FAAS		0.01 N sodium hydroxide	NIOSH S187	Other tellurium compounds and zinc may cause interference during the analysis.

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Temephos	*3383-96-8*	10		OVS (OSHA Versatile Sampler) tube with XAD 2 and quartz filter #SKC ST226-58			GC-FPD		Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. NIOSH method 5600 is for analyzing organophosphate compounds and can be adapted to temephos.
TEPP	*107-49-3*	0.047	Pc	OVS (OSHA Versatile Sampler) tube with XAD-2 and glass fiber filter #SKC ST226-30-16	1	480	GC-FPD		Toluene	OSHA IMIS2334	
Terphenyls	*26140-60-3*	4.7		Glass fiber filter #SKC FLT225-7			GC-FID		Carbon disulfide	NIOSH S27	NIOSH method S27 is for analyzing o-terphenyl and can be adapted to all other isomers of terphenyls.
1,1,2,2-Tetrabromoethane	*79-27-6*	14		Silica gel tube #SKC ST226-10	0.2-1	98	GC-FID	80	Tetrahydrofuran	NIOSH 2003	
1,1,1,2 -Tetrachloro-2,2-difluoroethane	*76-11-9*	4170		Activated charcoal tube #SKC ST226-01	0.01-0.35	2	GC-FID	300	Carbon disulfide	NIOSH 1016	
1,1,2,2 Tetrachloro-1,2-difluoroethane 190-1	*76-12-0*	4170		Activated charcoal tube #SKC ST226-01	Maximum: 0.05	2	GC-FID	417	Carbon disulfide		Since a specific analysis is recommended, no other substance may be sampled simultaneously.
1,1,2,2-Tetrachloroethane 158-1	*79-34-5*	6.9	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	17	Carbon disulfide		
Tetrachloronaphthalene	*1335-88-2*	2		Mixed cellulose ester filter #SKC FLT225-5 in series with a glass midget impinger #SKC IMP225-36-1 containing 15 ml of isooctane	1.3	100	GC-ECD			NIOSH S130	The level of isooctane in the impinger must be frequently checked since this substance evaporates easily during sampling. Tetrachloronaphthalene is an isomeric mixture; analysis is therefore done on a group of peaks.
Tetrahydrofuran 179-1	*109-99-9*	300		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	9	GC-FID	53	Carbon disulfide		
Tetramethyl succinonitrile	*3333-52-6*	2.8	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 1	55	GC-FID		Carbon disulfide	NIOSH S155	
Tetranitromethane	*509-14-8*	8		Glass midget impinger #SKC IMP 225-36-1 containing 15 mL of ethyl acetate	1	250	GC-FID			NIOSH S224	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Tetrasodium pyrophosphate	*7722-88-5*	5		Mixed cellulose ester filter #SKC FLT225-5	2	960	IC-CD		Deionized water	OSHA IMIST102 IRSST 211-1	IRSST method 211-1 is for analyzing phosphates and can be adapted to tetrasodium pyrophosphate. The sampling conditions in OSHA data sheet IMIST 102 are used.
Tetryl	*479-45-8*	1.5		Mixed cellulose ester filter #SKC FLT225-5	1.5	100	Colo	150	N,N-diethylethanolamine	NIOSH S225	Other aromatic nitro compounds may cause interference.

Table of substances in RRQWE

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Thallium [7440-28-0], soluble compounds (as TI)	0.1	Pc	Mixed cellulose ester filter #SKC FLT225-5	2	960	FAAS		Nitric acid: water	OSHA ID121	
4,4'-Thiobis (6-tert-butyl-m-cresol) 48-1 *96-69-5*	10		Polyvinyl chloride filter #Omega P08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Thioglycolic acid *68-11-1*	3.8	Pc	Glass midget impinger #SKC IMP 225-36-1 containing 15 mL of deionized water	1	120	HPLC-UV			OSHA IMIS2423	A copy of the OSHA file is available in the IRSST files.
Thionyl chloride *7719-09-7*	5		Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of water	1	15	ICCD			IRSST 211-1 OSHA IMIST104	During sampling, thionyl chloride is hydrolyzed by water and produces sulfur dioxide and hydrochloric acid. A method must be developed using the sampling device in IMIS T104 and the analytical technique of IRSST method 211-1.
Thiram® *137-26-8*	5		Polytetrafluorocarbon (teflon) filter ASKC FLT225-7	1-3	240	HPLC-UV	5	Acetonitrile	NIOSH 5005	
Tin [744031-5], Organic compounds (as Sn)	0.1	Pc							OSHA IMIS2431	Every organic compound of tin must be treated as a specific case (see the IRSST file).
Tin [7440-31-5], Oxide and inorganic compounds, except SnH4 (as Sn) 5-1	2		Mixed cellulose ester filter Omega M083700AFor Omega M-082500AFP	1.5	180	FAAS	50	Concentrated hydrochloric acid		Specific sampling must be carried out for this substance. The analytical results are expressed as total tin.
Tin, Metal 5-1 *7440-31-5*	2		Mixed cellulose ester filter Omega M083700AF or Omega M082500AFP	1.5	180	FAAS	50	Concentrated hydrochloric acid		Specific sampling must be carried out for this substance. The analytical results are expressed as total tin.
Titanium dioxide (total dust) 48-1 *13463-67-7*	10 Pt		Polyvinyl chloride filter #Omega P-08370K	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
o-Tolidine *119-93-7*		Pc C2	Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.0011	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine gioup with HFBA (heptafluorobutyric acid anhydride).	OSHA 71	The filters must be transferred to vials containing deionized water within 10 hours of sampling. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. Any compound that reacts with the sulfuric acid on the filters may cause interference.
Toluene 16-2 *108-88-3*	377 565		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	5 3	GC-FID	10	Carbon disulfide		

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	References	Remarks
Toluene diisocyanate (TDI) (isomers mixture) 236-1 *26471-62-5*	0.036 0.14	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700	1	15	HPLC-UV-Flu	0.031	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 236-1 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 226-2. The results are then expressed as total monomeres or total oligomeres. "The glass fiber filters are heated to 400^{0}C and then impregnated with (N methyl ammo-methyl)-9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4°C, before and after sampling. If possible, hardener must also be sent.
Toluene diisocyanate (TDI) (isomers mixture) 226-1 *26471-62-5*	0.036 0.14	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700	1	15	HPLC-UV-Flu	0.029	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile		The results of method 226-1 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 236-2. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N-methyl-amino-methyl) 9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
o-Toluidine *95-53-4*	8.8	Pc C2	Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.097	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 73	OSHA method 73 is valid for the three isomers of toluidine. Any compound that reacts with the sulfuric acid on the filters may cause interference.
m-Toluidine *108-44-1*	8.8	Pc	Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.079	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 73	OSHA method 73 is valid for the three isomers of toluidine. Any compound that reacts with the sulfuric acid on the filters may cause interference.
p-Toluidine *106-49-0*	8.8	Pc C2	Two glass fiber filters #SKC FLT225-7 impregnated with sulfuric acid. (The filters must be impregnated in the laboratory.)	1	100	GC-ECD	0.055	Desorption in water with sodium hydroxide added. Then, extraction in toluene, followed by derivatization of the amine group with HFBA (heptafluorobutyric acid anhydride).	OSHA 73	OSHA method 73 is valid for the three isomers of toluidine. Any compound that reacts with the sulfuric acid on the filters may cause interference.
Tributyl phosphate *126-73-8*	0.22		Mixed cellulose ester filter #SKC FLT225-5	1.5	100	GC-FPD	2	Ether	OSHA IMIS2477 NIOSH S208	According to OSHA data sheet IMIS2477, two mixed cellulose ester filters in series can be used in the case where the temperature of the sampling site exceeds 23°C. A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Trichloroacetic acid *76-03-9*	6.7		Silica gel tube #SKC ST226-10	0.2	10	HPLC-UV		Deionized water	OSHA IMIST337	

