Industrial Minerals Association - Europe

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IRAS

IMA-Europe Standardised Dust Monitoring Protocol

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CONTENT

ANNEXES

IMA HYGIENE PROJECT:
Standardised dust monitoring protocol

1 CONTEXT

The European Industrial Minerals Association (IMA-Europe) has acknowledged that the concern for general dust exposure at the workplaces has significantly grown in recent years, notably even more under the triggering of the crystalline silica issue. Indeed, the International Agency for Research on Cancer (IARC) has classified crystalline silica as carcinogen to humans in 1997 [1]. In addition, there are threshold limits established by the European legislation for mineral dust (see Annex 2 of this document).

Therefore, the Board of IMA-Europe recognised the vital need to be able to document dust exposure in the mineral industry in order to be in a position to discuss with regulatory authorities.

For this purpose, IMA – Europe commissioned in 2000 the Cnam-IHIE Ouest (Conservatoire National des Arts et Métiers des Pays de la Loire – Institut d'Hygiène Industrielle et de l'Environnement) to prepare an IMA industrial hygiene programme.

In a first step, the project leader, Dr. Guy Auburtin and his team, reviewed dust monitoring practices in IMA member companies. As a result, it appeared that documentation on dust exposure in our sector went through the implementation of a protocol on dust exposure assessment. This protocol should be representative of the actual situations and compatible with the current monitoring strategies and the European legislation. It will answer the following questions:

- Why collect dust measurement data? (objectives)
- What information should be collected? (methodology)
- How can the data be collected? (metrology)
- How can the data be used and what format should be used to store and handle the data? (handling)

A training on the implementation of the IMA standardised dust monitoring protocol was organised on 21 – 22 March 2002, in Limelette, Belgium.
Since then, an annual debriefing meeting is organised every year during which participation in IMA's dust monitoring programme is reviewed and the statistical results (for respirable dust and respirable crystalline silica dust exposures) are presented.
As of 1st January 2006, the occupational health institute in charge of the project is Arbo-Unie (Netherlands) who works on this project in close cooperation with the Institute for Risk Assessment (IRAS) of the Utrecht University.

2 OBJECTIVES

The objective of the general protocol is to collect data on dust exposure levels in IMA Member companies.

- **The aims of the program are:**

For each individual company:

- Provide data to assess compliance with national (and partly European) Occupational Hygiene regulations, such as TLV's (Threshold limit values): this is part of the general obligations on employers to assess risks at work, according to the European Council directive 89/391/EEC of 12 June 1989 [2]. The Member States have brought this European directive into force in their national regulations.
- Provide data to guide prevention. This is the first step (as it alerts and gives indications) in implementing and/or checking preventive means (identification of pollutant activities, assessment of local exhaust ventilation efficiency…). Further investigation is required to define a prevention strategy.

For IMA-Europe: provide data on occupational dust exposures at the European level in order to:

- Provide the European authorities with data on health risk assessment from occupational dust exposures in European mineral industry.
- Start the elaboration and production of exposure data like "job-exposure matrices" available for possible further epidemiological survey[1] (those surveys are not concerned by this protocol).

- **To be useful, the dust exposure assessment must be:**

- Compatible with the considered requirements for the different IMA-Europe objectives (be in accordance with regulatory requirements, allow traceability in time etc…), with organisation and current company strategy (even though fitting will be necessary), and with the current companies' strategies.
- Comparable in order to compare results between sites/companies, countries, minerals, and laboratories. This comparison concern data measurements as well as the overall elements allowing data gathering. As absolute comparability is not possible, minimal requirements will be proposed.
- Provided by a valid process (including sampling strategy, measurement and data management). In epidemiology, the validity of a measurement tool is the extent to which it measures efficiently what it is intended to measure. This validity include common notion of representativeness, reliability, acceptable precision, etc…

[1] The aim of an epidemiological survey is to study the aetiology of a disease and identify causal associations between occupational exposures and subsequent diseases.

- **Background concepts**

In general, exposure assessment is a complex process, which associates:

- Exposure assessment for each job function, with all the qualitative and quantitative characteristics (exposure levels and their statistical distribution).
- Description of the different job functions in time and space.

Those two elements are the basement for the concept of homogeneous exposure group. This concept is complex in its use but vital in exposure assessment (see paragraph 3.2).

- Distribution of the different job functions in the workforce. Indeed, in a descriptive study, at a given time, one looks at the number and/or proportion of workers exposed to the different exposure levels. In an epidemiological longitudinal study one aims at building the cumulated exposure for each worker including their occupational history (reconstitution of occupational history is not concerned by this protocol).

3 METHODOLOGY

3.1 Minimal requirements

- It is of utmost importance that each individual worker will be coded with a **UNIQUE WORKER CODE**. A good example of a unique worker code is the personal registration number which is used at personnel departments. With the unique worker code we are able to distinguish between worker A and worker B. Additionally, we have to be sure that worker A is the same worker A in all campaigns.
- Collect 6 dust samples per job function per site and per campaign.
- Measurement conditions:
  - Personal measurements (companies can do static measurements as well if they require them). It must be clearly identified, however, which measurements are personal samples and which ones are static samples.
  - Dust fractions: at least respirable and (optional) total inhalable (also called inhalable), thoracic dust fractions
- Sampling equipment must be in conformity with the European standard EN 481.
- Analytical technique: either X-ray diffraction, or Fourier transform infrared spectroscopy as required in standards.
- Full documentation on the equipment, the procedures and the results should be made available along with data by the companies.
- The laboratories involved should join an inter laboratory round exercise as defined in paragraph 5.
- The protocol, including the quality assurance system, should be followed.

3.2 Studied population

The studied population is the company workforce. The workforce is subdivided into groups corresponding to the unit for sampling strategy, i.e. the exposure group (EG). Those exposure groups are defined before the sampling.

To enable comparison across minerals, countries, companies, etc… exposure groups are characterised according to executed tasks and activities of the workers. Hence, exposure groups are classified according to job functions.

Data analysis of the dust measurement will be different whether the exposure groups correspond to homogeneous exposure groups or not. The criteria for homogeneous exposure groups are described in the European standard EN 689 [3], and are defined as group of workers with:

- similar executed tasks and work pattern ;
- similar exposure conditions (substances, type of exposure) ;
- similar neighbourhood (process/phase of the process, ventilation system).

The concept of homogeneous exposure group is a tool of comparison to determine the number of samples to be collected. In the current sampling protocol and sampling strategy, homogeneous exposure groups are defined based in the job functions as mentioned in section 3.3 and annex 3.

3.3 Sampling characteristics

Sampling location:

The sampling locations should follow the different job functions **described in the list attached in Annex 3**. In order to create a list of job functions meaningful across companies and sites, it is indeed necessary to bring the different job titles currently used together into a **standardised nomenclature**.

A criterion is that the sampling locations should first correspond to common job functions, in other words, job functions present on most sites in the mineral industry:

1) Quarry operator (outdoor)

2) Crusher operator (indoor)

3) Wet process operator

4) Dry process operator

5) Miller operator

6) Bagging operator

7) Transport/bulk loading

8) Foreman/plant management staff

9) Maintenance

10) Multi-skilled operator[2]

11) Laboratory Workers

12) Research and Development

13) Plastification

Sampling duration time:

Ideally, the sampling duration should correspond to a full shift (7-8 hours) unless the job considered has a very low or high level of dust exposure. In this case sampling duration should be more than a full shift (for low level of dust exposure) or less (for high level of dust exposure).

In fact the main criterion for sampling duration is to avoid saturation of the sampler: for example 50mg for the respirable dust fraction using CIP 10 and 40mg for 10mm cyclone [4].

[2] The multi-skilled operator is an operator who does several job functions, none of which amounting to or exceeding 50 % of his working time.

Number of samples:

When considering homogeneous exposure group (HEG) concept, and as a general rule, sampling should be carried out for at least one employee in ten, in a properly selected HEG. However, it is advised to sample more workers within a HEG in order to obtain a probability of 95% to get at least 20% of the most exposed workers [5].

A minimum of **six samples** per job function per campaign at each site must be collected in order to enable good statistical analysis and to ensure that representative data is obtained.

If insufficient resource is available to collect six samples for every job function at a site in a monitoring campaign, the number of job functions monitored should be reduced so that the minimum six samples is collected for each remaining job function. From a statistical perspective, this is better than monitoring all job functions with fewer than six samples.

3.4 Campaign duration and periodicity

Measurement campaign duration:

As an indication, 5-7 weeks (20-33 working days) are required to carry out a measurement campaign in order to collect 6 to 12 samples per job function, for 7 job functions and using 7 samplers (see **simulation** in Annex 4).

Periodicity:

Participating companies should aim to complete two campaigns per year at each site. i.e. one campaign during summer time (April 1 – October 31) and one campaign during winter time (November 1 – March 31), in order to help study the effect of weather conditions on the data. Two full campaigns should at least be completed during the first year of participation. After that, commitment to the Protocol can be reduced following the instructions provided in **Annex 5: Campaigns' Periodicity**. Data from all sampling work is valuable and participating companies are asked to submit any available sampling results so that they can be added to the Protocol database.

4 METROLOGY

4.1 Sampling

4.1.1 Actor

Two types of actors for dust analysis:

- Internal laboratory
- External laboratory: it must meet the defined requirements described in the agreement sheet (see paragraph 5). The laboratory should use the required equipment and follow the procedure given below.

4.1.2 Equipment

The sampling equipment used must be in conformity with the European standards EN 481 and EN 1232 [6, 7]. This equipment is a one or three-piece equipment with collection equipment, containing either foam or filter[3], and a sampling pump. Performance of personal samplers has been assessed in previous studies [8-13].
Examples of such equipment are:

- CIP 10 with polyurethane foam sponge as the sample collection material, and using a flow rate of 10l/min
- Respicon particle sampler using a flow rate of 3.11l/min
- Dorr-Oliver 10mm nylon cyclone connected to a personal sampling pump using a flow rate of 1.7l/min and with filter as the sample collection material
- Higgins-Dewell cyclone connected to a personal sampling pump using a flow rate of 2.2l/min, and with filter as the sample collection material

For the cyclone sampling equipment, the sample collection materials (filters) are placed in a 3 or 2-piece filter cassette. Examples of filter are:

- Polyvinyl chloride (PVC) membrane filter, 25 or 37mm diameter, 5µm pore size
- Silver membrane filter, 25mm diameter, 0.45µm pore size
- Mixed cellulose ester membrane filter, 25 or 37mm diameter, 0,8µm pore size

In addition to the sampling equipment, **sampling record sheets 1 and 2** (see Annexes 7 and 8) must be used in order to note relevant information during the sampling.
Sampling record sheet 1 corresponds to one sample and gives indication on the worker's activities and conditions during sampling. The worker himself can fill in part of this sheet (see the table on this sheet). It is very important to take notes during the sampling, e.g. information on process conditions, production rate, local exhaust ventilation system, weather conditions, etc.