RRQWE Name	CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	Refe-rences	Remarks
1,2,4- Trichlorobenzene	*120-82-1*	37		Polytetrafluorocarbon (teflon) filter #SKC FLT225-17-03 in series with an XAD 2 tube #SKC ST226-30-04	0.010.2	10	GC-ECD	0.005	Hexane	NIOSH 5517	A flame ionization detector and carbon disulfide as desorption solvent can be used.
1,1,2-Trichloroethane 102-1	*79-00-5*	55	Pc	Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	22	Carbon disulfide		
Trichloroethylene 75-3	*79-01-6*	269 1070		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10 3	GC-FID	58	Carbon disulfide		
Trichlorofluoromethane 151-1	*75-69-4*	5620		Activated charcoal tube #SKC ST226-09	Maximum: 0.05	4	GC-FID	1120	Carbon disulfide		Trichlorofluoromethane must be sampled specifically in reason of the sampling device used.
Trichloronaphthalene	*1321-65-9*	5	Pc	OVS (OSHA Versatile Sampler) tube with XAD 2 and glass fiber filter #SKC ST226-30-16	1	100	GC-ECD		Toluene	OSHA IMIS2483	
1,2,3- Trichloropropane	*96-18-4*	60	Pc	Activated charcoal tube #SKC ST226-01	0.01-0.02	10	GC-FID	10	Carbon disulfide	NIOSH 1003	
1,1,2Trichloro-1,2,2-trifluoroethane 191-1	*76-13-1*	7670 9590		Activated charcoal tube #SKC ST226-01	Maximum: 0.05	1.5 0.75	GC-FID	570	N.NDimethylacetamide		A specific desorption must be carried out for this substance.
Triocresyl phosphate	*78-30-8*	0.1	Pc	Mixed cellulose ester filter #SKC FLT225-5	1.5	100	GC-FPD	0.05	Ether	NIOSH S209	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Triethylamine	*121-44-8*	41 62		XAD 7 tube impregnated with 10% (w/w) 7-chloro-4-nitrobenzo-2-oxa-1,3diazole (NBD chloride) #SKC ST226-96			HPLC-Flu		Tetrahydroturan: 7chloro-4-nitrobenzo-2-oxa-1,3 diazole (95:5)	OSHA 41	The tubes are stable for two months. OSHA method 41 is for analyzing diethylamine and can be adapted to triethylamine. A detector in the visible range can be used.
Trimellitic anhydride	*552-30-7*	0.039		Glass fiber filter #SKC FLT225 -7 impregnated with veratrylamine and di-N-octylphthalate. (The filters must be impregnated in the laboratory.)	2.0	480	HPLC-UV	0.3	Ammonium hydroxide	OSHA 98	
Trimethyl benzene 251-1	*25551-13-7*	123		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	62	Carbon disulfide		
Trimethylphosphite	*121-45-9*	10		OVS (OSHA Versatile Sampler) tube with XA0- 2 and quartz filter #SKC ST226-58			GC-FPD		Toluene: acetone (90:10)	NIOSH 5600	A nitrogen and phosphorus detector can be used to improve analytical sensitivity. NIOSH method 5600 is for analyzing organophosphate pesticides and can be adapted to trimethyl phosphite.
Trimethylamine	*75-50-3*	24 36		XAD 7 tube impregnated with 10% (wfw) 7-chloro-4nitrobenzo-2-oxa 1,3-diazole (NBD chloride) #SKC ST226-96			HPLC-Flu		Tetrahydroftiran: 7-chloro-4 nitrobenzo-2 oxa-1,3-diazole (95:5)	OSHA 34	The tubes are stable for two months. OSHA method 34 is for analyzing dimethylamine and can be adapted to trimethylamine. A detector in the visible range can be used.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value	Desorption Digestion	References	Remarks
2,4,6-Trinitrotoluene (TNT) ***118-96-7***	0.5	**Pc**	Mixed cellulose ester filter #SKC FLT 225-5 in series with a glass midget impinger //SKCIMP225-36 1 containing 10 mL of ethylene glycol			HPLC-UV		**A** volume of 5 mL of methanol is added to the contents of the impinger.	NIOSH S215	NIOSH method S215 is for analyzing dinitrotoluene and can be adapted to 2,4,6 trinitrotoluene (TNT).
Triphenyl amine ***603-34-9***	**5**		Glass fritted tip impinger # SKC IMP 225-36-2 containing 15 mL of isopropanol	1	250	HPLC-UV			OSHA IMIS2534	
Triphenyl phosphate ***115-86-6***	**3**		Mixed cellulose ester filter # SKC FLT225-5	1.5	100	GC-FPD	10	Ether	NIOSH S210	A nitrogen and phosphorus detector can be used to improve analytical sensitivity.
Tungsten [7440-33-7] (as W) , Insoluble compounds	**5** 10		Mixed cellulose ester filter # SKC FLT225-5	1-4	1000	FAAS	125	Hydrofluoric acid: nitric acid (1:1)	NIOSH 7074	Other types of digestion can be considered, based on the tungsten compounds present in the sample.
Tungsten [7440-33-7] (as W) , Solub/e compounds	**1** **3**		Mixed cellulose ester filter # SKC FLT225-5	1-4	1000	FAAS	50	Deionized water	NIOSH 7074	
Turpentine **254-1** ***8006642***	556		Activated charcoal tube # SKC ST2260-1	Maximum: 0.2	10	GC-FID	125	Carbon disulfide		A process sample must be supplied.
Uranium (natural) [7440-61-1], Soluble compounds (as U)	0.05		Low ash polyvinyl chloride filter # SKC FLT225-8-01	2	240	Polaro	0.2	0.05 M tartaric acid: 0.05 M triethanolamine	OSHA ID170SG	
Uranium [7440-61-1] (natural), Insoluble compounds (as U)	0.2 **0.6**		Mixed cellulose ester filter # SKC FLT225-5	2	960 30	ICP			OSHA IMIS2560	
n-Valeraldehyde **334-1** ***110-62-3***	176		Orbo 23 tube # KSupelco 2-0257	0.1	10	GC-MS	**0.3**	Toluene		Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Vanadium pentoxide, fume and respirab/e dust (as V205)	0.05		Polyvinyl chloride filter # SKC FLT225-5	2	480	ICP	**1.9**	Sulfuric acid: hydrogen peroxide	OSHA ID125G	
Vegetable oil mists (except castor, cashew and other similar irritant oils) ***68956-68-3***	10		Mixed cellulose ester filter # Nuclepore 142789			FTIR		Carbon tetrachloride	IRSST 51-2	IRSST method 51-2 is for analyzing mineral oil mists and can be adapted to vegetable oil mists.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m^3)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Vinyl acetate 208-2 *108 05 4*	35 70		ORBO 92 (Carboxen-564 carbon molecular sieve)	Maximum: 0.2	12 3	GCFID	7.5	Methylene choride: methanol (95:5)		Vinyl acetate must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Vinyl bromide *593-60-2*	22	C2 EM	Activated charcoal tube #SKC ST226 01	0.010.2	6	GCFID		Ethanol (ultrasonic bath)	NIOSH 1009	The chromatographic conditions for this method do not allow bromine to be separated from vinyl bromide.
Vinyl chloride (monomer) 862 *75-01-4*	2.5 13	C1 RP	Activated charcoal tube #SKC ST22601	Maximum: 0.05	5 0.75	GC-FID	0.64	Carbon disulfide		Since a specific analysis is recommended, no other substance may be sampled simultaneously.
Vinyl cyclohexene dioxide *106-87-6*	57	Pc C2	XAD 2 tube #SKC ST226 30 05		10	GCFID		Carbon disulfide	OSHA IMIS 2581	
Vinyl toluene *25013-15-4*	242 483		Activated charcoal tube #SKC226-01	Maximum: 0.2	10	GC-FID	10	Carbon disulfide	NIOSH 1501	Other volatile organic solvents may cause interference during the analysis. The use of a less polar column or a different column temperature may minimize these interferences.
VM&P Naphtha 29-1 *8032-32-4*	1370		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	10	GC-FID	170	Carbon disulfide		A process sample must be supplied.
Warfarin *81-81-2*	0.1		Polytetrafluorocarbon (teflon) filter #SKC FLT225 17 01	1-3	408	HPLC-UV	2.5	Methanol	NIOSH 5002	
Welding fumes (not otherwise classified) 48-1	5		Polyvinyl chloride filter Omega P-082550 (25mm) or P-08370K (37 mm) or mixed cellulose ester filter Omega M-082500AFP (25 mm) or M-083700AF (37mm) if any metal analysis is required	1.5	180	Grav	25			To evaluate welding fumes, personal sampling must be carried out within the mask. Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Wood dust (red cedar) 48 1	2.5		Polyvinyl chloride filter, with capsule (Accu-Cap)	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03,92-02 and 98 06. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Wood dust hard and soft, except red cedar 48-1	5		Polyvinyl chloride filter, with capsule (Accu-Cap)	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Xylene (o,m,p- isomers) 101-2 *1330-20-7*	434 651		Activated charcoal tube #SKC ST226-01	Maximum: 0.2	12 3	GC-FID	50	Carbon disulfide		
m-Xylenealpha, alpha'-diamine *1477-55-0*	0.1	Pc	Glass fritted tip impinger #SKC IMP 225-36-2 containing 10 mL of deionized water	1	5	HPLC-UV			OSHA IMIS2592	
Xylidine (mixed isomers) *1300-73-8*	2.5	Pc C2	Silica gel tube #SKC ST226-10	0.02-0.2	20	GCFID	10	Ethanol: water (95:5) (ultrasonic bath)	NIOSH 2002	A nitrogen and phosphorus detector and a capillary column can be used to improve analytical sensitivity and chromatographic separation, respectively.

RRQWE Name CAS	TWAEV STEV Ceiling (mg/m³)	Nota-tions	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Refe-rences	Remarks
Yttrium (7440-65-5), metal and compounds (as Y)	1		Mixed cellulose ester filter #SKC FLT225-5			FAAS		Concentrated nitric acid	OSHA ID121	OSHA method ID121 is for analyzing metallic elements and compounds and can be adapted to yttrium. Other types of digestion can be used in relation to the yttrium compounds present in the sample.
Zinc chloride, fume 17-2 *7646-85-7*	1		Mixed cellulose ester filter Omega M 083700AF or Omega M082500AFP	1.5	180	FAAS	1	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total zinc.
Zinc chromates (as Cr) 271-1 *13530-65-9*	0.01	C1 RP	Polyvinyl chloride filter Omega P-50370K and polyethylene container	1.5	360	IC-VIS	0.2	Sodium hydroxide: sodium carbonate: water (2:3:95)		The filter must be handled with plastic tweezers and be transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST (#2625).
Zinc stearate 48-1 *557-05-1*	10		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals are required.	1.5	180	Grav	25			Additional information is available in Info-Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Zinc, oxide, Dust (total dust) 48-1 *1314-13-2*	10 Pt		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M 083700AF if metals are required.	1.5	180	Grav	25			Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Zinc, oxide, Fume 17-2 *1314-13-2*	5 10		Mixed cellulose ester filter Omega M 083700AF or Omega M082500AFP	1.5	180	FAAS	1	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid		The analytical results are expressed as total zinc.
Zirconium [7440-67-7] and compounds (as Zr)	5 10		Mixed cellulose ester filter #SKC FLT225-5			FAAS		Concentrated hydrofluoric acid	OSHA ID121	OSHA ID-121 is for analyzing metallic elements and compounds and can be adapted to zirconium. The addition of ammonium fluoride can minimize the interferences. Other types of digestion can be used, based on the zirconium compounds present in the sample. Fluoride, chloride, ammonium, sulfate and nitrate salts and nickel bromide may cause interference during the analysis.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Acetaldehyde 322-1 *75-07-0*	180 270	C3	Orbo 23 tube #Supelco 20257 2186 Orbo 23	0.1	10	GC-MS	0.09	Toluene	The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The tubes must be stored in the freezer before and after sampling. The use of an "Icepak" is not necessary when shipping samples.
Acetic acid 195 2 *64-19-7*	25 37		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	1	50	HPLC-UV	21.6	0,1 N sodium hydroxide	IRSST method 195-2 is for the specific analysis of acetic acid.
Acetone 22-2 *67-64-1*	1780 2380		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	2 1.5	GC-FID	180	Carbon disulfide	
Acetone 39-A *67-64-1*	1780 2380					DRI-PAD			The reported minimum value is of 1 mg/m^3 (0.4 ppm).
Acetone 555-1 *67-64-1*	1780 2380		3M Organic Vapor Monitor #3500 2695 Passive dosimeter			GC-FID	180	Carbon disulfide	The recommended sampling time is of 4 hours, although it may be variable.
Acetylene 9-C *74-86-2*		Ax				DRI-EX			IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Acrolein 326-1 *107-02-8*	0.23 0.69		Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GC-MS	0.02	Toluene	The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The tubes must be stored in the freezer before and after sampling. The use of an "Icepak" is not necessary when shipping samples.
Acryionitrile 147-2 *107-13-1*	4.3	Pc C2 RP EM	Activated charcoal tube #SKC ST22601 2120 Activated charcoal #11	Maximum: 0.2	20	GC-FID	8	N,N Dimethylacetamide containing propionitrile as an internal standard	Specific desorption must be carried out for this substance.
Allyl alcohol 169-1 *107-18-6*	4.8 9.5	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	2.5	Carbon disulfide	
Aluminum (as Al), Metal 11-2 *7429-90-5*	10		Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	20	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total aluminium.
Aluminum [7429-90-5], (as Al), Pyro powders 48-1	5		Polyvinyl chloride filter Omega P08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the sampling and desorption parameters (use of lithium borate) described in OSHA data sheet IMISA101 and the analytical conditions in IRSST method 11-2. The gravimetric method for dusts is by definition nonspecific.