Sampling record sheet 2 corresponds to several dust samples (therefore it embraces several sampling record sheets 1) but it should concern only one measurement campaign. The technician fills in this sheet.

4.1.3 Procedure (see flow sheet in annex 6)

The collection equipment is previously washed, conditioned and weighed (see procedure in paragraph 4.2.1). Then, the sampling procedure is:

[3] Foams can be used several times whereas filters can only be used once.

1) Make sure the pump batteries have been recharged. Calibrate sampling pump according to manufacturer's instructions. Load the collection equipment in the sampler and connect to the sampling pump. Set and record the sampling flow rate.
2) Switch on the pump. Place sampling equipment in the breathing zone of the worker (no more than 30cm from the mouth).
3) During sampling, record all the important information (see sampling record sheets in annexes 7 and 8) and, if the equipment allows it, check the sampling flow rate. It is important to take detailed observations during the sampling period about the activities conducted, the dust control measures in use, etc.
4) After sampling, remove the sampling equipment from the worker and switch off the pump. Record the sampling time duration. Check the pump flow rate and sampling equipment (pump, tubing and collection equipment connections).
5) Remove the collection equipment from the sampling equipment. Take the collection equipment to the laboratory for weighing procedure.

4.1.4 Field blanks

Each campaign a number of field blanks should be collected. Field blanks should follow the entire procedure, except active monitoring (see also annex 6). The number of field blanks normally varies dependent on the total number of samples that are taken during a campaign. It is however advised to collect at least one field blank per day of sampling. Information on field blanks should be entered in the collection sheet as they can be used to calculate the limits of detection and to correct all samples for these field blanks. Furthermore, it is advised to send part of the field blanks in for analyses for quartz (or other analytes) together with the regular samples. Information on quartz analyses of field blanks is again important for the correct calculation of limits of detection.

4.2 Analysis

4.2.1 Gravimetry

- Actor:

Two types of actors for dust analysis:

- Internal laboratory: it must follow the procedure given below.
- External laboratory: it must follow the procedure given below.

- Equipment:

The following equipment is necessary for the procedure:

- calibrated analytical balance with resolution of 0,1mg when the sample collection materials are foams, and 0,01mg when sample collection materials are filters
- desiccant and oven for drying and conditioning the collection equipment
- **weighing record sheet** (annex 9)

- Procedure and calculation of dust concentrations:

The sample collection materials are weighed before and after sampling on the same balance. The net weight enables the determination of the dust concentration.

<u>Procedure (See flow sheet in annex 6)</u>

This procedure is given in standards and consists in a few steps [14-16].
Before the sampling (step a):

1) If foams are used, they are washed in hot water and rinsed in distilled water. When filters (new ones) are used, the filter cassettes are washed in hot water.
2) The foams or filters are dried in an oven at 50-60°C for 12 hours.
3) The rotating cups or filter cassettes are numbered (different number for each rotating cups or filter cassettes).
4) Collection equipment (foams in their open cups or filters + cassettes) is left for conditioning next to the balance for at least 12 hours before weighing.

After the sampling (step b):
When sampling is carried out under humid conditions, foams or filters should be placed in an oven at 50-60°C for at least 4 hours. Then, the collection equipment (foams in their open cups or filters + cassettes) is left next to the balance for at least 12 hours before weighing.

Blank foams or filters must be used following the same conditioning than the active foams or filters.

The dates of pre-sampling and post-sampling weights should be recorded as well as the initial (before sampling) and final (after sampling) weights and the net weight of dust in mg (information given on the weighing record sheet).

Dust concentration calculation

It is necessary to calculate dust concentration for all the collected dust samples. This calculation follows the indication given in standards [4, 17].
To calculate the dust concentration, one needs the net weight m (in mg), the sampling flow rate F (in l/min) and the sampling time T (in min). The concentration C (in mg/m^3) is then obtained with the following equation:

$$C = 1000*(m / (F*T))^4$$

4.2.2 Qualitative analysis

- Actor

Two types of actors for dust analysis:

- Internal laboratory: it must follow the procedure given below and participate to an inter-laboratory round-robin exercise as described in the annex 11.
- External laboratory: it must be an accredited/approved laboratory and the provided information should not be limited to the concentration values and corresponding job or occupation (see paragraphs 5 and 6.1).

- Equipment

Two different analytical techniques can be used to determine the content of the collected dust: Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction.

They have different method detection limit [18] and different handling procedures, but they are both recommended and described in standards [19, 20], [21-25]. Hence, any of those can be applied.

[4] Factor 1000 is used to obtain the concentration in mg/m^3 instead of mg/dm^3.

The technique to be used, either FTIR or X-ray, will depend on the equipment currently used by the companies or by the external laboratory doing dust analysis.

- Procedure

The analytes considered are at least quartz (also called α–quartz or free silica) and sometimes (if relevant when considering the process and/or the required quality for the product) cristobalite, tridymite and/or other inorganic compounds.

Four steps have to be completed when analysing dust samples. The 4 steps of the procedure are:

- sample preparation
- calibration of the apparatus using sample standards
- measurement
- calculation of the concentration

Those general steps are identical whatever technique is used, but the content is different. They are given in the same standards as indicated earlier.

The question “do all samples require content analysis?” is debatable. It is necessary to have some quartz results and check their variation. Indeed, there are different answers to this question depending on the questioned person.

The analyst will answer that all samples require content analysis because the content in a group of samples (supposed to be homogeneous) can vary.
The occupational hygienist will answer that it depends on the mass of collected dust. If the collected weight is too low to consider the dust sample as representative, considering the accuracy of the equipment (for example 0.1mg for cyclone 10mm and 0.7mg for CIP 10 [4]), or if the mass is close to the limit of detection of the analytical technique, the results of the content analysis will not be representative.
One could also answer that it depends on previously analysed samples. If the quartz content was low or is thought to be low, the need to carry out further analysis can be discussed.

4.3 Dust measurement results

When the dust campaign has been completed, the dust measurement data should be presented and sent as an excel file (see standard excel collection sheet in Annex 12). When entering the data in the collection sheet, all concentration calculations will be done automatically.

Companies may use Annex 10 (Dust measurement results) during the sampling campaign but the data can only be transmitted through the standard excel collection sheet in Annex 12.

5 REQUIREMENTS FOR EXTERNAL LABORATORY

The external laboratory's current practices and their reference standards should meet this protocol's requirements. The external laboratory should also participate to an inter-laboratory round-robin exercise as described in the annex 11.

As described in the AFNOR French standard[5] [26], the external actor carrying out the measurement should fill in, prior to the measurement, a contract with at least the following items:

- descriptive title
- name of the external laboratory
- name of the internal company interlocutor and the external laboratory actor
- objectives and measurement characteristics such as expected sampling location/job functions, expected sampling time, expected number of samples, dust fraction considered
- equipment used (for sampling and analysis if applicable) with its characteristics (flow rate, sample collection material, procedure for analysis…)
- references used (regulatory and standard documents)
- expected cost

The minimal requirements for such contract are attached in annex 11.
The person in charge of checking that the external laboratory procedure meeting the protocol requirements is the internal company actor[6].
The external laboratory should also provide the company with a report on the measurement campaign with the information described in paragraph 6.1.

[5] This French standard is given as an example as there are similar standards in other Member states.
[6] The internal actor is whether the person attending the training session or another person being trained by the former person.

6 DATA MANAGEMENT

6.1 Campaign report

The companies or the laboratory conducting the measurements must write a campaign report for internal circulation, for management information and action.

The provided information comes from the actor (internal or external to the company) carrying out the measurement campaign, or from the company internal actor only (items indicated by the symbol (*)). The information required is:

- company name and location of the site under consideration (*)
- mineral(s) under consideration and granulometric range of the commercial product(*)
- actor(s) (internal and external) and role(s)
- detailed list of job functions (*)
- workplace factors (workplaces configuration, process, ventilation installations, personal protective equipment and work pattern) (*)
- applied occupational exposure limits
- date and duration of measurement campaign
- sampling characteristics (dust fraction, homogeneous exposure group, job functions, location, sample code, duration, number of samples, weather conditions, and any other information relevant for the measurement procedure)
- equipment used for sampling and the procedure
- technique and equipment used for quartz analysis and the procedure + calibration of the equipment.
- dust measurement data per job function (tables)
- references (regulatory references and standards used)

6.2 Data collection

The companies must provide Arbo Unie / IRAS with their results so that the data handling will be carried out. The annex 13 describes the different possibilities for the company in transmitting their data as well as the code system used to ensure confidentiality. The important items (classified into three categories of information) to provide are as follow:

- general information (country, company, site and mineral)
- sampling information (worker code and/or sample code, job function, shift, date, sampler type, sample collection material, flow rate, sampling duration time)
- analysis information (dust concentration values, analytical technique, analyte, analyte concentration values)

The data should be transmitted through the **standardized excel collection sheet** only (see annex 12)

6.3 Data handling

For the data storage, computerised data compatible with MS-Excel© or MS-Access© formats is necessary. Paper format data can also be used for internal use but computerised data allows better homogeneity in the collected information and easier connection between companies and Arbo Unie / IRAS in charge of the data handling. The format used should be compatible with the statistical software used for data handling (see paragraph 6.2.1).

6.3.1 Statistical handling

The first step in data handling is the comparison of the concentration values with threshold limit values, and the verification of the homogeneity of the exposure groups (HEG concept, as described in paragraph 3.2).

6.3.2 Elaboration of a database

The second step in data handling consists in building a database on dust exposure levels. A hierarchical design database can be used to facilitate the retrieval of information (for each job, and so also by occupation). Because the same job could have different meaning at different sites, a compound code will be used which combines the site (and the country if necessary) and the job codes. This job codes will be defined from the elaborated list of job functions (see Annex 3).