RRQWE Name Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (M	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Aluminum [7429-905], (as Al), Soluble salts 212-3		2		Polyvinyl chloride filter Gelman 66467 903 PVC filter 37	1.5	180	FAAS	20	Water at room temperature	Specific sampling must be carried out for this substance. The analytical results are expressed as total aluminium (soluble compounds).
Aluminum [7429 90-5], (as Al), Welding fumes 11-2		5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter-25	1.5	180	FAAS	20	Nitric acid: perchloric acid (4:1), concentrated hydrochloric add finally, concentrated nitric acid	To evaluate welding fumes, personal sampling must be carried out within the mask. Aluminium oxides formed while welding are not made soluble with the actual digestion method. The analytical results are expressed as total aluminium.
Aluminum oxide (as Al) (total dust) 48-1	*1344-28-1*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92 02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% crystalline silica.
2-Aminoethanol 303-1	*141-43-5*	7.5 15		XAD-2 tube impregnated with 10%(w/w) 1-naphthylisothiocyanate (NIT) # SKC ST226-30-18 2170 XAD-2/ NIT	0.2	4	HPLCUV	0.15	Acetonitrile	
Ammonia 220-1	*7664-41-7*	17 24		Carbon bead tube #SKC ST226-29 pretreated with sulfuric acid 2144 Pretreated carbon beads	0.10-0.5	24 7.5	ICCD	9.4	Demineralized water at room temperature	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 may cause interference. The analytical results are expressed as ammonia (NH3).
Ammonia 39-A	*7664-41-7*	17 24					DRIPAD			The reported minimum value is 0.5 mg/m³ (0.80 ppm).
Ammonium chloride fume 48-1	*12125-02-9*	10 20		Polyvinyl chloride filter #Omega P08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91 03 and 92-02. If the substance needs to be identified, a method must be developed using the sampling parameters and device in OSHA method ID 188 and the analytical conditions in IRSST method 220-1. The gravimetric method for dusts is by definition nonspecific.
Ammonium sulfamate 48-1	*7773-06-0*	10		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the sampling parameters and device in OSHA method ID188 and the analytical conditions in IRSST method 220 1. The gravimetric method for dusts is by definition nonspecific.
n-Amylacetate 74-1	*628-63-7*	532		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	265	Carbon disulfide	
sec-Amyl acetate 272-1	*626-38-0*	665		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	335	Carbon disulfide	
Antimony [7440360] metal and compounds (as Sb) 55-2		0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	10	Concentrated nitric acid.concentrated hydrochloric acid	Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Antimony trioxide (as Sb) 55-2 *1309-64-4*	0.5	C3	Mixed cellulose ester filter Omega M-083700AF or Omega M-083700AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	10	Concentrated nitric acid, concentrated hydrochloric acid	Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
Antimony trioxide, production (as Sb) 55-2 *1309-64-4*	0.5	C2 RP EM	Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter-25	1.5	180	FAAS	10	Concentrated nitric acid, concentrated hydrochloric acid	Specific sampling must be carried out for this substance. The analytical results are expressed as total antimony.
Argon 26-C *7440-37-1*		Ax				DRI-elec			Since argon is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26-C). The reported minimum value is 1% oxygen.
Asbestos, Actinolite 243-1 *12172-67-7*	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.516	400	PCOM			Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm². Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Asbestos, Amosite 243-1 *12172-73-5*	0.2 f/cc 1 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open cassette sampling. A flow rate not exceeding 2.5 Lfmin is recommended for determining an average concentration. The standard is applicable where the use of this product is permitted. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm². Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Asbestos, Anthophyllite 243-1 *17068-78-9*	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open cassette sampling. A flow rate not exceeding 2.5 Lfmin is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Asbestos, Chrysotile 243-1 *12001-29-5*	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open cassette sampling. A flow rate not exceeding 2.5 Lfmin is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (U	Principle	Min. Value	Desorption Digestion	Remarks
Asbestos, Crocidolite 243-1 12001-28-4	0.2 f/cc 1 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE fitter 25	0.5-16	400	PCOM			Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The standard is applicable where the use of this product is permitted. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Asbestos, Tremolite 243-1 14567-73-8	1 f/cc 5 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open cassette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Asphalt (petroleum) fumes 201-1 8052-42-4	5		Glass fiber filter pretreated in the laboratory #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 20264 2187 Orbo 42 911 GF filter-37	2	960	Grav	50	Benzene	The sampling device includes a cassette followed by a tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. Ten polycyclic aromatic hydrocarbons (PAH) are analyzed on the filter and tube.
Barium, soluble compounds (as Ba) 57-1 7440-39-3	0.5		Polyvinyl chloride filter #Gelman 66467 903 PVC filter 37	1.5	180	FAAS	5	Demineralized water at room temperature	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble baryum.
Barium sulfate (respirable dust) 481 7727437	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Barium sulfate (total dust) 48-1 7727437	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92 02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Benzene 24-3 71-43-2	3 15.5	C1 RP EM	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	12 3	GC-FID	3	Carbon disulfide	The use of carbon disulfide with low benzene content is strongly recommended.
Benzo(a)pyrene 282-1 50-32-8	0.005	C2 RP EM	Pretreated glass fiber filter in the laboratory #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264 2187 Orbo 42 911 GF filter-37	2	960	GC MS	0.02	Benzene	The sampling device includes a cassette followed by a tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Benzyl chloride 253-1 100447	5.2		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	2.7	Carbon disulfide	
Bismuth telluride (as Bi2Te3), Sedoped 48-1	5		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m³)	Notations	Sampling Device	Flow rate (L/min)	Volumes [TWAEV] (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Bismuth tellurite fas Bi2Te3), Undoped	48-1	*1304-82-1*	10		Polyvinyl chloride filter #Omega P08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in InfoLabo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Boron oxide	48-1	*1303-86-2*	10		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in InfoLabo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Bromotrifluoromethane	181-1	*75-63-8*	6090		Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01 2120 Activated charcoal #1 2121 Activated charcoal 02	Maximum: 0.05	1	GCFID	305	Carbon disulfide	The bromotrifluoromethane must be sampled specifically in reason of the sampling device used.
1,3-Butadiene	171-1	*106-99-0*	22	C2 EM	Activated charcoal tube impregnated with TBC #SKC ST226-73 2189 Activated charcoal with TBC	Maximum: 0.075	10	GC-FID	4.4	Carbon disulfide	Butadiene-1,3 must be sampled specifically in reason of the sampling device used.
Butane	9-C	*106-97-8*	1900					DRIEX			IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Butane	182-1	*106-97-8*	1900		Mylar sampling bag #Calibrated Instruments Inc. IC-5 1905 Bag 5		1	GCFID			IRSST method 182-1 is for analyzing total hydrocarbons (C1 to C4). This method is currently in revaluation. Please contact the laboratory's Customer service department to learn of its availability.
2-Butoxyethanol	94-2	*111-76-2*	121	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	27	methylene chloride: methanol (95:5)	Specific desorption must be carried out for this substance.
n-Butylacetate	77-1	*123-86-4*	713 950		Activated charcoal tube #SKC ST22601 2120 Activated charcoal #1	Maximum: 0.2	10 3	GCFID	71	Carbon disulfide	
sec-Butyl acetate	274-1	*105-46-4*	950		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	475	Carbon disulfide	
tert-Butyl acetate	275-1	*540-88-5*	950		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	475	Carbon disulfide	
n Butyl alcohol	90-1	*71-36-3*	152	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0 2	10	GCFID	81	Carbon disulfide	
sec Butyl alcohol	276-2	*78-92-2*	303		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	65	Carbon disulfide	
tert-Butyl alcohol	277-1	75-65-0	303 455		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	150	Carbon disulfide	
Cadmium [7440-43 9], dusts and salts (as Cd)	19-2		0.05	C2 EM	Mixed cellulose ester filter Omega M-083700AF or Omega M 082500AFP 905 MCE filter 37 915 MCE fitter 25	1.5	180	FAAS	0.5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total cadmium.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Cadmium oxide, Fume (as Cd) 19-2 *1306-19-0*	0.05	C2 EM	Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	0.5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total cadmium.
Cadmium oxide. Production fas Cd) 19-2 *1306-19-0*	0.05	C2 RP EM	Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	5.5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total cadmium.
Calcium carbonate 48-1 *1317-65- 3*	10 Pt		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M 083700AF if metals must be analized 902 PVC filter-37 913 MCE filter 37	1.5	180	Grav	50		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Calcium hydroxide 1-1 *1305-62-0*	5		Mixed cellulose ester filter Omega M083700AF ou Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	5	Concentrated nitric acid, then nitric acid: perchloric acid (2:1)	Specific sampling must be carried out for this substance, The analytical results are expressed as total calcium.
Calcium oxide 1-1 *1305-78-8*	2		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	5	Concentrated nitric acid, then nitric acid: perchloric acid (2:1)	Specific sampling must be carried out for this substance, The analytical results are expressed as total calcium.
Calcium silicate (synthetic) (total dust) 48-1 *1344-95-2*	10 Pt		Polyvinyl chloride filter Omega P08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Calcium sulfate (respirable dust) 48-1 *7778-18-9*	5 Pr		Cyclone in series with a polyvinyl chloride filter Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals must be analysed 902 PVC filter-37 913 MCE filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted at the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Calcium sulfate (total dust) 48-1 *7778-18-9*	10 Pt		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals must be analysed 902 PVC filter-37 913 MCE filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92 02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Camphor (synthetic) 83-1 *76-22-2*	12 19		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum. 0.2	20 3	GCFID	12	Carbon disulfide: methanol (99:1)	Specific desorption must be carried out for this substance
Captan 48-1 *133-06-2*	5		Polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMIS0529. The gravimetric method for dusts is by definition nonspecific.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m³)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Carbon black 48-1 *1333-86-4*	3.5		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	15	180	Grav	25		Additional information is available in InfoLabo 91-03 and 92-02. If the required analysis is for one or more substances adsorbed by carbon black, the standards and methods corresponding to these substances must be followed. The quantitative method for dusts ts by definition nonspecific.
Carbon dioxide 34-C *124-38-9*	9000 54000					DRIIR			The reported minimum value is 18 mg/m³ (10 ppm).
Carbon dioxide 39-A *124-38-9*	9000 54000					DRIPAO			The reported minimum value is of 5.4 mg/m³ (3 ppm).
Carbon monoxide 115-1 *630-08-0*	40 230		Mylar sampling bag #Calibrated Instruments Inc. IC-5 1905 Bag 5		5	IRnd			The reported minimum value is 0.2 ppm. This method is currently under revaluation. Please contact the laboratory Customer service department to learn of its availability.
Carbon monoxide 3-B /36B *630080*	40 230					DRI-elec			The reported minimum value is 1.1 mg/m³ (1 ppm).
Carbon monoxide 39A *630080*	40 230					DRI-PAD			The reported minimum value is of 0.2 mg/m³ (0.2 ppm).
Carbon tetrachloride 157-2 *56-23-5*	31	Pc C2 EM	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	15	GCFID	25	Carbon disulfide	
Cellulose (paper fibres) (total dust} 48-1 *9004-34-6*	10 Pt		Polyvinyl chloride filter with capsule (AccuCap) 910 PVC filter 37 with capsule (AccuCap)	15	180	Grav	25		Additional information is available in InfoLabo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Chlorodifluoromethane 153-1 *75-45-6*	3540		Activated charcoal tube #SKC ST226-09 2121 Activated charcoal *#2*	Maximum: 0.05	3	GC-FID	525	Benzyl alcohol	Chlorodifluoromethane must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Chloroform 26-2 *67-66-3*	24.4	C2 RP EM	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	15	GCFID	22	Carbon disulfide	
Chromite ore processing (chromate) (as Cr) 271-1	0.05	C1 RP EM	Polyvinyl chloride filter Omega P-50370K and polyethylene container 1116 PE container 922 PVC filter-37	15	360	IC-VIS	0.2	Sodium hydroxide: sodium carbonate: water (2:3:95)	The filter must be handled with plastic tweezers and transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment (#2625) is available at the IRSST.
Chromium (metal) 3-2 *7440-47-3*	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AF 905 MCE filter 37 915 MCE filter 25	15	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total chromium.
Chromium (III) compounds (as Cr, 32	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	15	180	FAAS	5	Nitric acid, perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total chromium.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Chromium (III) compounds (as Cr) 3-2	0.5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	15	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total chromium.
Chromium (VI) compounds, Certain water insoluble (as Cr) 271-1	0.05	C1 RP EM	Polyvinyl chloride filter Omega P-50370K and polyethylene container 1116 PE container 922 PVC filter-37	15	360	ICVIS	0.02	Sodium hydroxide: sodium carbonate: water (2:3:95)	The filter must be handled with plastic tweezers and transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST.
Chromium (VI) compounds, Water soluble (as Cr) 271-1	0.05		Polyvinyl chloride filter Omega P-50370K and polyethylene container 1116 PE container 922 PVC filter 37	15	360	IC-VIS	0.02	Sodium hydroxide: sodium carbonate: water (2:3:95)	The filter must be handled with plastic tweezers and transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). The use of this method is not adapted to processes that produce mists containing Cr VI (i.e. electrolytic plating); in this case, method 03-2 for total chromium is recommended. Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST.
Chrysene 307-1 *218019*		C2 RP EM	Pretreated glass fiber filter in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264 2187 Orbo 42 911 GF filter 37	2	960	GCMS	0.02	Benzene	In the sampling train, the cassette comes first followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Clopidol 48-1 *2971-90-6*	10		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	15	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Coal dust (less than 5% crystalline silica) (respirable dust) 48-1 *53570-85-7*	2 Pr		Cyclone in series with a polyvinyl chloride filter #0mega P-08370K 902 PVC filter-37	17	800	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Coal dust (more than 5% crystalline silica) (quartz respirable dust) 56-3 *53570-85- 7*	0.1 Pr		Cyclone in series with a silver membrane filter from Selas 907 Ag filter-25	17	800	XRD	15		This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Coal dust (more than 5% crystalline silica) (quartz respirable dust) 206-2 *53570-85-7*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	17	800	XRD	6		

Table of substances analyzed by the IRSST

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Coal dust (more than 5% crystalline silica) (quartz respirable dust)	78-1	*53570-85-7*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	800	FTIR	6		
Coal tar pitch volatiles, as benzene solubles	201-1	*65996-93-2*	0.2	C1 RP EM	Pretreated glass fiber filter in the laboratory #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0264 2187 Orbo 42 911 GF filter-37	2	960	Grav	50	Benzene	The sampling device includes a cassette followed by a tube. The samples must be stored in the freezer until analysis The tubes and filters must be shipped together. The result of gravimetric analysis is used to establish compliance with the standard Ten polycyclic aromatic hydrocarbons (PAHs) are determined on the filter and the tube.
Cobalt [7440-48-4], metal dust and fume (as Co)	2-3		0.05		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter-25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total cobalt.
Copper [7440 50-8], Dust and mists (as Cu)	4-3		1		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total copper.
Copper [7440-50-8], Fume (as Cu)	4-3		0.2		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total copper.
Corundum (Emery) (total dust)	48-1	*1302-74-5*	10 Pt		Polyvinyl chloride filter Omega P08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Cotton dust, raw	48-1		0.5		Vertical elutriator and polyvinyl chloride filter Gelman 66467 904 PVC filter-37	7.4	450	Grav	25		Sampling must be carried out with the cassette open. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Cresol (all isomers)	172-1	*1319-77-3*	22	Pc	Silica gel tube #SKC ST226-10 2140 Silica gel #1	Maximum: 0.2	20	GC-FID	22	Acetone	Cresols must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Cumene	159 1	*98-82-8*	246	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	86	Carbon disulfide	
Cyanides (as Cn)	40-1	*57-12-5*	5	Pc	Glass midget impinger #SKC IMP 225-36-1 containing 10 mL of 0,1 N sodium hydroxide 1401 Trap 1402 Holster 1414 Glass midget impinger	1.5	30	SE	6.5		Sample is stable for 5 days. Contact the laboratory to confirm the arrival of samples. Wipe samples for cyanides can be carried out and the required equipment is available at the IRSST. S-, Cl-, I- and Br- ions and Cd, Cu, Zn, Ag, Ni and Hg will cause interference.
Cyclohexane	194-1	*110-82-7*	1030		Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	3	GCFID	160	Carbon disulfide	

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Cyclohexanol	134-1	*108-93-0*	206	Pc	Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	100	Carbon disulfide	
Cyclohexanone	135-1	*108-94-1*	100	Pc	Chromosorb-106 tube #SKC ST226-110 2127 Chromosorb-106	Maximum: 0.2	10	GC-FID	20	Carbon disulfide	Cyclohexanone must be sampled specifically in reason of the sampling device used.
Di-sec-octyl phthalate	309-1	*117-81-7*	5 10	C3	Cellulose nitrate filter Whatman 7188 003 912 CN filter 37	1.0	30 15	HPLCUV	1.7	Acetonitrile: water (70:30)	Store in refrigerator after sampling.
Diacetone alcohol	133-1	*123-42-2*	238		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	46	Carbon disulfide: isopropanol (95:5)	Specific desorption must be carried out for this substance.
Diazinon®	228-1	*333-41-5*	0.1	Pc	Supelco 0RB0 49P tube, # 2-350 2180 Orbo 49P	0.2-1	480	GCNPD	2	Toluene: acetone (90:10), containing an internal standard (tributylphosphate)	
Dibutyl phthalate	308-1	*84-74-2*	5		Cellulose nitrate filter Whatman 7188 003 912 CN filter 37	1.0	30	HPLC UV	1.5	Acetonitrile: water (70:30)	Store in refrigerator after sampling.
o-Dichlorobenzene	62-1	*95-50-1*	301	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal A1	Maximum: 0.2	10	GCFID	150	Carbon disulfide	
p-Dichlorobenzene	37-1	100-40-7	450 660	C3	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GCFID	225	Carbon disulfide	
Dichlorodifluoromethane	152-1	75-71-8	4950		Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01 2120 Activated charcoal #1 2121 Activated charcoal #2	Maximum: 0.05	10	GCFID	743	Benzyl alcohol	Dichlorodifluoromethane must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
1,2-Dichloroethane	173-1	107-06-2	4 8	C2 EM	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	20 10	GC-FID	8.1	Benzyl alcohol	A specific desorption must be carried out for this substance.
1,2-Dichloroethylene	174-1	040-59-0	793		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	3	GCFID	120	Carbon disulfide	
Dichlorofluoromethane	185-2	75-43-4	42		Two activated charcoal tubes #SKC ST226-09 in series 2121 Activated charcoal #2	Maximum: 0.05	3	GC-FID	12.8	Benzyl alcohol	Dichlorofluoromethane must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
1.2 Dichloro-1.1.2.2-tetrafluoroethane	186-1	76-14-2	6990		Two activated charcoal tubes in series #SKC ST226-09 and #SKC ST226-01 2120 Activated charcoal #1 2121 Activated charcoal #2	Maximum: 0.05	3	GC-FID	1050	Carbon disulfide	Dichloro-1,2 tetrafluoro-1,1,2,2 ethane must be sampled specifically in reason of the sampling device used. IRSST method 186-1 is for the specific analysis of 1,2 dichloro 1,1,2,2-tetrafluoroethane
Dicyclopentadiene	242-1	77-73-6	27		Activated charcoal tube XfSKC ST226-01 2120 Activated charcoal #1l	Maximum: 0.2	20	GCFID	30	Carbon disulfide	
Diethyl ether	28-1	60-29-7	1210 1520		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	3 3	GC-FID	72	Carbon disulfide	

Table of substances analyzed by the IRSST

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m³)	Notations	Sampling Device	Flow rate (L/min)	\Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Diethyl phthalate 310-1 *84-66-2*	5		Cellulose nitrate filter Whatman 7188 003 912 CN filter-37	1.0	30	HPLC-UV	1.6	Acelonitrile: water (70:30)	Store in refrigerator after sampling.
Diisobutyl ketone 252-1 *108-83-8*	145		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 1.0	100	GC-FID	28.3	Carbon disulfide	
N,NDimethylformamide 148-1 *68-12-2*	30	Pc C2 EM	Silica gel tube #SKC ST226-10 2140 Silica gel #1	Maximum: 0.2	5	GC-FID	7.5	Carbon disulfide	N,N-dimethylformamide must be sampled specifically in reason of the sampling device used.
Dimethylphthalate 311-1 *131-11-3*	5		Cellulose nitrate filter Whatman 7188 003 912 CN filter 37	1.0	30	HPLC-UV	1.8	Acetonitrile: water (70:30)	Store in refrigerator after sampling.
Dioxane 160-2 *123-91-1*	90	Pc C3	Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	20	Carbon disulfide	
Emery (total dust) 48-1 *12415-34-8*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Enflurane 339-1 *13838-16-9*	566		Activated charcoal tube series #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	5	GCFID		Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously. Enflurane standards have limited availability because this anesthetic agent is practically no longer used in Quebec.
Epichlorohydrin 223-2 106-89-8	7.6	Pc C2 RP EM	Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	20	GCFID	9	Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously.
9C *74-84-0*		Ax				DRI-EX			Method IRSST 9-C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
2-Ethoxyethanol (EGEE) 137-2 110-80-5	18	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	6	GC-FID	5.4	Acetonitrile: ethanol (95:5)	Specific desorption must be carried out for this substance.
2-Ethoxyethyl acetate (EGEEA) 207-2 111-15-5	27	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0 2	10	GC-FID	15	Carbon disulfide	
Ethyl acetate 21-2 *141-78-6*	1440		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	6	GC-FID	80	Carbon disulfide	
Ethyl acrylate 319-1 140-88-5	20 61	C3	Activated charcoal tube #SKC ST226-73 impregnated with 4 tert butylcatechol (TBC) 2189 Activated charcoal with TBC	0.05	12	GC-FID	12	Carbon disulfide	Ethyl acrylate must be sampled specifically because of the sampling device used.
Ethyl alcohol 91-2 64-17-5	1880		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.05	1	GC-FID	95	Carbon disulfide	
Ethyl benzene 250-1 100-41-4	434 543		Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	43.3	Carbon disulfide	

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Ethylene 9-C *74-85-1*		Ax				DRIEX			IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Ethylene glycol (vapour end mist) 258-1 *107-21-1*	127		Glass fiber filter with a silica gel tube 2143 silica gel 3030 GF-13	Maximum: 0.2	10	GC^2 FID	50	Water containing an internal standard (1,6 hexanediol)	Ethylene glycol must be sampled specifically because of the sampling device used and of the specific desorption solvant. The application range and the precision must be reviewed taking into account the TLV lowering.
Ethylene oxide 39-A *75-21-8*	1.8	C2 RP EM				DRIPAD			The reported minimum value is 0.43 mg/m^2 (0.24 ppm).
Ethylene oxide 81-2 *75-21-8*	1.8	C2 RP EM	Activated charcoal tube #SKC ST226-36 2122 Activated charcoal #1	Maximum: 0.2	5	GC-FID	22.5	Benzyl alcohol	Ethylene oxide must be sampled specifically in reason of the sampling device used and of the specific desorption solvant. This method is not very well adapted to the new TLV for ethylene oxide (1994).
Fibres, Artificial Vitreous Mineral Fibres, Refractory fibres (ceramic or others) 243-1	1 f/cc	C3	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5 16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a carboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Fibrous glass, continuous filament fibres (total dust) 48 1	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fibres, Artificial Vitreous Mineral Fibres, Fibrous glass, microfibres 243-1	1 f/cc		Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter-25	0 5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Glass wool 243-1	2 f/cc	C3	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fiberslmm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Rock wool 243-1	1 f/cc	C2 EM	Mixed cellulose ester filter #environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter-25	0.5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Artificial Vitreous Mineral Fibres, Insulation wool fibres, Slag wool 243-1	1 f/cc	C2 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Natural Mineral Fibres, Wollastonite 243-1 *13983-17-0*	1 f/cc		Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5 16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Natural Mineral Fibres, Attapulgite 243-1 *12174-11-7*	1 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Natural Mineral Fibres, Erionite 244-1 *66733-21-9*		C1				PLM			A quantity of 1 to 10 g of bulk sample must be supplied to the laboratory. The use of this substance is prohibited. The reported minimum value is less than 1%.
Fibres, Organic Synthetic Fibres, Carbon and graphite fibres, total dust 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fibres, Organic Synthetic Fibres, Carbon and graphite fibres, respirable dust 48-1	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	180	Grav	25		The actual flow rale must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. +The TLV is for dust containing no asbestos and less than 1% of crystalline silica.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Fibres, Organic Synthetic Fibres, Para-aramide fibres (Keytar®. Twaron®) 243-1	1 f/cc		Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter 25	0.5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2. Supply at least 2 blanks per series of samples or 10% of sample total, whichever is highest. Send the samples in a cardboard box (#3010) available at IRSST.
Fibres, Organic Synthetic Fibres, Polyolefin fibres 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Fluorides (as F) 41-1 *16984-48-8*	2.5		Polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide 1401 Trap 1402 Holster 1416 PE midget impinger	2.0	40	SE	9.5		
Formaldehyde 295-1 *50-00-0*	3	C2 EM	XAD-2 tube impregnated with HMP 2188 XAD-2/HMP	Maximum: 0.1	25	GC-NPD	2	Toluene containing 2,4,6-collidine as an internal standard.	XAD-2 tubes #2188 impregnated with HMP (hydroxymethyl piperidine) are used for quantitative analysis of formaldehyde. These tubes must be stored in the freezer before and after sampling. IRSST method 295 1 is for the specific analysis of formaldehyde. A method for volatile aldehydes is also available at IRSST (329-1).
Formaldehyde 39-A *50-00-0*	3	C2 EM				DRI-PAD			The reported minimum value is 0.18 mg/m^3 (0.12 ppm).
Formaldehyde 329-1 *50-00-0*	3	C2 EM	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GC-MS	3	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Furfural 328-1 *98-01-1*	7.9	Pc	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GC-MS	0.11	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Furfuryl alcohol 87-2 *98-00-0*	40 60	Pc	Porapak Q tube #SKC ST226-115 2162 Porapak Q #1	Maximum: 0.05	6 0.75	GC-FID	4.7	Acetone	Furfuryl alcohol must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Gasoline 304-1 *8006-61-9*	890 1480	C3	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	0.2	10 3	GC-FID	450	Carbon disulfide	IRSST method 80-1 is for analyzing Stoddard solvent (mixture of hydrocarbons from C9 to C12) and can be adapted to gasoline (mixture of hydrocarbons from C4 to C12).
Glutaraldehyde 283-1 *111-30-8*	0.82		Two glass fiber filters #SKC ST227-5 impregnated with 2,4-dinitrophenylhydrazine (DNPH) and phosphoric acid. 921 GF Filter DNPH 37	1	15	HPLC-UV	0.27	Acetonitnle	Open cassette sampling The sampling device must be refrigerated before and after sampling.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Glycerin (mist) 48-1 56-81-5	10		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The analysis can also be carried out by using IRSST method 51-2 for mineral oil mists. The gravimetric method for dusts is by definition nonspecific.
Grain dust (oat, wheat, barley) (total dust) 48-1	4 Pt		Polyvinyl chloride filter, with capsule (AccuCap) 910 PVC filter 37 with capsule (AccuCap)	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Graphite (natural) (respirable dust) 48-1 *7782-42-5*	2.5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Graphite (synthetic, except fibres) (total dust) 48-1 *7440-44-0*	10 Pt		Polyvinyl chloride filter Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Gypsum (respirable dust) 48-1 *13397-24-5*	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Gypsum (total dust) 48-1 *13397-24-5*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Halothane 266-2 *151-67-7*	404		Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	5	GCFID	41	Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously.
Helium 26 C *744059-7*		Ax				DRIelec			Since helium is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26-C). The reported minimum value is 1% oxygen.
n-Heptane 142-1 *142-82-5*	1640 2050		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	4 3	GCFID	320	Carbon disulfide	
Hexamethylene diisocyanate 224-3 *822-06-0*	0.034	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLCUV-Flu	0.026	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 224-3 give the vapour fraction in terms of monomeres and oligomers. This method is always carried out concomitantly to method 234-2. The results are then expressed as total monomeres or total oligomeres. "The glass fiber filters are heated to 400^{0}C and then impregnated with (N-methyl-amino methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2-methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.