7 CONFIDENTIALITY

One of the main criteria in the data-handling step of the protocol is to follow the confidentiality requirements of the companies.

7.1 Credibility of data collection

The data collection credibility, either at mineral industry level or at partner institute level, consists in the exhaustiveness of the data collection. This implies to having all the required information as described in the previous paragraphs available.

7.2 Confidential handling

Data handling will be confidential. Arbo Unie / IRAS , in charge of data handling, will receive non-coded crude data (to simplify data handling) and will codify them according to the code system attached in Annex 13.

Arbo Unie / IRAS commits itself to respect the following confidentiality clause which is included in the contract signed with IMA – Europe:

“Arbo Unie and the University agree to keep confidential all information received from IMA-Europe and third parties in relation to the Project.

IMA-Europe recognizes the Arbo Unie and the University policy which implies that the Project will be executed in accordance with scientific research standards and the results of the Project must be publishable. Under the condition that the consultation procedure is strictly followed, IMA-Europe will permit the Arbo Unie and the University to present scientific observations and analyses obtained in the course of the Project at symposia, national or regional professional meetings, and to publish them in peer reviewed scientific journals. Arbo Unie and the University are responsible for the content of the publications or presentations. It is agreed that no individual company data will be published/presented even in anonymous format. Only aggregated data (meaning no data on company level, on individual level and on a specific mineral level) could be published/presented with the prior consent of IMA-Europe.”

For data handling and presentation, codes will be used (see Annex 13). Those codes will not allow unauthorised persons to go back to the crude data.

The quality system (described in paragraph 8) will allow the traceability of the data and authorised persons will be able to go back to the original crude data.

8 QUALITY SYSTEM

Differences can arise from making measurement using various sampling strategies and inter-laboratory differences can also be quite large [29]. Those possible differences enhance the need to follow a unique strategy as described in this protocol.

Full documentation on sampling and analytical strategy, meeting this present protocol, is essential if data sets are to be compared and routinely collected data could be made more useful for further handling with the introduction of quality assurance systems [30].

Hence, detailed protocol and quality manual covering sampling and analytical methods and sampling strategy are required [29].

A general **quality control manual** is attached in Annex 14.
This manual will summarise the overall quality system and the procedure, and will emphasise the need to:

- obtain comparable, compatible and representative data
- document full information on the implementation of the protocol on site

It will cover the following items also described in the international standard ISO 9002 [31]:

- Management responsibility: the responsibility, authority and inter-relation of concerned people shall be defined and documented.

- Document and data control: the internal actor shall maintain documented procedures to control all documents and collected data, according to the protocol requirements.

- Traceability: the internal actor shall establish and maintain documented procedures for identification and traceability for each collected data.

- Corrective action: the internal actor shall identify the difficulties for implementing the protocol and propose corrective actions. The internal actor shall record any changes to the protocol resulting from corrective actions.

- Handling and storage: the internal actor shall document procedures for data handling and storage in the company.

- Training: the internal actor shall identify training needs (for himself or for any other concerned person) regarding the implementation of the protocol.

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32. Hawkins N.C., Norwood S.K., and Rock J.C., *A strategy for occupational exposure assessment*. 1991, Akron, Ohio: American Industrial Hygiene Association.

33. British Occupational Hygiene Society, *Sampling strategies for airborne contaminants in the workplace*, in *Technical guide n°11*. 1993, British Occupational Hygiene Society.

Web sites

AFNOR Association Française de Normalisation: http://www.afnor.fr

BOHS British Occupational Hygiene Society: http://www.bohs.org

CEN Comité Européen de Normalisation: http://www.cenorm.be/

HSE Health and Safety Executive: http://www.hse.gov.uk/

IARC International Agency for Research on Cancer: http://www.iarc.fr

ISO International Organisation for Standardization: http://www.iso.ch

NIOSH National Institute for Occupational Safety and Health: http://www.cdc.gov/niosh/

OSHA Occupational Safety and Health Administration: http://www.osha.gov/

ANNEX 1: Glossary

Accuracy: measure of the correctness of data, as given by the difference between the measured value and the true or standard value.

Actor: any person who participates to the implementation of the protocol. Actor can be internal to the company or external.

Aerodynamic diameter: diameter of a sphere of density mass 1g.cm^{-3} with the same fall terminal velocity in the air, related to the particle gravity, in the same conditions of temperature, pressure and relative humidity.

Arithmetic mean: sum all the measurements in a data set divided by the number of measurements in the data set.

Authorised person: an authorised person is a person who has been given the authorisation to get a confidential data obtained during the IMA project. The authorisation is given by IMA-Europe.

Bagging: step of the process during which products are put into bags (manually or automatically).

Bias: any effect at any stage of investigation or inference tending to produce results that depart systematically from the true values. Bias is also defined as a systematic error inherent in a method or caused by some feature of the measurement system.

Chemical agent: any chemical element or compound, on its own or admixed, as it occurs in the natural state or as produced, used or released, including release as waste, by any work activity, whether or not produced intentionally and whether or not placed on the market.

Collection equipment: means the sample collection material (foam or filter) and the material where the sample collection material is placed (i.e. the rotating cup or the filter cassette).

Contract: document establishing, between the internal company interlocutor and the external laboratory actor, the context, modalities and estimated cost of the operation. This document has to be signed before the operation.

Control measures: measures carried out in order to verify the efficiency of preventive measures.

Crushing: step of the process during which the stones (mineral ore) are broken (crushed) into big fragments.

Dry process: means process using a drying step during the production.

Dust: disperse distribution of solids in air, brought about by mechanical processes or stirred up.

Epidemiology: study of the distribution and determinants of health-related states and events in populations, and the application of this study to control health problems.

Employer: any natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/or establishment.

Exposure: the presence of a chemical agent in the air within the breathing area of a worker. It is described in terms of concentration of the agent as derived from exposure measurements and referred to the same reference period as that used for the limit value.

Exposure assessment: process of measuring or estimating the intensity, frequency and duration of human contact with chemical agents actually present in the working environment.

External actor: any person or group of person, external to the company, who participates to the implementation of the protocol (sampling and/or analysis). The external actor can be a private or public organism but it need to follow the protocol requirements.

Geometric mean: the n^{th} root of the product of n values.

Hazard: intrinsic property of a chemical agent with the potential to cause harm.

Health surveillance: the assessment of an individual worker to determine the state of health of that individual, as related to exposure to specific chemical agents at work.

Homogeneous exposure group: defined as a group of workers with similar work patterns, but not necessarily at the same time. These workers represent basically similar exposure conditions.

Incidence: the number of new cases of a disease in a defined population, within a specified period of time.

Internal actor: any person, within the company, who participates to the implementation of the protocol (methodology, sampling, analysis, data management…).

Job Function: means the set of activities carried out by a worker during his daily working time. The job function is characterised by the jobs hold, the occupied locations, and the executed tasks.

Limit of detection (LOD) or method detection limit (MDL): minimum concentration of an analyte that, in a given matrix and with a specific method, has a 99% probability of being identified, qualitatively or quantitatively measured, and reported to be greater than zero.

Limit value: reference figure for the concentration of a chemical.

Measurement: set of process carried out in order to determine the value of a substance.

Measurement procedure: procedure for sampling and analysing one or more chemical agents in workplace air, including storage and transportation.

Median value: value in a measurement data set such that half the measured values are greater and half are less.

Metrology: technical and scientific approach used to determinate an assessment strategy as well as a measurement strategy, in order to give a figure to the occupational exposure of a pollutant present in the air at the workplace.

Milling: step of the process during which the stones are reduced into thin product (sand, powder…).

Mode: value in a data set that occurs most frequently.

Occupational exposure limit value: the maximum concentration of a substance in the air present at the workplace which generally does not affect the health of an employee, even if minor and reversible modifications are sometimes tolerated. It also means, unless otherwise specified, the limit of the time-weighted average of the concentration of a chemical agent in the air within the breathing zone of a worker in relation to a specified reference period.

Personal sampler (or personal sampling device): a device attached to a person that samples air in the breathing area, in order to determinate his exposure to pollutants.

Pneumoconiosis: lung disease due to dust.

Precision: measure of the reproducibility of a measured value under a given set of conditions.

Preparation: mixtures or solutions composed of two or more substances.

Prevalence: the number of instances of a given disease or other condition in a given population at a designated time.

Prevention: all the steps or measures taken or planned at all stages of work in the undertaking to prevent or reduce occupational risks.

Quality assurance (QA): integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality control (QC): overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of the users. The aim is to provide quality that is satisfactory, adequate, dependable, and economical.

Quantification limit (QL): concentration of an analyte in a specific matrix for which the probability of producing analytical values above the method detection limit is 99%.

Random: random means governed by chance or as what is not completely determined by other factors.

Random samples: samples selected from a statistical population such that each sample has an equal probability of being selected.

Range: difference between the largest and smallest values in a measurement data set.

Representativeness: degree to which a sample is, or samples are, characteristic of the whole medium, exposure for which the samples are being used to make inferences.

Respirable dust fraction: fraction of an airborne material that penetrates to the gas exchange region of the lung. Respirable particles are also defined as particles that are small enough to be breathed into the depths of the lung.

Risk: likelihood that the potential for harm will be attained under the conditions of use and/or exposure.

Sample collection material: part of the collection equipment, which collects the dust, i.e. foams or filters.

Sampling equipment: means the sampler, the sampling pump, the connecting tubes and the collection equipment.

Sampling frequency: time interval between the collection of successive samples.

Sampling strategy: choice of the methods and materials, and co-ordination of the sampling actions in order to obtain, with efficiency, useful data.

Shift: length of time spent by a worker at his workplace. It is described in terms of duration in hours usually in a one-day basis.

Standard: Document elaborated by consensus and agreed by an approved organism with standardisation activities. This document gives, for common and repeated practices, rules and guidelines warranting an optimal level of disposition in a defined context.

Static sampler: device positioned next to an emission source.

Substance: chemical elements and their compounds as they occur in the natural state or as produced by industry.

Surface and underground mineral-extracting industries: all industries practising surface or underground extraction in the strict sense of the word of minerals, and/or prospecting with a view to such extraction, and/or preparation of extracted materials for sale, excluding the activities of processing the materials extracted, excluding the mineral-extracting industries through drilling.