RRQWE Name Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Hexamethylene diisocyanate 234-2	*822-06-0*	0.034	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0.041	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 234-2 give the aerosol fraction in terms of monomeres and oligomers. This method is always carried out concomitantly to method 224-3. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N methyl aminomethyl)-9anthracene)(MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1(2methoxy phenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
n-Hexane 141-2	*110-54-3*	176		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	4	GCFIO	15	Carbon disulfide	
Hydrazine 346-1	*302-01-2*	0.13	Pc C2 RP EM	Two glass fiber filters #Gelman 66208, impregnated with sulfuric acid 925 GF Filter H2S04	1	240	HPLC-UV		Sodium phosphate buffer with EDTA	
Hydrogen 9-C	*1333740*		Ax				DRI-EX			IRSST method 9-C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Hydrogen 47-A	*1333740*		Ax				DRI-elec			Refer to the note about simple asphyxiants at the beginning of the tables. The reported minimum value is of 0.2 mg/m^3 (2 ppm).
Hydrogen bromide 211-1	*10035-10-6*	9.9		Treated silica gel tube SKC 226 10-03 2147 Silica gel	0.2	48	IC-CD	10	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate	Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Samples are stable 21 days at 25°C. All acid salts may cause positive interference.
Hydrogen chloride 211-1	7647-01-0	7.5		Treated silica gel tube SKC 226-10-03 2147 Silica gel	0.2	15	IC-CD	5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate	Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Samples are stable 21 days at 25°C. All acid salts may cause positive interference.
Hydrogen cyanide 40-1	74-90-8	11	Pc	Mixed cellulose ester filter Omega M083700AF in series with a glass midget impinger #SKC IMP225-36 1 containing 10 mL of 0.1 N sodium hydroxide 1401 Trap 1402 Holster 1414 Glass midget impinger 908 MCE filter 37	0.2	12	SE	68		The filter is thrown away after sampling. Hydrocyanic acid in sodium hydroxide is stable for one week. Contact the laboratory to confirm the arrival of the samples. Cyanide particles retained on the filter may release hydrocyanic acid in the presence of high humidity. Furthermore, S-, Cl-, I, Br- ions and Cd, Cu, Zn, Ag, Ni and Hg will cause interference.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Hydrogen fluoride (as F) 164-1 *7664-39-3*	 2.6		Mixed cellulose ester filter Omega M-083700AF in series with a polyethylene impinger containing 10 mL of 0.1 N sodium hydroxide 1401 Trap 1402 Holster 1416 PE midget impinger 908 MCE filter-37	1.5	90	SE	10		The lilter is thrown away after sampling.
Hydrogen sulfide 7-B *7783064*	14 21					DRI-elec			The reported minimum value is 1.4 mg/m^3 (1 ppm).
Hydroquinone 156-1 *123-31-9*	2		Mixed cellulose ester filter Omega M 083700AF (37 mm) and a container filled with 1% acetic acid *[ft* 919). 905 MCE filter-37 919 Ac. acetic vial	1.5	90	HPLCUV	18		The sampling method is for the aerosol form of hydroquinone. If sampling is done above 20 ^{0}C, the temperature must be noted on the analysis request form accompanying the samples. Hydroquinone is unstable on the filter and must be stabilized. Immediately after sampling, the filter must be placed in a jar containing 1% acetic acid supplied by the laboratory.
Iron trioxide, dust and fume (as Fe) 6-2 *1309-37-1*	5		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	50	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total iron.
Isoamyl acetate 273-1 *123-92-2*	532		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	260	Carbon disulfide	
Isobutyl acetate 249-1 *110-19-0*	713		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	70	Carbon disulfide	
Isobutyl alcohol 278-1 *78-83-1*	152		Activated charcoal tube #SKC ST226-01 120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	75	Carbon disulfide	
Isophorone 96-1 *78-59-1*	 28		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	12	GC-FID	15	Carbon disulfide	
Isophorone diisocyanate 230-1 *4098-71-9*	0.045	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLCUV-Flu	0.033	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 230-1 give the vapour fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 240-1. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N methyl amino methyl) 9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1-(2methoxyphenyl) piperazine (MDPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Isophorone diisocyanate 240-1 *4098-71-9*	0.045	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MISI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0.015	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 240-1 give the aerosol fraction in terms of monomeres. This method is always carried out concomitantly to method 230-1. The results are then expressed as total monomeres or total oligomeres. "The glass fiber filters are heated to 400^{0}C and then impregnated with (N methyl amino methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1-(2 methoxypheny)-piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
Isopropyl acetate 279-1 *108-21-4*	1040 1290		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	475	Carbon disulfide	
Isopropyl alcohol 93-1 *67-63-0*	985 1230		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	3 3	GC-FID	30	Carbon disulfide	
Kaolin (total dust) 48-1 *1332-58-7*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Lead and inorganic compounds, dusts and fumes (as Pb) 13-2 *7439-92-1*	0.15		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	5	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total lead.
Lead chromate (as Cr) 271-1 *7758-97-6*	0.012	C2 RP EM	Polyvinyl chloride filter Omega P-50370K and polyethylene container 1116 PE container 922 PVC filter-37	1.5	360	IC-VIS	0.2	Sodium hydroxide: sodium carbonate: water (2:3:95)	The filter must be handled with plastic tweezers and be transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST.
Magnesite (total dust) 48-1 *546-93-0*	10 Pt		Polyvinyl chloride filter Omega P-08370K or mixed cellulose filter Omega M-083700AF if metals are required. 902 PVC filter-37 913 MCE filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Magnesium oxide fume (as Mg) 82 *1309484*	10		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total magnesium.
Malathion 228-1 *121-75-5*	10	Pc	Supelco tube ORBO 49P, # 2-350 2180 Orbo 49P	0.2-1	60	GC-NPD	15	Toluene: acetone (90.10), containing an internal standard (tabutylphosphate)	

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Manganese (as Mn), Fume	7-3	*7439-96-5*	1 3		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180 22.5	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total manganese.
Manganese [7439-96-5] (as Mn), Dust and compounds	7-3		5		Mixed cellulose ester filter Omega M-083700AF ou Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total manganese.
Manganese tetroxide	7-3	*1317-35-7*	1		Mixed cellulose ester filter Omega M083700AF ou Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total manganese.
Mercury [7439-97-6], All forms except alkyl (as Hg), vapour	2-A		0.05	Pc				DRI-Am			A direct-reading instrument (by amalgamation) can be used for determining the mercury in vapor form. The lower limit of quantification is 3 µg/m^3 expressed as mercury.
Methane	9-C	*74-82-8*		Ax				DRI-EX			Method IRSST 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Methane	182-1	*74-82-8*		Ax	Mylar sampling bag #Calibrated Instruments Inc. IC-5 1905 Bag 5		5	GC-FID			IRSST method 182-1 is for analyzing total hydrocarbons (C1 to C4). Refer to the note about simple asphyxiants at the beginning of the tables. This method is currently under revaluation. Please contact the laboratory Customer service department to learn of its availability.
2-Methoxyethanol (EGME)	138-3	*109-86-4*	16	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	9.6	Acetonitrile: ethanol (95:5)	Specific desorption must be carried out for this substance.
2-Methoxyethy/ acetate (EGMEA)	139-2	*110-49-6*	24	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	15	Carbon disulfide	
Methyl acetate	136-1	*79-20-9*	606 760		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	7 3	GC-FID	215	Carbon disulfide	
Methyl acrylate	146-2	*96-33-3*	35	Pc	Activated charcoal tube #SKC ST226-73 impregnated with 4-tert-butylcatechol (TBC) 2189 Activated charcoal with TBC	0.05	12	GC-FID	10	Carbon disulfide	Methyl acrylate must be sampled specifically in reason of the sampling device used.
Methyl alcohol	92-2	*67-56-1*	262 328	Pc	Silica gel tube #SKC ST226-10 2140 Silica gel #1	Maximum: 0.1	3 1.5	GC-FID	60	Water	Methanol must be sampled specifically in reason of the sampling device used and of the specific desorption solvant. Specific desorption must be carried out for this substance.
Methyl amyl alcohol	205-1	*108-11-2*	104 166	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	5 3	GC-FID	25	Carbon disulfide	
Methyl n-amyl ketone	316-1	*110-43-0*	233		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	49	Carbon disulfide	

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Methyl chloroform	100-1	*71-55-6*	1910 2460		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	6 3	GC-FID	57	Carbon disulfide	
Methyl ethyl ketone (MEK)	25-3	*78-93-3*	150 300		Anasorb 747 tube #SKC ST226-81 2190 Anasorb 747	Maximum: 0.2	10 3	GC-FID	30	Carbon disulfide	An activated charcoal tube 100/50 mg (#2120) may be used if the samples are refrigerated immediately after sampling and desorbed as quickly as possible after their arrival at the laboratory. This alternative is recommended if other organic substances must be analyzed simultaneously on the same sample.
Methyl isoamyl ketone	265-2	*110-12-3*	234		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	98	Carbon disulfide	
Methyl isobutyl ketone	132-3	*108-10-1*	205 310		Activated charcoal tube #SKC ST22601 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	40	Carbon disulfide	
Methyl methacrylate (monomer)	85-2	*80-62-6*	410		Anasorb 727 tube #SKC ST226-75 2185 Anasorb 727	Maximum: 0.25	3	GC-FID	19	Carbon disulfide	Methyl methacrylate must be sampled specifically in reason of the sampling device used.
Methyl propyl ketone	178-1	*107-87-9*	530		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GCFID	110	Carbon disulfide	
alpha-Methyl styrene	177-2	*98-83-9*	242 484		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	3 3	GCFID	15	Carbon disulfide	
Methylcyclohexane	175 1	*10887-2*	1610		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0 2	4	GCFID	320	Carbon disulfide	
Methylcyclohexanol	176-1	*25639-42-3*	234		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	140	Carbon disulfide	
Methylene chloride	27-2	*75-09-2*	174	C2 EM	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	3	GC-FID	27	Carbon disulfide	
4,4 'Methylene bis (2-chloroaniline)	337-1	*101-14 4*	0.22	Pc C2 RP EM	Glass fiber filter #SKC FLT-225-7 impregnated with 0.26 N sulfuric acid 990 GF-H2S04	2	240	HPLC-UV	2.74	0.1 N potassium hydroxide solution in methanol.	In the 4 hours following the sampling, the filter must be transfered in a jar containing 4 mL of 0.1 N hydroxide potassium solution in methanol. The numbers on the jar and on the sampling cassette must be the same. Samples are stable at 20 ^{0}C for 60 days.
4,4'Methylene dianiline	289-1	*101-77-9*	0.81	Pc C2 EM	Glass fiber filter #SKC FLT225-7 impregnated with 0.26 N sulfuric acid 990 GF-H2S04	1-2	100	HPLC-UV	0.12	0.1 N sodium hydroxide: methanol	In the 4 hours following the sampling, the filter must be transfered in a jar containing 4 mL of 0.1 N hydroxide potassium solution in methanol. The numbers on the jar and on the sampling cassette must be the same. Samples are stable at 20 ^{0}C for 60 days. Methylene bis (4 phenyl isocyanate) (MDI) may cause interference during sampling.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Methylene bis (4 phenyl lsocyanate) (MDI) 238-1 *101-68-8*	0.051	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0.041	For the glass fiber filter, solution of dimethylformamide: acetonitnle buffered to pH 3 For the teflon filter, acetic anhydride: acetonitnle	The results of method 238-1 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 237-2. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^0C and then impregnated with (N methyl-amino methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1 (2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4°C, before and after sampling. If possible, hardener must also be sent.
Methylene bis (4-phenyl isocyenatej (MDI) 237-2 *101-68-8*	0.051	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter # M S I Z50WP03700 917 PTF filter GF filter Vial		15	HPLCUV-Flu	0.036	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 237-2 give the vapor fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 238-1. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^0C and then impregnated with (N methyl-amino methyl)-9-anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1(2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4°C, before and after sampling. If possible, hardener must also be sent.
Mica (respirable dust) 48-1 *12001-26-2*	3 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	17	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Mineral oil (mist) 51-2 *8012-95-1*	5 10		Mixed cellulose ester filter Omega M-083700AF 906 MCE filter 37	15	100	FTIR	24	Carbon tetrachloride	Undiluted mineral oil must be supplied as reference. Sampling must be carried out with open cassette. The reference oil must be soluble in a halogenated solvent. The lower limit of quantification may vary in fonction of the oil used. Cigarette smoke may cause interference.
Molybdenum [7439-98-71] (as Mo), Soluble compounds 213-1	5		Polyvinyl chloride filter Gelman 66467 903 PVC filter-37	15	180	FAAS	50	Hot water	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble molybdenum.
Molybdenum [7439-98-7] (as Mo) Insoluble compounds 73-1	10		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	15	180	FAAS	50	Concentrated nitric acid, ther nitric acid: hydrochloric acid (1:4)	Specific sampling must be carried out for this substance. The analytical results are expressed as total molybdenum.
Naphthalene 09-1 *91-20-3*	52 79		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 1.0	200 15	GCFID	500	Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously.
Neon 26-C *7440 01-9*		Ax				DRI-elec			Since neon is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26 C). The reported minimum value is 1% oxygen.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Nickel, Metal 10-2 *7440-02-0*	1		Mixed cellulose ester filterOmega M083700AF ou Omega M-082500AFP 905 MCE filter 37 915 MCE filter-25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total nickel.
Nickel [7440020], Insoluble compounds (as Ni) 102	1		Mixed cellulose ester filter Omega M-083700AF ou Omega M082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	2	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total nickel.
Nickel [7440020], Soluble compounds (as Ni) 214-2	0.1		Polyvinyl chloride filter #Gelman 60714 903 PVC filter 37	1.5	180	FAAS	2	Hot water	Specific sampling must be carried out for this substance. The analytical results are expressed as total soluble nickel.
Nickel sulfide roasting, fume and dust (as Ni) 48-1	1	C1 RP EM	Polyvinyl chloride filter Omega P-08370K 902 PVC filter-37	1.5	180	FAAS	2		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Nicotine 233-1 *54-11-5*	0.5	Pc	XAD-2 tube #SKC ST226-30-04 2152 XAD-2 #2	1.0	100	GC-NPD	0.5	Ethyl acetate containing diphenylamine as an internal standard	Nicotine must be sampled specifically in reason of the sampling device used and of the specific desorption solvant. Additional information is available in Info Labo 89 01.
Nitric acid 211-1 *7697-37-2*	5.2 10		Treated silica gel tube SKC 226-1003 2147 Silica gel	0.2	48 3	IC CD	5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate	Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Nitrogen 26-C *7727-37-9*		Ax				DRIelec			Since azote is a simple asphyxiant, the method for determination of oxygen in air is used (IRSST 26 C). The reported minimum value is 1% oxygen.
Nitrogen dioxide 30-B *10102-44-0*	5.6					DRI-elec			The reported minimum value is 0.9 mg/m^3 (0.5 ppm).
Nitrogen monoxide 06-A *10102-43-9*	31					DRI-elec			The reported minimum value is 1.2 mg/m^3 (0.5 ppm).
Nitroglycerin (NG) 84-1 *55-63-0*	1.86	Pc	Tenax tube #SKC ST226-35-03 2175 Tenax	1.0	15	GC-ECD	3	Ethanol	Nitroglycerine must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
1-Nitropropane 312-1 *108-03-2*	91		Chromosorb-106 tube #SKC ST226 110 2127 Chromosorb-106	Maximum: 0.05	2	GC-FID	4	Carbon disulfide	
2-Nitropropane 30-2 *79-46-9*	36	C2 RP EM	Chromosorb-106 tube #SKC ST226-110 2127 Chromosorb-106	Maximum: 0.05	2	GC-FID	1.4	Carbon disulfide	
Nitrous oxide 39 A *10024-97-2*	90					DRI-PAD			The reported minimum value is 0.09 mg/m^3 (0.05 ppm).

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Nonane 306-1 *111-84-2*	1050		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	4	GC-FID	210	Carbon disulfide	
Octane 143-1 *111-65-9*	1400 1750		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	4 3	GC-FIO	290	Carbon disulfide	
Ozone 05-A *10028-15-6*	0.2					DRI Chi			The reported minimum value is 0.008 mg/m^3 (0.004 ppm).
Paraffin wax, fume 48-1 *8002-74-2*	2		Polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMIS2000. The gravimetric method for dusts is by definition nonspecific.
Parathion 228-1 *56-38-2*	0.1	Pc	Supelco ORB0 49P tube, # 2-350 2180 Orbo49P	0.2-1	480	GC-NPD	2	Toluene: acetone (90:10), containing an internal standard (tributylphosphate)	
Particulates Not Otherwise Classified (PNOC) (total dust) 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Pentachlorophenol 46-1 *87-86-5*	0.5	Pc C2 EM	Mixed cellulose ester filter Omega M083700AF (37 mm) in series with a glass fritted tip impinger #SKC IMP225-36-2 containing 15 mL of ethylene glycol 1401 Trap 1402 Holster 1420 GFT impinger 908 MCE filter 37	1.5	180	HPLCUV	9		The filter must be added to the contents of the impinger at the end of sampling.
Pentaerythritol 48-1 *115-77-5*	10		Polyvinyl chloride filter Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific.
n-Pentane 144-2 *109 66 0*	350		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	4	GCFID	21	Carbon disulfide	
Perchloroethylene 140 2 *127-18 4*	339 1357	C3	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	68	Carbon disulfide	
Perlite (respirable dust) 48-1 *83969-76 0*	5 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Per/ite (total dust) 48-1 *83969-76-0*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Phenol 12-4 *108-95-2*	19	Pc	Glass midget impinger #SKC IMP 225-36-1 containing 15 mL of 0.1 N sodium hydroxide 1422 Glass midget impinger	1	15	HPLC-UV	6.2		

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Phosphoric acid	211-1	*7664-38-2*	1 3		Treated silica gel tube SKC 226-10-03 2147 Silica gel	0.2	48 3	IC-CD	2.5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate	Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Phthalic anhydride	82-1	*85-44-9*	6.1		Mixed cellulose ester filter Omega M-083700AF 905 MCE filter 37	1.5	100	HPLC-UV	60	Water	
Picloram	48-1	*1918-02-1*	10		Polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.5	180	Grav			Additional information is available in Info Labo 91-03, 92-02 and 98 06. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMIS2017. The gravimetric method for dusts is by definition nonspecific.
Piperazine dihydrochloride	48-1	*142-64-3*	5		Polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03,92-02 and 98 06. If the substance needs to be identified, a method must be developed using the conditions described in OSHA data sheet IMISP155. The gravimetric method for dusts is by definition nonspecific.
Plaster of Paris (respirable dust)	48-1	*26499-65-0*	5 Pr		Cyclone in series with a polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Plaster of Paris (total dust)	48-1	*26499-65-0*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Portland cement (respirable dust)	48-1	*65997-15-1*	5 Pr		Cyclone in series with a polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted at the sampling site conditions. Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Portland cement (total dust)	48-1	*65997-15-1*	10 Pt		Polyvinyl chloride filter Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1 %.
Potassium hydroxide	288-1	*1310-58-3*	2		Polyvinyl chloride filter #Gelman 60714 903 PVC filter-37	1.5	180	FAAS	12.5	Demineralized water at room temperature	A specific sampling must be carried out for this substance. The analytical results are expressed as potassium (soluble compounds).
Propane	9 C	*74-98-6*	1800					DRI-EX			IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Propane	182-1	*74-98-8*	1800		Mylar sampling bag #Calibrated Instruments Inc. IC 5 1905 Bag 5		5	GC-FID			IRSST method 182-1 is for analyzing total hydrocarbons (C1 to C4). This method is currently in revaluation. Please contact the laboratory's Customer service department to learn of its availability.
n-Propyl acetate	168-1	*109-60-4*	835 1040		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	420	Carbon disulfide	
n-Propyl alcohol	93-1	*71-23-8*	492 615	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	250	Carbon disulfide	

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Propylene 9-C *115-07-1*		Ax				DRI-EX			IRSST method 9 C is for analyzing combustible gases according to their lower explosive limit. Refer to the note about simple asphyxiants at the beginning of the tables.
Propylene glycol monomethyl ether 334-1 *107-98-2*	369 553		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	0.2	10	GC-FID	74	Methylene chloride: Methanol (95:5)	Specific desorption must be carried out for this substance.
Pyridine 199-1 *110-86-1*	16		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	5	GC-NPD	4	Methylene chloride	Pyridine must be sampled specifically in reason of the sampling device used and of the specific desorption solvent.
Rouge (total dust) 48-1	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03,92-02 and 98 06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Rubber solvent (Naphtha) 154-1 *8030-30-6*	1570		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	800	Carbon disulfide	A process sample must be supplied.
Silica, Amorphous, Diatomaceous earth (uncalcined) (total dust) 48-1 *61790-53-2*	6 Pt		Polyvinyl chloride filter Omega P-08370K 902 PVC filter 37	1.5	180	Grav			Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silica, Amorphous, gel (total dust) 48-1 *63231-67-4*	6 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silica, Amorphous, precipitated (total dust) 48-1 *1343-98-2*	6 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silica, Crystalline, Cristobalite (respirable dust) 56-3 *14464-46-1*	0.05 Pr		Cyclone in series with a silver membrane filter from Selas 907 Ag filter 25	1.7	1000	XRD			This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used. The reported minimum value is undetermined.
Silica, Crystalline, Cristobalite (respirable dust) 206-2 *14464-46-1*	0.05 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	1000	XRD	6		
Silica, Crystalline, fused (respirable dust) 78-1 *60676-86-0*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	800	FTIR	6		
Silica, Crystalline, fused (respirable dust) 56-3 *60676-86-0*	0.1 Pr		Cyclone in series with a silver membrane filter from Selas 907 Ag filter 25	1.7	800	XRD	15		This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Silica, Crystalline, fused (respirable dust) 206-2 *60676-86-0*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	800	XRD	6		