Thoracic dust fraction: fraction of an airborne material that penetrates beyond the larynx.

Total inhalable dust: fraction of an airborne material which enters the nose and mouth during breathing, and is therefore available for deposition anywhere in the respiratory tract (MDHS 14/2). The standard EN 481 gives the percentage of the suspended total particulate that can be inhaled according to their size.

Wet process: means process involving addition of water at some stage of the production.

Work pattern: the definable series of activities from the periods under consideration.

Work station: delimited zone of a workplace where a given task is carried out or a set of tasks.

Worker: any person employed by an employer, including trainees and apprentices but excluding domestic servants.

Workers' representative (with specific responsibility for the safety and health of workers): any person elected, chosen or designated in accordance with national laws and/or practices to represent workers where problems arise relating to the safety and health protection of workers at work.

Workplace: the whole area intended to house workstations, relating to the immediate and ancillary activities and installations of the surface or underground mineral-extracting industries, including overburden dumps and other tips and accommodation, where provided, to which workers have access in the context of their work.

Workshop: zone grouping eventually a few work areas or workplaces.

Worst case: semiquantitative term referring to the maximum possible exposure or risk, that can conceivably occur, whether or not this exposure or risk actually occurs is observed in a specific population.

ANNEX 2: Occupational Exposure Limits in mg/m^3 – Respirable dust In EU 25[7] + Norway & Switzerland

Country/Authority *(see caption p. 2)*	Non specified (inert) dust	Quartz	Cristobalite	Tridymite	Diatomaceous earth	Amorphous silica	Fused silica	Kaolin	Mica	Talc
Austria/I	6	0,15	0,15	0,15			0,3			5
Belgium/II	3	0,1	0,05	0,05	3	2	0,1	2	3	2
Czech Republic/III		0,1	0,1	0,1					2	2
Denmark/IV	5	0,1	0,05	0,05	1,5		0,1	2		
Estonia		0,1	0,05	0,05		2				
Finland/V	/	0,2	0,1	0,1	5					5
France/VI		5 or 25k/Q[8]								
France/VII	5	0,1	0,05	0,05				10		
Germany/VIII	3	/[9]	0,15	0,15			0,3			2
Greece/IX	5	0,1	0,05	0,05						2
Hungary		0,15	0,1	0,15						2
Ireland/X	4	0.05	0.05	0.05		2,4	0,08	2	0,8	0,8
Italy/XI	3	0,05	0,05	0,05			0,1	2	3	2
Luxembourg/XII	6	0,15	0,15	0,15			0,3			2
Netherlands/ XIII	5	0,075	0,075	0,075				10	2,5	1
Norway/ XIV	5	0,1	0,05	0,05	1,5	1,5			3	2
Poland		0,3	0,3	0,3	2		1			1
Portugal/ XV	5	0,05	0,05	0,05			0,1	2	3	2
Slovakia		0,1	0,1	0,1		2			2	2
Slovenia		0,15	0,15	0,15			0,3			2
Spain/XVI		0,1								
Spain/XVII		5 or 25k/Q								
Spain/XVIII	3	0,1	0,05	0,05			0,1	2	3	2
Sweden/XIX	5	0,1	0,05	0,05						1
Switzerland/XX	6	0,15	0,15	0,15		0,3	0,3	3	3	2
UK/XXI	4	0,1	0,1	0,1	1,2	2,4	0,08	2	0,8	1

[7] Missing information for Cyprus, Latvia, Lithuania and Malta – To be completed.
[8] Q : quartz percentage – K=1
[9] Germany has no more OEL for quartz. Employers are obliged to minimize exposure as much as possible, and to follow certain protective measures.

Caption

Country		Adopted by/Law denomination	OEL Name (if specific)
Austria	**I**	Bundesministerium für Arbeit und Soziales	Maximale ArbeitsplatzKoncentration (MAK)
Belgium	**II**	Ministère de l'Emploi et du Travail	
Czech Republic	**III**	Governmental Directive n°441/2004	
Denmark	**IV**	Direktoratet fot Arbeidstilsynet	Threshold Limit Value
Finland	**V**	National Board of Labour Protection	Occupational Exposure Standard
France	**VI**	Ministère de l'Industrie (RGIE)	Empoussiérage de référence
	VII	Ministère du Travail	Valeur limite de Moyenne d'Exposition
Germany	**VIII**	Bundesministerium für Arbeit	Maximale ArbeitsplatzKoncentration (MAK)
Greece	**IX**	Legislation for mining activities	
Ireland	**X**	2002 Code of Practice for the Safety, Health & Welfare at Work (CoP)	
Italy	**XI**	Associazone Italiana Degli Igienisti Industriali	Threshold Limit Values (based on ACGIH TLVs)
Luxembourg	**XII**	Bundesministerium für Arbeit	Maximale ArbeitsplatzKoncentration (MAK)
Netherlands	**XIII**	Ministerie van Sociale Zaken en Werkgelegenheid	Maximaal Aanvarde Concentratie (MAC)
Norway	**XIV**	Direktoratet for Arbeidstilsynet	Administrative Normer (8hTWA) for Forurensing I ArbeidsmiljØet
Portugal	**XV**	Instituto Portuges da Qualidade, Hygiene & Safety at Workplace NP1796:2004	Threshold Limit Value
Spain	**XVI**	Instituto Nacional de Seguridad e Higiene en el Trabajo	Valores Limites
	XVII	Reglamento general de Normas Basicas de Seguridad Minera	
	XVIII	Instrucciones de Técnicas Complementarias (ITC)	
Sweden	**XIX**	National Board of Occupational Safety and Health	Yrkeshygieniska Gränsvärden
Switzerland	**XX**		Valeur limite de Moyenne d'Exposition
United Kingdom	**XXI**	Health & Safety Executive	Workplace Exposure Limits

Source : IMA-Europe. Date : July 2006, updated version available at http://www.ima-eu.org/en/publication.htm

ANNEX 3: Job function's nomenclature

General category	Example of tasks/activities description
1. Quarry operator (outdoor)	Works in quarry Load dumper using an excavator Feed the crusher in quarry Transport raw materials to the unloading places using a dumper or wheel loader
2. Crusher operator (indoor)	Feed the crusher in plant Control of crusher in plant
3. Wet process operator	Supervise the process in a control room Sampling and control of sieve
4. Dry process operator	Supervise the process in a control room Sampling and control of sieve
5. Miller operator	Supervise the process near the mill
6. Bagging operator	Supervise automatic bagging machines and bulk loading into 25/50kg bags Add bag to semi-automatic bagging machine Fill powder bags and cover pallets with plastic films Handle bags on pallets Stock the product in the storage building
7. Transport/bulk loading	Fill the hopper with end product using a wheel loader Supervise the conveyor belt feeding ship/train/truck Load goods in lorries and organise the storage operation
8. Foreman/plant management staff	General office work Supervise and organise plant activities Control of process and product
9. Maintenance	Control of plates in the crusher, new sieves, dust sealing, checking and cleaning inside enclosures In charge of mechanical and electrical maintenance in plant/office/quarry
10. Multi-skilled*	The multi-skilled operator is an operator who does several job functions, none of which amounting to or exceeding 50 % of his working time.
11. Laboratory workers	Samples collection in the plant, analysis & quality control of the samples.
12. Research and Development	Development of new products in a pilot plant Running tests on an installation for technology or product improvement Applications of products on laboratory scale.
13. Plastification	Manufacture of prepared body from clay.

* For this category, it is necessary to fully describe the activities of the workers as well as the time percentages for each activity.

ANNEX 4: Simulation

Measurement campaign duration

Hypothesis:

- 7 samplers
- sampling duration of 7-8 hours
- 7 job functions to be monitored
- Size of the exposure group: 1 – 8 workers
- 6 samples are required for each job function. So the number of samples required for the 7 job functions is 42.
- 1 sampling corresponds to 2 working days (1 day for sampling and 1 day for sampler reloading).
- Weighing procedure takes 4 days (2 days for step a and 2 days for step b as described in paragraph 4.2.1).
- Qualitative analysis takes 2 days.
- Writing report takes 1 day.

Time scale:

<table>
<tr><td>Day</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td></tr>
<tr><td>Sampling procedure</td><td colspan="2">RL</td><td>S1</td><td>RL</td><td>S2</td><td>RL</td><td>S3</td><td>RL</td><td>S4</td><td>RL</td><td>S5</td><td>RL</td><td>S6</td><td>RL</td><td>S7</td><td>RL</td><td></td><td></td><td></td><td rowspan="3">R</td></tr>
<tr><td rowspan="2">Analytical procedure</td><td colspan="2" rowspan="2">W1.a</td><td rowspan="2">W2.a</td><td colspan="2">W1.b</td><td colspan="2">W2.b</td><td colspan="2">W3.b</td><td colspan="2">W4.b</td><td colspan="2">W5.b</td><td>W6.b</td><td rowspan="2">W6.b</td><td colspan="2" rowspan="2">W7.b</td><td colspan="2" rowspan="2">QA</td></tr>
<tr><td>W2.a</td><td colspan="2">W3.a</td><td colspan="2">W4.a</td><td colspan="2">W5.a</td><td colspan="2">W6.a</td><td colspan="2">W7.a</td></tr>
<tr><td>Number of collected samples</td><td></td><td></td><td>6</td><td></td><td>12</td><td></td><td>18</td><td></td><td>24</td><td></td><td>30</td><td></td><td>36</td><td></td><td>42</td><td></td><td></td><td></td><td></td></tr>
</table>

RL: sampler reloading
Si: i^{th} sampling procedure
Wi.x: step x of the i^{th} weighing procedure
QA: qualitative analysis (for quartz content determination for example)
R: campaign report

Conclusion:

A measurement campaign takes 20 days (5-7 weeks) for assessing dust exposure (42 dust measurements for 7 job functions).