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m³)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Silica, Crystalline, Quartz (respirable dust) 56-3 *14808-60-7*	0.1 Pr	C2 EM	Cyclone in series with a silver membrane filter from Selas 907 Ag filter-25	1.7	800	XRD	15		This method must only be used in certain specific cases. Normally, IRSST method 206-2 is used.
Silica, Crystalline, Quartz (respirable dust) 78-1 *14808-60-7*	0.1 Pr	C2 EM	Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	800	FTIR	6		
Silica, Crystalline, Quartz (respirable dust) 206-2 *14808-60-7*	0.1 Pr	C2 EM	Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	800	XRD	6		
Silica, Crystalline, Tridymite (respirable dust) 206-2 *15468-32-3*	0.05 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	1000	XRD			The reported minimum value is undetermined.
Silica, Crystalline, Tridymite (respirable dust) 56-3 *15468-32-3*	0.05 Pr		Cyclone in series with a silver membrane filter from Selas 907 Ag filter 25	1.7	1000	XRD			This method must only be used in certain specific cases. Normally, IRSST method 206 2 is used. The reported minimum value is undetermined.
Silica, Crystalline, Tripoli (respirable dust) 78-1 *1317-95-9*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	800	FTIR	6		
Silica, Crystalline, Tripoli (respirable dust) 56-3 *1317-95-9*	0.1 Pr		Cyclone in series with a silver membrane filter from Selas 907 Ag filter 25	1.7	800	XRD	15		This method must only be used in certain specific cases. Normally, IRSST method 206 2 is used.
Silica, Crystalline, Tripoli (respirable dust) 206-2 *1317-95-9*	0.1 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	800	XRD	6		
Silicon (total dust) 48-1 *7440-21-3*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silicon carbide (non fibrous) (total dust) 48-1 *409-21-2*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Silver, Metal 20-3 *7440-22-4*	0.1		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	ET-AAS	0.05	Concentrated nitric acid	Specific sampling must be carried out for this substance. The analytical results are expressed as total silver.
Soapstone (respirable dust) 48-1 *14378-12-2*	3 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Soapstone (total dust) 48-1 *14378-12-2*	6 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Sodium hydroxide 287-1 *1310-73-2*	2		Polyvinyl chloride 5 µm filter Gelman 66467 903 PVC filter-37	1.5	180	FAAS	25	Demineralized water at room temperature	A specific sampling must be carried out for this substance. The analytical results are expressed as sodium (soluble compounds).
Starch (total dust) 48-1 *9005-25-8*	10 Pt		Polyvinyl chloride filter Omega P-08370K 910 PVC filter 37 with capsule (Accu-Cap)	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystaline silica.
Stoddard solvent 80-1 *8052-41-3*	525		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	275	Carbon disulfide	A process sample must be supplied.
Styrene (monomer) 39-A *100-42-5*	213 426	Pc C3				DRI-PAD			The reported minimum value is of 0.5 mg/m^3 (0.12 ppm).
Styrene (monomer) 318-1 *100-42-5*	213 426	Pc C3	3M Organic Vapor Monitor #3500 2695 Passive dosimeter			GC-FID	27	Carbon disulfide	The recommended sampling time is of 4 hours, although it may be variable.
Styrene (monomer) 31-3 *100-42-5*	213 426	Pc C3	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	5 3	GC-FID	27	Carbon disulfide	
Sucrose 48-1 *57-50-1*	10		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03, 92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific.
Sulfur dioxide 8-B *7446-09-5*	5.2 13					DRI-elec			The reported minimum value is 1.3 mg/m^3 (0.5 ppm).
Sulfuric acid 211-1 7664-93-9	1 3		Treated silica gel tube SKC 226-10 03 2147 Silica gel	0.2	48	ICCD	2.5	Solution of 1.8 mM sodium carbonate and 1.7 mM sodium bicarbonate	Five acids can be analyzed simultaneously, namely hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acids. Results are expressed as hydrobromic, hydrochloric, nitric, phosphoric and sulfuric acid. Samples are stable 21 days at 25^{0}C. All acid salts may cause positive interference.
Talc, fibrous 243-1	1 f/cc	C1 EM	Mixed cellulose ester filter #Environmental Express F250800 and cassette with a conductive extension #Environmental Express 0025100 918 MCE filter-25	0.5-16	400	PCOM			Open casette sampling. A flow rate not exceeding 2.5 L/min is recommended for determining an average concentration. The method applies to the counting of fibers other than asbestos whose refractive index is compatible with the mounting solution. The reported minimum value is 25 fibers/mm^2.
TALC, non *fibrous (respirable dust)* 48-1 *14807-96-6*	3 Pr		Cyclone in series with a polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.7	180	Grav	25		The actual flow rate must be adjusted to the sampling site conditions. Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Tantalum [7440-25-7], metal and oxide dusts (as Ta) 48-1	5		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.

RRQWE Name	Method #	CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
1,1,2,2 Tetrachloro-1,2-difluoroethane	190-1	*76-12-0*	4170		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.05	2	GC-FID	417	Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously.
1,1,2,2-Tetrachloroethane	158-1	*79-34-5*	6.9	Pc	Activated charcoal tube #SKC ST226 01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	17	Carbon disulfide	
Tetrahydrofuran	179-1	*109-99-9*	300		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	9	GC-FID	53	Carbon disulfide	
4,4'-Thiobis (6-tert-butyl-m-cresol)	48-1	*96-69-5*	10		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter-37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Tin (7440-31-5), Oxide and inorganic compounds, except SnH4 (as Sn)	5-1		2		Mixed cellulose ester filter Omega M083700AFor Omega M-082500AFP 905 MCE filter 37 915 MCE f.lter 25	1.5	180	FAAS	50	Concentrated hydrochloric acid	Specific sampling must be carried out for this substance. The analytical results are expressed as total tin.
Tin, Metal	5-1	*7440-31-5*	2		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	50	Concentrated hydrochloric acid	Specific sampling must be carried out for this substance. The analytical results are expressed as total tin.
Titanium dioxide (total dust)	48-1	*13463-67-7*	10 Pt		Polyvinyl chloride filter #Omega P-08370K 902 PVC filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91 03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos whose percentage of crystalline silica is less than 1%.
Toluene	16-2	*108-88-3*	377 565		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	5 3	GC-FID	10	Carbon disulfide	
Toluene diisocyanate (TDI) (isomers mixture)	236-1	*26471-62-5*	0.036 0.14	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter #MSI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0.031	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 236-1 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 226-2. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (N methyl-amino methyl) 9 anthracene) (MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1-(2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Toluene diisocyanate (TDI) (isomers mixture) 226-1 *26471-62-5*	0.036 0.14	EM	Glass fiber filter *#Millipore AP4003705 pretreated in the laboratory in series with a polytetrafluorocarbon (teflon) filter MSI Z50WP03700 917 PTF filter GF filter Vial	1	15	HPLC-UV-Flu	0.029	For the glass fiber filter, solution of dimethylformamide: acetonitrile buffered to pH 3 For the teflon filter, acetic anhydride: acetonitrile	The results of method 226-1 give the aerosol fraction in terms of monomeres and oligomeres. This method is always carried out concomitantly to method 236-2. The results are then expressed as total monomeres or total oligomeres. *The glass fiber filters are heated to 400^{0}C and then impregnated with (Nmethyl-amino-methyl)-9-anthracene)(MAMA). Immediately after sampling, the filter is handled with tweezers (face down) and placed in a vial containing 5 mL solution of 1-(2 methoxyphenyl) piperazine (MOPIP) in toluene. The vial must bear the same number as the sampling cassette. The cassette and the vial are returned to the laboratory. The samples must be stored at 4^{0}C, before and after sampling. If possible, hardener must also be sent.
1,1,2-Trichloroethane 102-1 *79-00-5*	55	Pc	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	22	Carbon disulfide	
Trichloroethylene 75-3 *79-01-6*	269 1070		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10 3	GC-FID	58	Carbon disulfide	
Trichlorofluoromethane 151-1 *75-69-4*	5620		Activated charcoal tube #SKC ST226-09 2121 Activated charcoal *#2*	Maximum: 0.05	4	GC-FID	1120	Carbon disulfide	Trichlorofluoromethane must be sampled specifically in reason of the sampling device used.
1,1,2 Trichloro-1,2,2-trifluoroethane 191-1 *76-13-1*	7670 9590		Activated charcoal tube #SKC ST22601 2120 Activated charcoal #1	Maximum: 0.05	1.5 0.75	GC-FID	570	N,N-Dimethylacetamide	A specific desorption must be carried out for this substance.
Trimethyl benzene 251-1 *25551-13-7*	123		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	62	Carbon disulfide	
Turpentine 254-1 *8006-64-2*	556		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	125	Carbon disulfide	A process sample must be supplied.
n-Valeraldehyde 334-1 *110-62-3*	176		Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GC-MS	0.3	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Vinyl acetate 208-2 *108-05-4*	35 70		ORBO-92 (Carboxen-564 carbon molecular sieve) 2195 ORBO 92	Maximum: 0.2	12 3	GC-FID	7.5	Methylene choride: methanol (95:5)	Vinyl acetate must be sampled specifically in reason of the sampling device used and of the specific desorption solvant.
Vinyl chloride (monomer) 86-2 *75-01-4*	2.5 13	C1 RP EM	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.05	5 0.75	GC-FID	0.64	Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously.
VM&P Naphtha 29-1 *8032-32-4*	1370		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	10	GC-FID	170	Carbon disulfide	A process sample must be supplied.

RRQWE Name Method # CAS	TWAEV STEV Ceiling (mg/m^3)	Notations	Sampling Device	Flow rate (L/min)	Volumes (TWAEV) (STEV) (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Welding fumes (not otherwise classified) 48-1	5		Polyvinyl chloride filter Omega P082550 (25 mm) or P-08370K (37 mm) or mixed cellulose ester filter Omega M-082500AFP (25 mm) or M-083700AF (37 mm) if any metal analysis is required 914 PVC filter 25 916 MCE filter 25	1.5	180	Grav	25		To evaluate welding fumes, personal sampling must be carried out within the mask. Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Wood dust (red cedar) 48-1	2.5		Polyvinyl chloride filter, with capsule (Accu-Cap) 910 PVC filter 37 with capsule (Accu Cap)	1.5	180	Grav	25		Additional information is available in Info-Labo 91-03,92-02 and 98-06. The gravimetric method for dusts is by definition nonspecific. The standard is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Wood dust hard and soft, except red cedar 48 1	5		Polyvinyl chloride filter, with capsule (Accu-Cap) 910 PVC filter 37 with capsule (Accu-Cap)	1.5	180	Grav	25		Additional information is available in Info-Labo 91-03,92-02 and 98 06. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and with a percentage of cristalline silica less than 1%.
Xylene (o-,m-,p- isomers) 101-2 *1330-20-7*	434 651		Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 0.2	12 3	GC-FID	50	Carbon disulfide	
Zinc chloride, fume 17-2 *7646-85-7*	1		Mixed cellulose ester filter Omega M083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	1	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total zinc.
Zinc chromates (as Cr) 271-1 *13530-65-9*	0.01	C1 RP EM	Polyvinyl chloride filter Omega P-50370K and polyethylene container 1116 PE container 922 PVC filter 37	1.5	360	IC-VIS	0.2	Sodium hydroxide: sodium carbonate: water (2:3:95)	The filter must be handled with plastic tweezers and be transferred to a polyethylene container within one hour after sampling. The sample must be analyzed within two weeks. The analytical results are expressed as total chromium VI (hexavalent chromium). Wipe samples for chromates can be carried out, and the required equipment is available at the IRSST (#2625).
Zinc stearate 48-1 *557-05-1*	10		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals are required. 902 PVC filter 37 913 MCE filter 37	1.5	180	Grav	25		Additional information is available in Info-Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific.
Zinc, oxide, Dust (total dust) 48-1 *1314-13-2*	10 Pt		Polyvinyl chloride filter #Omega P-08370K or mixed cellulose ester filter Omega M-083700AF if metals are required. 902 PVC filter 37 913 MCE filter 37	1.5	180	Grav	25		Additional information is available in Info Labo 91-03 and 92-02. The gravimetric method for dusts is by definition nonspecific. The TLV is for dust containing no asbestos and less than 1% of crystalline silica.
Zinc, oxide, Fume 17-2 *1314-13-2*	5 10		Mixed cellulose ester filter Omega M-083700AF or Omega M-082500AFP 905 MCE filter 37 915 MCE filter 25	1.5	180	FAAS	1	Nitric acid: perchloric acid (4:1), concentrated hydrochloric acid finally, concentrated nitric acid	The analytical results are expressed as total zinc.

Name Method #	CAS	Sampling device	Flow rate (L/min)	Sampling volume (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Acenaphtene 225-2	*83-32-9*	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter-37	2	960	GC-MS	• 0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Anthracene 225-2	*120-12-7*	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0 2187 Orbo 42 911 GFfilter-37	2	960	GC-MS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Benz(a)anthracene 225-2	*56-55-3*	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter 37	2	960	GC-MS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Benzo(e)pyrene 225-2	*192-97-2*	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter-37	2	960	GC-MS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Butyraldehyde 324-1	*123-72-8*	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GC-MS	0.1	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Endotoxins 332-1		Treated glass fiber filter #Gelman 61652 935 GF Filter-Treated	2.0	480	UV/VIS-S		Pyrogen free water	An agreement must first be made with the person in charge of the IRSST microbiology laboratory.
Fluoranthene 225-2	200-44-0	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter 37	2	960	GC-MS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.
Fluorene 225-2	86-73-7	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo-42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter-37	2	960	GC-MS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.