Cost for one measurement campaign

Hypothesis:

- 7 rent samplers
- 7 job functions to be monitored
- 42 samples
- 14 days are required to collect 42 samples and 28 days to collect 84 samples
- 21 quartz analysis (meaning 3 per job function)
- technician salary of 12 Euros per hour

Level of participation / Activity	External laboratory for sampling and analysis		External laboratory for quartz analysis only		No external laboratory	
Sampling equipment (to rent)	Per sample and for 1 week	For 42 samples	Technician		Technician	
	15	2520	Time (hours)	Cost	Time (hours)	Cost
			75	900	80	1200
Weighing	Per sample	For 42 samples	Technician		Laboratory technician	
	27	1134	Time (hours)	Cost	Time (hours)	Cost
			4	48	4	48
Quartz analysis	Per analysis	For 21 samples	Per analysis	For 21 samples	Laboratory technician	
	76	1596	76	1596	Time (hours)	Cost
					10	90
TOTAL	**5250**		**2544**		**1368**	

Comment:

Example of cost: 6,494 Euros for 7 CIP 10 samplers; 7,740 Euros for 7 Gilair-3 pumps and 850 Euros for 7 10mm nylon cyclone.
Example of cost for collection equipment: 441 Euros for 100 foams; 145 Euros for 20 cassettes and 350 for 100 membrane filters.
Other accessories: 70-120 Euros for battery charger, 33 Euros for tool set, 42 Euros for transport case.

ANNEX 5: Campaigns' Periodicity

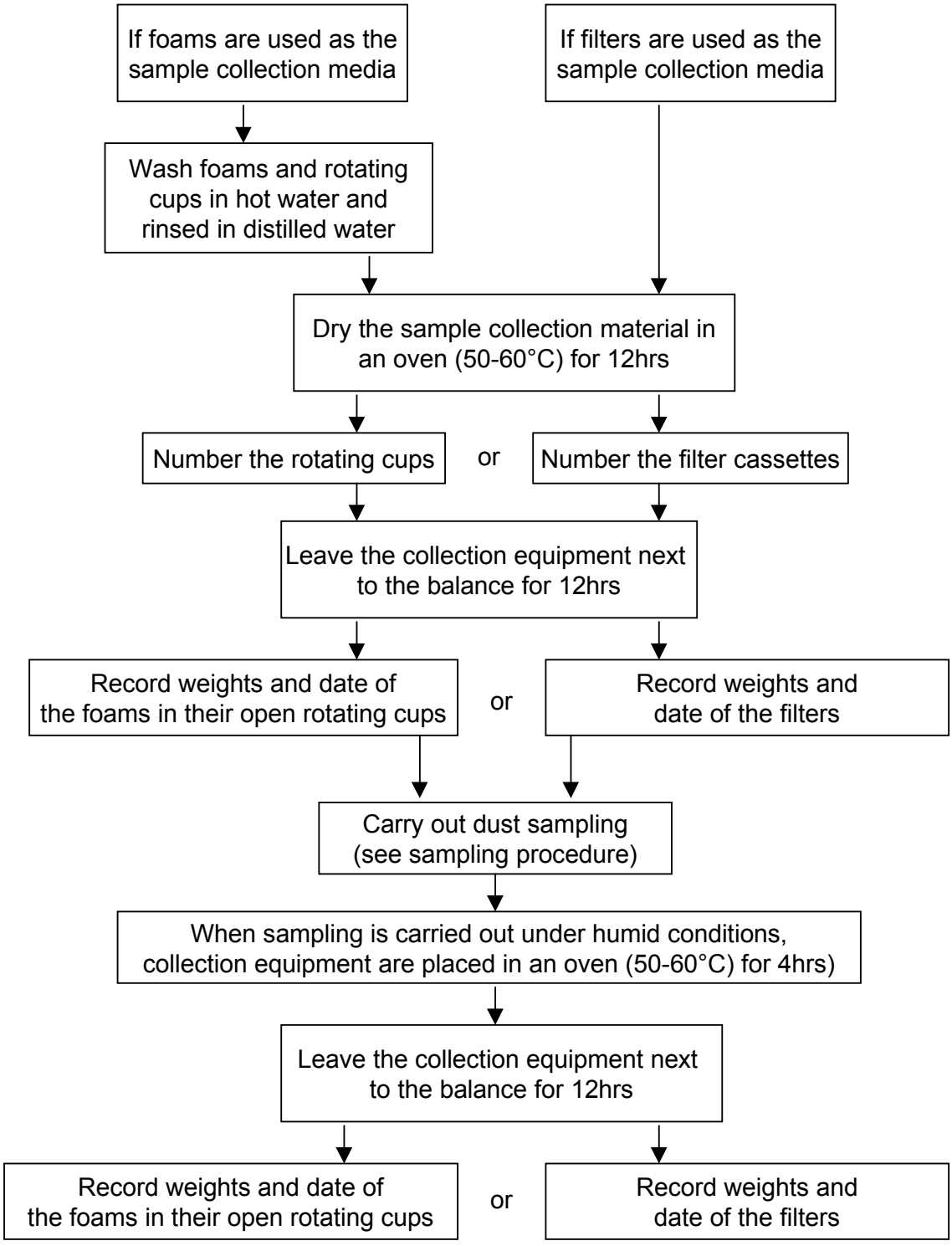
Two full campaigns (in winter and in summer season) should be completed during the first year of participation. After that, commitment to the Protocol can be reduced following the instructions of the table below:

<table>
<tr><th>Number of previous campaigns</th><th>GSD* < 3</th><th>Diagnostic</th><th>Actions</th></tr>
<tr><td rowspan="2">N ≤ 4</td><td>Yes</td><td>Green
Orange
Red</td><td>The target is to do 2 campaigns per year (1 during summer time and 1 during winter time) to study the effect of the season on the data. This should at least be done the first year.
After that, 1 campaign per year is the minimum. If only 1 campaign per year is performed, one should alternate summer and winter period.</td></tr>
<tr><td>No</td><td>Green
Orange
Red</td><td>Need to study workers' conditions of exposure (workplace survey and sampling sheets analyses)
After 4 campaigns of measurement, this situation should persist only for mobile functions (maintenance, foreman, transport and multi-skilled).
A GSD>3 for the well-defined functions (bagging, crusher, dry process, wet process, miller, laboratory), means that workers of the group don't perform identical or similar tasks at the same place of work and don't have a similar exposure.
The exposure group must be re-defined.</td></tr>
<tr><td rowspan="4">N > 4
and at least 24 samples for the considered job function</td><td rowspan="3">Yes</td><td rowspan="2">Green / orange
for the 3 last campaigns</td><td><u>No modification of working conditions:</u>
Perform one campaign of measurement one year out of two for the considered job functions, alternate Winter and Summer.
This option can allow companies having many sites and job functions to distribute the costs over two years.</td></tr>
<tr><td><u>Modifications of working conditions:</u>
1 campaign per year, alternate Winter and Summer.</td></tr>
<tr><td rowspan="2">Red for the 3 last campaigns</td><td><u>No modification of working conditions:</u>
A campaign of measurement one year out of two for the considered job functions if no preventive scheme is implemented.
This option can allow companies having many sites and job functions to distribute the costs over two years.</td></tr>
<tr><td><u>Modifications of working conditions/implementation of preventive scheme:</u>
1 campaign per year to verify the effects of the modifications</td></tr>
<tr><td>No</td><td>Green
Orange
Red</td><td>Need to study workers' conditions of exposure (workplace survey and sampling sheets analyses)
After 4 campaigns of measurement, this situation should persist only for mobile functions (maintenance, foreman, transport and multi-skilled).
A GSD>3 for the well-defined functions (bagging, crusher, dry process, wet process, miller, laboratory), means that workers of the group don't perform identical or similar tasks at the same place of work and don't have a similar exposure.
The exposure group must be re-defined.</td></tr>
</table>

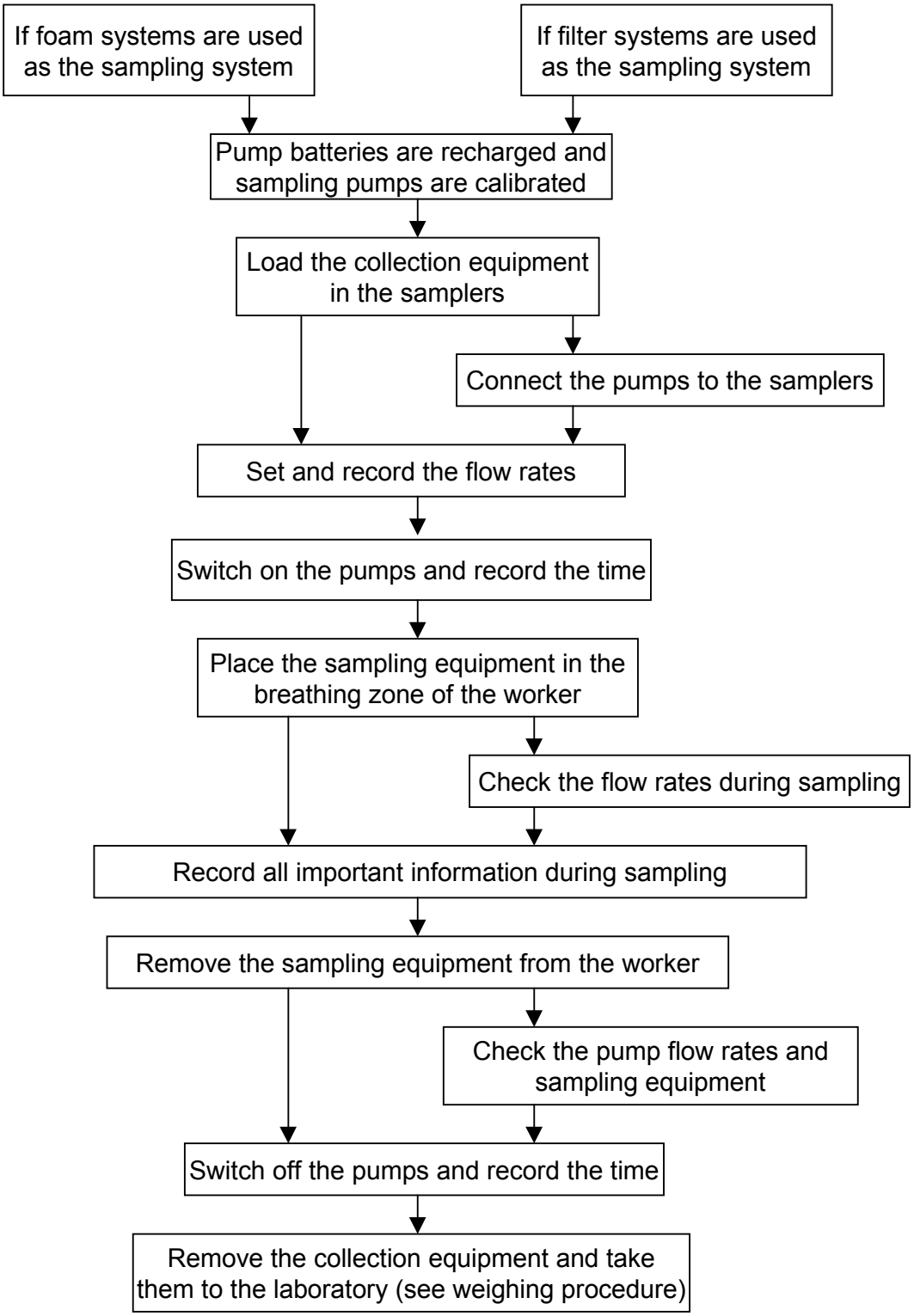
* Geometric Standard Deviation

ANNEX 6: Flow sheet for weighing and sampling

Weighing procedure



Sampling procedure



1. Step a of the weighing procedure (regular samples AND field blanks)

1.1 If foams are used, they are washed in hot water and rinsed in distilled water. When filters (new ones) are used, the cassettes are washed in hot water.

1.2 Foams or filters are dried in an oven at 50-60°C for 12 hours.

1.3 Rotating cups or filter cassettes are numbered (different number for each rotating cups or filter cassettes).

1.4 Collection equipment (foams in open cups or filters + cassettes) is left for conditioning next to the balance for at least 12 hours.

1.5 Foams in their open cups or filters are weighed on a calibrated balance (resolution of 0.1mg for foams or 0.01mg for filters).

1.6 Record weight and date on the weighing record sheet (see annex 9).

2A. Sampling procedure (regular samples)

2.1 Pump batteries are recharged and, if necessary, sampling pumps are calibrated according to manufacturer's instructions (this step is carried out during step a of the weighing procedure).

2.2 Load the collection equipment in the samplers and connect to the sampling pumps.

2.3 Set and record the sampling flow rates.

2.4 Switch on the pumps and record the time.

2.5 Place sampling equipment in the breathing zone of the worker (no more than 30cm from the mouth).

2.6 During sampling, record all the important information (see sampling record sheets in annexes 7 and 8) and, if materials allow it, check the sampling flow rates.

2.7 After sampling, remove the sampling equipment from the worker and record the time.

2.8 Check the pumps flow rate and sampling equipment (pump, tubing and sample collection material connections).

2.9 Switch off the pumps.

2.10 Remove the collection equipment from the sampling.

2.11 Take the collection equipment to the laboratory for weighing procedure.

2B. Sampling procedure (field blanks)

Field blanks should follow the complete procedure and must be taken on the field trip. The only difference, however, is that they will not be connected to a pump and there will be no active sampling.

3. Step b of the weighing procedure (regular samples AND field blanks)

3.1 When sampling is carried out under humid conditions, foams or filters should be placed in an oven at 50-60°C for at least 4 hours.

3.2 Collection equipment (foams in open cups or filters + cassettes) is left next to the balance for at least 12 hours.

3.3 Foams in their open cup or filters are weighed on a calibrated balance.

3.4 Record weight and date on the weighing record sheet (see annex 9).

4. Qualitative analysis (regular samples AND field blanks)

4.1 Samples are prepared.

4.2 Apparatus is calibrated using standard samples.

4.3 Samples are analysed (All regular samples and a fraction of the field blanks)

4.4 Record date and inorganic contents (quartz, cristobalite, tridymite…) on the weighing record sheet (see annex 9).

ANNEX 7: Sampling record sheet 1

Annex 7: Sampling record sheet 1

Sampling record sheet number:	
Company name:	**Site:**
Technician:	**Date of sampling:**
Sampler number:	**Collection material number:**
Job function:	**Worker's ID code:**
Shift length:	**Shift period:**
Sampling time on:	**Measured flow rate (l/min):**
Sampling time off:	**Befo re** / **During** / **After**
Weather conditions:	

Time	Description of the worker's activities	Duration	Personal protective equipment worn	Incident/Event*

* e.g. information on process conditions, production rate, local exhaust ventilation system

ANNEX 8: Sampling record sheet 2

ANNEX 8: Sampling record sheet 2										
Sampling record sheet number:										
Company name :				**Site :**				**Campaign:**		
Technician:				**Mineral and granulometry range :**						

Worker ID code	Job function	Date	Dust fraction	Sampler number	Collection material number	Flow rate (l/min)	Sampling time			Comment
							On	Off	Total (min)	

ANNEX 9: Weighing record sheet

ANNEX 9: Weighing record sheet								
Weighing record sheet number :								
Technician :					Precision of the balance :			

Collection material number	Before sampling		After sampling		Weight of collected dust (mg)	Analytical results		
	Date	Weight (mg)	Date	Weight (mg)		Date	Analyte	Weight collected (mg)
Blank1								
Blank 2								
Blank 3								

ANNEX 10: Dust measurement results

ANNEX 10: Dust measurement result										
Sheet number:										
Company name :					**Site :**			**Campaign :**		
Mineral + granulometry range:					**Flow rate :**			**Technician :**		
Worker ID code	Job function	Shift	Sampling Date	Sampler number	Collection material number	Sampling duration time (min)	Dust collected (mg)	Dust concentration (mg/m3)	Analytical results	
									Analyte	Concentration (mg/m3)

ANNEX 11: Minimal requirements for external laboratory sub-contracting

The contract sheet
The contract sheet between the external laboratory and the company should contain at least the following items, which must meet the protocol requirements:

- name, status and location of the external laboratory
- accreditation paper if necessary and name of the accreditation organism
- descriptive title/description of the context
- name of the laboratory interlocutor
- name of the company interlocutor
- description of the different interlocutor roles
- expected campaign duration and date
- equipment and technique used for sampling and analysis
- references (regulatory and standard documents)
- cost
- characteristics for campaign report

Laboratories which are involved in the sampling exercise should take field blanks as specified in the protocol and in the instructions for the collection sheet.

Analytical limits of detection should be specified for dust and for the different analytes.

Inter-laboratory round-robin exercise
The external organism should participate in an inter-laboratory round-robin exercise in its country or at a European scale.

This exercise consists in the grouping of a few laboratories. The laboratories looking for accreditation receive from a central organism/institute standard samples to be analysed (for example α-quartz standards). The analysis' results are sent back to the organism/institute for comparison with the actual value.
Then, the organism/institute let them know the exercise's results, with statistical analysis.

This exercise enables comparison of laboratory's equipment and working practices, and allows the checking of the equipment's calibration.

ANNEX 12: Standard Excel Collection Sheet

Please fill in the yellow cells concerning analytical LOD and blank filters								
INFORMATION ON THE ANALYTICAL LIMIT OF DETECTION:								
Balance (mg)								
IR (mg)								
RX (mg)								
FIELD BLANKS						**ANALYSIS OF FIELD BLANkS**		
For information on field blanks see instruction								
Date	**Field blank ID**	**Pre-weight (mg)**	**Post-weight (mg)**	**Amount (mg)**		**Quartz (mg)**	**Cristobalite (mg)**	**Tridymite (mg)**
1/Jan/2006	example	2,000	2,200			0,001	0,002	0,003
LOD								
LOQ								
blank correction				**0,000**		**0,000**	**0,000**	**0,000**

Standard Excel Collection Sheet
Columns' titles

Company	Country	Site	Mineral	Date	Shift	Weather condition 1	Weather condition 2	Sample ID	Type of Measurement	**UNIQUE** worker code	Smoking during sampling	Job function

Quarry operator	Crusher operator	Wet proces operator	Dry process operator	Miller operator	Bagging operator	Transport worker	Foreman	Maintenance worker	Laboratory	Research and development	Plastification	Other job function	Specify here if other	**Total**	Comment	Shift length (hours)	personal protective equipment during sampling

Sampler	Sample collection material	Measured Flow rate at start sampling (l/min)	Measured Flow rate at end sampling (l/min)	**Average flow rate (l/min)**	Sampling time on	Sampling time off	**Sampling duration time (min)**	**Sampled volume (l)**	Filter Weight before sampling (mg)	Filter Weight after sampling (mg)	**Weight collected dust (mg)**	**Calculated dust concentration (mg/m3)**	**8-hours TWA dust concentration (mg/m3)**

Analyte other	**Quartz** technique
Technique other analyte	Weight quartz (mg)
Weight other analyte (mg)	**Concentration quartz (mg/m3)**
Concentration other analyte (mg/m3)	**Percentage quartz (%)**
Percentage other analyte (%)	**8-hours TWA concentration quartz (mg/m3)**
8-hours TWA concentration other analyte (mg/m3)	**Cristobalite** Technique
Comment	Weight cristobalite (mg)
	Concentration cristobalite (mg/m3)
	Percentage cristobalite (%)
	8-hours TWA concentration cristobalite (mg/m3)
	Tridymite Technique
	Weight tridymite (mg)
	Concentration tridymite (mg/m3)
	Percentage tridymite (%)
	8-hours TWA concentration tridymite (mg/m3)

Annex 13: Data handling code system

Data Collection

The companies will send their data to Arbo Unie / IRAS using the standard excell collection sheet (see Annex 12) only, with a copy to IMA - Europe. Arbo Unie / IRAS will use a code system as described below and send the data reports to IMA-Europe and to each company.

The data sent by the companies should include the items described in paragraph 6.2. of the protocol.

Code system

The code system will consist of specific codes for each item which would only be recognisable by Arbo Unie / IRAS and IMA-Europe. Each country, each company, each site and each mineral will have their codes which will be jointly decided by IMA and Arbo Unie / IRAS.

It is important to note that data for which the origin is easily recognisable will never be released, for instance when there is less than 2 companies producing the same mineral in the same country, aggregated data will not be released for this pair country/mineral.

The items requiring codification are:

- country: 2-digit number
- company: 3-digit number
- site: 3-digit number
- mineral: 2 letters
- sample: company or lab's internal codification could be used
- worker: company's internal codification could be used. Note that each worker should be given a unique workers code (for more information see chapter 3.1.)