Name Method#	CAS	Sampling device	Flow rate (L/min)	Sampling volume (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Heptanel 321-1	*111-71-7*	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GCMS	0.04	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Hexanal 327-1	*66-25-1*	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GCMS	0.07	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Isobutyraldehyde 325-1	*78-84-2*	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GCMS	0.03	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Isoflurane 285-1	*26675-46-7*	Activated charcoal tube #SKC ST226-01 2120 Activated charcoal #1	Maximum: 02	5	GC-FID	95	Carbon disulfide	Since a specific analysis is recommended, no other substance may be sampled simultaneously. The Swedish National Board of Occupational Safety and Health has recommended a reference value of 80 mg/m³.
Isovaleraldehyde 330-1	*590-86-3*	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GCMS	0.05	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Phenanthrene 225-2	*85-01-8*	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo 42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter 37	2	960	GCMS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling. The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzolalpyrene.
Propionaldehyde 323-1	*123-38-6*	Orbo 23 tube #Supelco 2-0257 2186 Orbo 23	0.1	10	GCMS	0.04	Toluene	Before and after sampling, tubes must be stored in a freezer. The shelf life of these tubes is limited, order only the quantity necessary for the sampling. The eleven following aldehydes are determined simultaneously: acetaldehyde, isobutyraldehyde, isovaleraldehyde, propionaldehyde, butyraldehyde, furfural, heptanal, hexanal, valeraldehyde, acroleine and formaldehyde. Specific desorption must be carried out for this substance. The use of an "Icepak" is not necessary when shipping samples.
Pyrene 225-2	*129-00-0*	Glass fiber filter pretreated in the laboratory, #Millipore AP4003705 in series with an Orbo 42 tube #Supelco 2-0 2187 Orbo 42 911 GF filter-37	2	960	GCMS	0.02	Benzene	The sampling train consists of a cassette followed by the sampling tube. The samples must be stored in the freezer after sampling The tubes and filters must be shipped together. There is no reference value for the standard, but the concentration might be measured by targeting the lowest limit of detection possible, given the carcinogenicity designation C2. The ten following hydrocarbons are determined simultaneously: acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, chrysene, benz(a)anthracene, benzo(e)pyrene, benzo(a)pyrene.

Name Method # CAS	Sampling device	Flow rate (L/min)	Sampling volume (L)	Principle	Min. Value (µg)	Desorption Digestion	Remarks
Triglycidyl isocyanurate 336-1 *2451-62-9*	Polyvinyl chloride filter with capsule #Omega P-08370K 910 PVC filter 37 with capsule (Accu Cap)	2.0	480	HPLC-UV	6	Acetone	ACGIH has recommended a reference value of 0.05 mg/m^3.

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Appendix 1 : Sampling materials

#	Class	Description	Type	Manufacturer	
901	Sampling cassettes	Polyvinyl chloride filter, 0.8 micron, 37 mm (used as prefilter)	PVC filter-37	Omega	P-08370K
902	Sampling cassettes	Polyvinyl chloride filter, 0.8 micron, 37 mm, preweighed (Dusts)	PVC filter-37	Omega	P-08370K
903	Sampling cassettes	Polyvinyl chloride filter, 5.0 microns, 37 mm.	PVC filter-37	Gelman	66467
904	Sampling cassette	Polyvinyl chloride filter, 5.0 microns, 37 mm, preweighed.	PVC filter-37	Gelman	66467
905	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 37 mm, closed cassette.	MCE filter-37	Omega	M-083700AF
906	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 37 mm, open cassette.	MCE filter-37	Omega	M-083700AF
907	Sampling cassettes	Silver membrane filter, 1.2 microns, 25 mm, preweighed. To be used in special cases only	Ag filter-25	Selas	
908	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 37 mm (Used as prefilter for impinger)	MCE filter-37	Omega	M-083700AF
910	Sampling cassettes	Polyvinyl chloride filter, 0.8 microns, 37 mm, with capsule (Accu-Cap).	PVC filter-37 with capsule (Accu-Cap)	Omega	P-21161
911	Sampling cassettes	Glass fiber filter pretreated in the laboratory, 0.8 micron, 37 mm, for coal tar, petroleum fumes, and PAHs. The filter is previously heated to 400^0C in the laboratory.	GF filter-37	Millipore	AP4003705
912	Sampling cassettes	Cellulose nitrate filter, 0.8 micron, 37 mm, closed cassette (phtalates).	CN filter-37	Whatman	7188 003
913	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 37 mm, preweighed (Ousts and metals)	MCE filter-37	Omega	M-083700AF
914	Sampling cassettes	Polyvinyl chloride filter, 0.8 micron, 25 mm, preweighed (Dusts)	PVC filter-25	Omega	P-082550
915	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 25 mm (Metals)	MCE filter-25	Omega	M-082500AF
916	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 25 mm, preweighed (Dusts and metals)	MCE filter-25	Omega	M-082500AF
917	Sampling cassettes	Polytetrafluorocarbon and glass fiber filters, 0.8 micron, 37 mm, (two filters in the same cassette, Milipore AP4003705 and MSI Z50WP03750), plus vial with solution.	PTF filter GF filter Vial	IRSST	AP4003705 Z50WP0375
918	Sampling cassettes	Mixed cellulose ester filter, 0.8 micron, 25 mm, (black conductive cassette for mineral fibers)	MCE filter-25	EE	F-250800
919	Miscellaneous equipment	Vial containing acetic acid 1 %	Ac. acetic vial		Jarre d'acide acetiq
921	Sampling cassettes	Two glass fiber filters impregnated with 2,4-dinitrophenylhydrazine (DNPH) and phosphoric acid	GF Ffilter-DNPH-37	SKC	227-5
922 925	Sampling cassettes Sampling cassettes	Polyvinyl chloride filter, 5.0 microns, 37 mm Two glass fiber filters impregnated with sulfuric acid, 37 mm	PVC filter-37 GF Filter-H2S04	Omega Gelman	P-50370K 66208
930	Sampling cassettes	Polycarbonate filter, 0.8 µm, 37 mm	Polycarbonate filter	Poretics	12050
935	Sampling cassettes	Treated glass fiber filter, 37mm.	GF Filter-Treated	Gelman	61652
990	Sampling cassettes	Glass fiber filter #SKC FLT225-7 impregnated with 0.26 N sulfuric acid, plus vial with solution.	GF-H2S04 Vial	SKC	227-5
1116	Miscellaneous equipment	Polyethylene container (chromates)	PE container		
1401	Miscellaneous equipment	Impinger trap	Trap		
1402	Miscellaneous equipment	Impinger holster	Holster		
1414	Impinger	Glass midget impinger containing 10 mL of 0.1 N sodium hydroxide	Glass midget impinger	SKC	IMP225-36-1
1416	Impinger	Polyethylene midget impinger containing 10 mL of 0.1 N sodium hydroxide	PE midget impinger		
1418	Impinger	Glass midget impinger containing 15 mL of 0.1 N hydrochloric acid	Glass midget impinger	SKC	IMP225-36-1
1420	Impinger	Glass fritted tip impinger containing 15 mL of ethylene glycol with a prefilter (908)	GFT impinger	SKC	IMP225-36-2

1422	Impinger	Glass midget impinger containing 15 mL of 0 1 N sodium hydroxide	Glass midget im pinger	SKC	IMP225 36 1
1902	Miscellaneous equipment	Mylar bag, 2 L, for gases	Bag 2	CI	IC 2
1905	Miscellaneous equipment	Mylar bag, 5 L, for gases	Bag 5	CI	IC 5
2120	Sampling tubes	7 cm long, 100/50 mg of charcoal	Activated charcoal #1	SKC	226 01
2121	Sampling tubes	11 cm long, 400/200 mg of charcoal	Activated charcoal #2	SKC	226 09
2122	Sampling tubes	15 cm long, 700/390 mg of charcoal	Activated charcoal #4	SKC	226 36
2127	Sampling tubes	8,5 cm long, 100/50 mg of polymer	Chromosorb 106	SKC	226 110
2140	Sampling tubes	7 cm long, 150/75 mg of silica gel	Silica gel #1	SKC	226 10
2143	Sampling tubes	11 cm long, 520/260 mg of silica gel	silica gel	SKC	226 15
2144	Sampling tubes	11 cm long, 500/250 mg of carbon beads (Pretreated with H2S04)	Pretreated carbon beads	SKC	226 29
2147	Sampling tubes	11 cm long, 400/200 mg of treated silica gel	Silica gel	SKC	226 10 03
2152	Sampling tubes	11 cm long, 100/50 mg of styrene divinylbenzene copolymer	XAD 2 #2	SKC	226 30 04
2162	Sampling tubes	11 cm long, 150/75 mg of ethylvinylbenzene divinylbenzene copolymer	Porapak Q #2	SKC	226 59 03
2170	Sampling tubes	7 cm long, 140/70 mg of XAD 2 impregnated with 1 naphtylisothiocyanate	XAD 2 / NIT	SKC	226 30 18
2175	Sampling tubes	11 cm long, 100/50 mg of 2,6 diphenyl p phenylene oxide polymer	Tenax	SKC	226 35 03
2180	Sampling tubes	8 cm long, 270/140 mg of XAD 2 with glass fiber filter and polyurethane foam (OVS 2)	0rbo49P	Supelco	2 0350
2185	Sampling tubes	11 cm long, 300/150 mg of styrene polymer specially cleaned	Anasorb 727	SKC	226 75
2186	Sampling tubes	10 cm long, 120/60 mg of styrene divinylbenzene copolymer impregnated with 2 hydroxymethyl pipendine	Orbo 23	Supelco	2 0257
2187	Sampling tubes	10 cm long, 100/50 mg of styrene divinylbenzene copolymer To be used with GF filter no 911	Orbo 42	Supelco	2 0264
2188	Sampling tubes	11 cm long, 120/60 mg of XAD 2 impregnated with 2 hydroxymethyl pipen dine	XAD 2 / HMP	SKC	226 118
2189	Sampling tubes	7 cm long, 100/50 mg of activated charcoal impregnated with t butylcatechol	Activated charcoal with TBC	SKC	226 73
2190	Sampling tubes	7 cm long, 140/70 mg of molecular sieve	Anasorb 747	SKC	226 81
2195	Sampling tubes	7 cm long, 160/80 mg of carbon molecular sieve	ORBO 92	Supelco	2 0362
2695	Passive sampler	3M Passive dosimeters # 3500 for organic vapors	Passive dosimeter	3M	3500
3030	Sampling cassettes	Glass fiber filter #SKC FLT 225 16	GF 13	SKC	225 16

Note : Sampling tubes #2186, 2187 et 2195 are packaged 5 per bag instead of 10 as with other tubes.

Description of wipe sample kits (surface identification)	**IRSST #**
Chromium VI - 25 mL bottle of diphenyl-carbazide - 25 mL bottle of sulfuric acid	**2625**
Cyanide - bottle containing 0.1 N NaOH - bottle containing palladium dimethylglyoxine in 3N KOH - bottle containing nickel chloride and ammonium chloride in water	**3020**

Appendix 2 : List of acronyms

Acronym	Analytical principle
Colo	Colorimetry
CV-AAS	Cold vapour atomic absorption spectrophotometry
DRI-Am	Direct reading instrument-Amalgamation
DRI-Chi	Direct reading instrument-Chemiluminescence
DRI-elec	Direct reading instrument-Electrochemical cell
DRI-EX	Direct reading instrument-Explosimeter
DRI-IR	Direct reading instrument-Infrared
DRI-PAD	Direct reading instrument-Photoacoustic detection
ET-AAS	Electrothermal atomic absorption spectrophotometry
FAAS	Flame atomic absorption spectrophotometry
FTIR	Fourier transform infrared spectrophotometry
GC-ECD	Gas chromatography with electron-capture detection
GC-ELD	Gas chromatography with electrolytical conductivity detection
GC-FID	Gas chromatography with flame ionization detection
GC-FPD	Gas chromatography with flame photometric detection
GC-Hall	Gas chromatography with Hall electrolytic detection
GC-MS	Gas chromatography with mass spectrometry
GC-NPD	Gas chromatography with nitrogen-phosphorus detection
GC-PID	Gas chromatography with photoionization detection
GC-TCD	Gas chromatography with thermal conductivity detection
GC-TEA	Gas chromatography with a thermal energy analyzer
GC^2-FID	High resolution gas chromatography with flame ionization detection
Grav	Gravimetric measurement
HPLC-Flu	High performance liquid chromatography with fluorescence detection
HPLC-UV	High performance liquid chromatography with UV detection
HPLC-UV-Flu	High performance liquid chromatography with UV and fluorescence detectors
IC-CD	Ion chromatography with conductivity detection
IC-ECD	Ion chromatography with electrochemical detection
IC-VIS	Ion chromatography with visible detection
ICP	Inductively coupled plasma spectrometry
IRnd	Non-dispersive infrared spectrophotometry
PCOM	Phase contrast optical microscopy
PLM	Polarized light microscopy
Polaro	Pulse polarography
SE	Ion specific electrode
XRD	X-ray diffraction