ANNEX 14: Quality control manual

The quality control manual defines the general requirements for quality assurance within the organisation such as lines of responsibility and authority, record keeping and confidentiality. It also defines the particular quality systems for sampling, analysis and data handling.

Management responsibility
All the actors must be identified as well as the inter-relation and their roles.

- The internal actor has the responsibility of implementing the protocol and he is in charge of controlling if the external laboratory meets the protocol requirements. The internal actor is the interlocutor for IMA-Europe and Arbo Unie / IRAS. He is also responsible for transmitting the results of the dust measurement campaigns, after each campaign, to Arbo Unie / IRAS and/or IMA-Europe. During the protocol implementation, the internal actor identifies the:
    - encountered difficulties and proposes corrective actions to IMA-Europe and Arbo Unie / IRAS.
    - training needs (for himself or for any other concerned person).
- The external laboratory should meet the protocol requirements (see paragraph 5) and implement the protocol with the internal actor. After each campaign, it must send the results to the internal actor.
- IMA-Europe is in charge of collecting all the dust measurement data and transmits the results to Arbo Unie / IRAS with respect to the confidentiality agreement.
- Arbo Unie / IRAS is responsible for data handling and provides IMA-Europe and each company with reports on the dust measurement data.
- IMA-Europe and Arbo Unie / IRAS are in charge of controlling if the company properly implements the protocol. They are also responsible for giving technical support to the companies if necessary.

Quality system for sampling
The quality system for sampling encompasses the minimal requirements described in the protocol (see paragraph 3). It concerns the:

- sampling characteristics (personal sampling, respirable dust fraction, job functions monitored, number of samples, sampling duration)
- sampling procedure
- sampling equipment (sampler and collection equipment)
- periodicity between measurement campaign
- use of the sampling record sheets
- participation of an external laboratory

Quality system for analysis
The quality system for analysis encompasses the minimal requirements described in the protocol (see paragraph 3). It concerns the:

- gravimetry procedure
- qualitative analysis procedure
- analytical equipment
- use of the weighing record sheet
- participation of an external laboratory
- inter-laboratory round-robin exercise

Quality system for data handling

The quality system for data handling encompasses the minimal requirements described in the protocol (see paragraphs 6 and 7). It concerns the:

- data format collection and storage
- format of the campaign report
- data statistical handling
- data restitution to the companies and to IMA-Europe
- data collection confidentiality

Traceability

Traceability of the results is ensured by retaining detailed records on the implementation of the sampling and analysis strategies that must be kept by the internal actor and available for IMA-Europe if needed.

Annex 15: Implementation of the common protocol

OBJECTIVES

The phase II of the IMA Hygiene project had two objectives:

- Define criteria and recommendations for a common monitoring strategy for dust exposure assessment in the European industrial minerals industry which will ensure the collection of representative, compatible and comparable data. In this aim, a common protocol that the companies can adapt to their policies and practices was drafted.
- Train the actors of the different companies, which participate in the project, on the common protocol. The training (21st and 22nd March 2002) enabled each company to develop their monitoring strategies in accordance with the protocol.

Phase III consists of the implementation of the common protocol on site in order to collect data on dust exposure levels in some IMA Member companies.

- The objective of the data collection programme is to provide a database on dust exposure levels in the industrial minerals industry. Such a database could be useful for each company and for IMA-Europe. At the end of phase III, each company will have its own database.

DATA HANDLING OF DUST MEASUREMENTS

Data management

- Each company will carry out (on their own or with the local partner institute) its dust measurements. The data will be processed in a similar way in all companies.
- Elaboration of a database allowing collection and handling of data from different companies
- Data management: collection of produced data by the companies within the common database. The company data will be sent to the IHIE according to compatible formats (Spreadsheet, database)
- Company data control (cleaning data) and demand for possible further information concerning the data and their production
- Data statistical analysis and production of result tables :
    - For each company production of summary tables by job function and by type of dust (total dust, crystalline silica): number of measures, geometric mean, geometric standard deviation, range (min – max), compliance with applicable regulation (national), description of exposure groups (in accordance with HEG concepts)
    - For IMA industry : production of summary tables by mineral / country and job function
- The summary statistics will be produced for different periods :
    - After a trial period of 3 months which will follow the training session in order to verify that produced data are compatible with common protocol. Adaptation may follow this period.
    - After summer survey up to September 2002
    - After winter survey : October 2002 – February 2003
    - Recapitulation of the summer and winter surveys

- Analysis of job function description across the companies in order to enable evolution/adaptation of the job function codification of the protocol
- Production of an intermediate and final reports:
    - for each individual company
    - to IMA Europe Board
- The grouping of the dust exposure will respect confidentiality
- Quality procedures of data management

The debriefing

One-day debriefing meeting will be organised every year in order to present the results and discuss the difficulties met. All companies participating to the training session and the implementation will be invited.

To be discussed

Quality control of measures

TYPICAL PLANNING

- October – March: winter sampling campaign
- Deadline for sending record sheets to Institute: end April
- Reports sent to companies in July
- April – September: summer sampling campaign
- Deadline for sending record sheets to Institute: end October
- Reports sent to companies in January

Note that collection sheets sent after the deadline will be processed and the companies will receive their reports 3 months after.

ANNEX 16: USEFUL CONTACT DETAILS

STANDARDISATION ORGANISMS

Country	Organism	Address	Tel/Fax	E-mail	Web site
Austria	Österreichisches Normungsinstitut (ON)	Postfach 130, Heinestraße 38 1021 Wien	+43 1 213 00 +43 1 213 00 650	infostelle@on-norm.at	http://www.on-norm.at
Belgium	Institut Belge de Normalisation (IBN)	avenue de la Brabançonne, 29 1000 Bruxelles	+32 2 738 01 05 +32 2 733 42 64	info@ibn.be	http://www.bin.be
Czech Republic	Czech Standards Institute (CSNI)	Biskupsky dvúr 5 110 02 Praha 1	+420 2 21 802 100 +420 2 21 802 311	info@csni.cz	http://www.csni.cz
Denmark	Dansk Standard (DS)	Kollegievej 6 2920 Charlottenlund	+45 39 96 61 01 +45 39 96 61 02	dansk.standard@ds.dk	http://www.ds.dk
Finland	Suomen Standardisoimisliitto r.y. (SFS)	PO Box 116 00241 Helsinki	+358 9 149 93 31 +358 9 146 49 25	info@sfs.fi	http://www.sfs.fi
France	Association Française de Normalisation (AFNOR)	11 avenue Francis de Pressensé 93571 Saint Denis La Plaine Cédex	+33 (0) 1 49 17 91 91 +33 1 49 17 90 00	uari@afnor.org	http://www.afnor.fr
Germany	Deutsches Institut für Normung e.V. (DIN)	Burggrafenstrasse 6 10787 Berlin	+49 30 2601-0 +49 30 2601-1231	postmaster@din.de	http://www.din.de
Greece	Hellenic Organization for Standardization (ELOT)	313, Acharnon Street 11145 Athens	+30 1 021 20 100 +30 1 022 86 219	info@elot.gr	http://www.elot.gr
Ireland	National Standards Authority of Ireland (NSAI)	Glasnevin Dublin 9	+353 1 807 38 00 +353 1 807 38 38	nsai@nsai.ie	http://www.nsai.ie
Italy	Ente Nazionale Italiano di Unificazione (UNI)	Via Battistotti Sassi, 11b 20133 Milano MI	+39 02 70 02 41 +39 02 70 10 61 06	uni@uni.com	http://www.uni.com
Luxembourg	Service de l'Energie de l'Etat (SEE)	B.P. 10 2010 Luxembourg	+352 46 97 46 1 +352 46 97 46 39	see.normalisation@eg.etat.lu	http://www.see.lu
Netherlands	Nederlands Normalisatie-instituut (NEN)	PO Box 5059 2600 GB Delft	+31 15 269 03 90 +31 15 269 01 90	info@nen.nl	http://www.nen.nl/
Norway	Norges Standardiseringsforbund (NSF)	PO Box 353 Skøyen 0213 Oslo	+47 22 04 92 00 +47 22 04 92 11	info@standard.no	http://www.standard.no/nsf
Portugal	Instituto Português da Qualidade (IPQ)	Rua António Gião, 2 2829-513 Caparica	+351 21 294 81 00 +351 21 294 81 01	ipq@mail.ipq.pt	
Spain	Asociación Española de Normalización y certificación (AENOR)	Génova, 6 28004 Madrid	+34 914 32 60 00 +34 913 10 40 32	info@aenor.es	http://www.aenor.es
Sweden	Swedish Standards Institute (SIS)	118 80 Stockholm	+46 8 555 520 00 +46 8 555 520 01	info@sis.se	http://www.sis.se
Switzerland	Schweizerische Normen-Vereinigung (SNV)	Bürglistrasse 29 8400 Winterthur	+41 52 224 54 54 +41 52 224 54 74	info@snv.ch	http://www.snv.ch
United Kingdom	British Standard Institution (BSI)	389 Chiswick High Road London W4 4AL	+44 (0) 20 8996 9000 +44 (0) 20 8996 7400	Info@bsi-global.com	http://www.bsi-global.com

NATIONAL INSTITUTES

Germany:
Berufsgenossenschaftliches Institut für Arbeitssicherheit (BIA)
Alte Heerstr. 111
53754 Sankt Augustin
Tel: +49 22 41 231 02; Fax: +49 22 41 231 22 34
E-mail: bia@hvbg.de
Web site: www.hvbg.de/bia

Steinbruchs-Berufsgenossenschaft (STBG)
Postfach 10 15 40
30836 Langenhagen
Tel: +49 511 72 570
Fax: +49 511 72 57 790
E-mail: bg02@aol.com
Web site: www.stbg.de

Finland:
Finnish Institute of Occupational Health (FIOH)
Topeliuksenkatu 41 a A
00250 Helsinki
Tel.: +358 (0) 9 47 471; Fax: +358 (0) 9 4747 2548
Website: www.occuphealth.fi

France:
Institut National de Recherche et de Sécurité (INRS)
Centre de Paris
30 rue Olivier Noyer
75680 Paris Cédex 14
Tel: +33 (0) 1 40 44 30 00; Fax: +33 (0) 1 40 44 30 99
E-mail: info@inrs.fr
Web site: http://www.inrs.fr

Italy:
Instituto del Lavoro di Torino
Tel: +39 116 93 34 66; Fax: +39 116 93 34 92

Norway:
Statens arbeidsmiljøinstitutt (STAMI)
PB. 8149 Dep. 0033
Oslo
Norway
Website: http://www.stami.no/

Spain:
Instituto Nacional de la Silicosis
Calle Dr Bellmut s/n
33006 Oviedo
Tel.: +34 985 10 80 09; Fax: +34 985 10 80 43
Web site: www.ins.es

Sweden:
Arbetslivsinstitutet
11279
Stockholm
Sweden
Website: http://www.niwl.se

United Kingdom:
Institute of Occupational Medicine (IOM)
Research Park North, Riccarton, Edinburgh,
EH14 4AP Scotland, UK
Web site: www.iom-world.org

EUROPEAN INSTITUTES

European Committee for Standardisation (CEN)
36, rue de Stassart
1050 Brussels, Belgium
Tel: +32 2 550 08 11; Fax: +32 2 550 08 19
E-mail: infodesk@cenorm.be
Web site: http://www.cenorm.be/

European Agency for Safety and Health at Work
Web site: http://europe.osha.eu.int/
Gran via, 33
48009 Bilbao, Spain
Tel: +34 944 794 360, Fax: +34 944 794 383

INTERNATIONAL INSTITUTES

International Agency for Research on Cancer (IARC)
150 cours Albert Thomas
69372 Lyon CEDEX 08, France
Tel: +33 (0) 4 72 73 84 85; Fax: +33 (0) 4 72 73 85 75
Web site: http://www.iarc.fr/

International Organisation for Standardisation (ISO)
1, rue de Varembé
Case postale 56
1211 Geneva 20, Switzerland
Telephone: +41 22 749 01 11; Fax: +41 22 733 34 30
E-mail: central@iso.org
Web site: http://www.iso.org

US INSTITUTES

National Institute for Occupational Safety and Health (NIOSH)
200 Independence Ave., SW
Room 715H
Washington, DC 20201
Tel.: +1 513-533-8328; Fax: +1 513-533-8573
Web site: http://www.cdc.gov/niosh/homepage.html

Occupation Safety and Health Administration (OSHA)
U.S. Department of Labor
200 Constitution Avenue, NW
Washington, D.C. 20210
Web site: http://www.osha.gov/

NATIONAL REFERENCES FOR EUROPEAN STANDARDS

Country	Organism	EN 689	EN 481
Austria	ON	ONENORM EN 689	ONENORM EN 481
Belgium	BIN	NBN EN 689	NBN EN 481
Cyprus	CYS	CYS EN 689:1996	CYS EN 481:1993
Czech Republic	CSNI	CSN EN 689	CSN EN 481
Denmark	DS	DS/EN 689	DS/EN 481
Finland	SFS	SFS-EN 689	SFS-EN 481
France	AFNOR	NF EN 689	NF EN 481
Germany	DIN	DIN EN 689	DIN EN 481
Greece	ELOT	ELOT EN 689	ELOT EN 481
Ireland	NSAI	IS/EN 689:1995	IS/EN 481:1994
Italy	UNI	UNI EN 689	UNI EN 481
Luxembourg	SEE	ITM-EN 689	ITM-EN 481
Netherlands	NEN	NEN-EN 689	NEN-EN 481
Norway	NSF	NS-EN 689	NS-EN 481
Portugal	IPQ	EN 689	EN 481
Spain	AENOR	UNE-EN 689	UNE-EN 481
Sweden	SIS	SS-EN 689	SS-EN 481
Switzerland	SNV	SN-EN 689-1995	DIN EN 481
Turkey	TSE	TS EN 689	
United Kingdom	BSI	BS EN 689:1996	BS EN 481:1993

ANNEX 17: REFERENCE DOCUMENTS

European standards available from your national standardisation organism (see contact details page 53):

EN 481 Workplace atmospheres – Size fraction definitions for measurement of airborne particles. 1993.

EN 689 Workplace atmospheres – Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy. 1996.

TR 15230 Workplace atmospheres – Guidance for sampling of inhalable, thoracic and respirable aerosol fractions. 2005.

European Directives (copies enclosed):

Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work.

Council Directive 92/104/EEC of 3 December 1992 on the minimum requirements for improving the safety and health protection of workers in surface and underground mineral-extracting industries.

Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work.

Commission Directive 2000/39/EC of 8 June 2000 establishing a first list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work.

II

(Acts whose publication is not obligatory)

COUNCIL

COUNCIL DIRECTIVE

of 12 June 1989

on the introduction of measures to encourage improvements in the safety and health of workers at work

(89/391/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 118a thereof,

Having regard to the proposal from the Commission (1), drawn up after consultation with the Advisory Committee on Safety, Hygiene and Health Protection at Work,

In cooperation with the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas Article 118a of the Treaty provides that the Council shall adopt, by means of Directives, minimum requirements for encouraging improvements, especially in the working environment, to guarantee a better level of protection of the safety and health of workers;

Whereas this Directive does not justify any reduction in levels of protection already achieved in individual Member States, the Member State being committed, under the Treaty, to encouraging improvements in conditions in this area and to harmonizing conditions while maintaining the improvements made;

Whereas it is known that workers can be exposed to the effects of dangerous environmental factors at the work place during the course of their working life;

Whereas, pursuant to Article 118a of the Treaty, such Directives must avoid imposing administrative, financial and legal constraints which would hold back the creation and development of small and medium-sized undertakings;

Whereas the communication from the Commission on its programme concerning safety, hygiene and health at work (4) provides for the adoption of Directives designed to guarantee the safety and health of workers;

Whereas the Council, in its resolution of 21 December 1987 on safety, hygiene and health at work (5), took note of the Commission's intention to submit to the Council in the near future a Directive on the organization of the safety and health of workers at the work place;

Whereas in February 1988 the European Parliament adopted four resolutions following the debate on the internal market and worker protection; whereas these resolutions specifically invited the Commission to draw up a framework Directive to serve as a basis for more specific Directives covering all the risks connected with safety and health at the work place;

Whereas Member States have a responsibility to encourage improvements in the safety and health of workers on their territory; whereas taking measures to protect the health and safety of workers at work also helps, in certain cases, to preserve the health and possibly the safety of persons residing with them;

(1) OJ No C 141, 30. 5. 1988, p. 1.
(2) OJ No C 326, 19. 12. 1988, p. 102, and OJ No C 158, 26. 6. 1989.
(3) OJ No C 175, 4. 7. 1988, p. 22.
(4) OJ No C 28, 3. 2. 1988, p. 3.
(5) OJ No C 28, 3. 2. 1988, p. 1.

Whereas Member States' legislative systems covering safety and health at the work place differ widely and need to be improved; whereas national provisions on the subject, which often include technical specifications and/or self-regulatory standards, may result in different levels of safety and health protection and allow competition at the expense of safety and health;

Whereas the incidence of accidents at work and occupational diseases is still too high; whereas preventive measures must be introduced or improved without delay in order to safeguard the safety and health of workers and ensure a higher degree of protection;

Whereas, in order to ensure an improved degree of protection, workers and/or their representatives must be informed of the risks to their safety and health and of the measures required to reduce or eliminate these risks; whereas they must also be in a position to contribute, by means of balanced participation in accordance with national laws and/or practices, to seeing that the necessary protective measures are taken;

Whereas information, dialogue and balanced participation on safety and health at work must be developed between employers and workers and/or their representatives by means of appropriate procedures and instruments, in accordance with national laws and/or practices;

Whereas the improvement of workers' safety, hygiene and health at work is an objective which should not be subordinated to purely economic considerations;

Whereas employers shall be obliged to keep themselves informed of the latest advances in technology and scientific findings concerning work-place design, account being taken of the inherent dangers in their undertaking, and to inform accordingly the workers' representatives exercising participation rights under this Directive, so as to be able to guarantee a better level of protection of workers' health and safety;

Whereas the provisions of this Directive apply, without prejudice to more stringent present or future Community provisions, to all risks, and in particular to those arising from the use at work of chemical, physical and biological agents covered by Directive 80/1107/EEC (1), as last amended by Directive 88/642/EEC (2);

Whereas, pursuant to Decision 74/325/EEC (3), the Advisory Committee on Safety, Hygiene and Health Protection at Work is consulted by the Commission on the drafting of proposals in this field;

Whereas a Committee composed of members nominated by the Member States needs to be set up to assist the Commission in making the technical adaptations to the individual Directives provided for in this Directive.

HAS ADOPTED THIS DIRECTIVE:

SECTION I

GENERAL PROVISIONS

Article 1

Object

1. The object of this Directive is to introduce measures to encourage improvements in the safety and health of workers at work.

2. To that end it contains general principles concerning the prevention of occupational risks, the protection of safety and health, the elimination of risk and accident factors, the informing, consultation, balanced participation in accordance with national laws and/or practices and training of workers and their representatives, as well as general guidelines for the implementation of the said principles.

3. This Directive shall be without prejudice to existing or future national and Community provisions which are more favourable to protection of the safety and health of workers at work.

Article 2

Scope

1. This Directive shall apply to all sectors of activity, both public and private (industrial, agricultural, commercial, administrative, service, educational, cultural, leisure, etc.).

2. This Directive shall not be applicable where characteristics peculiar to certain specific public service activities, such as the armed forces or the police, or to certain specific activities in the civil protection services inevitably conflict with it.

In that event, the safety and health of workers must be ensured as far as possible in the light of the objectives of this Directive.

(1) OJ No L 327, 3. 12. 1980, p. 8.
(2) OJ No L 356, 24. 12. 1988, p. 74.
(3) OJ No L 185, 9. 7. 1974, p. 15.

Article 3

Definitions

For the purposes of this Directive, the following terms shall have the following meanings:

(a) worker: any person employed by an employer, including trainees and apprentices but excluding domestic servants;

(b) employer: any natural or legal person who has an employment relationship with the worker and has responsibility for the undertaking and/or establishment;

(c) workers' representative with specific responsibility for the safety and health of workers: any person elected, chosen or designated in accordance with national laws and/or practices to represent workers where problems arise relating to the safety and health protection of workers at work;

(d) prevention: all the steps or measures taken or planned at all stages of work in the undertaking to prevent or reduce occupational risks.

Article 4

1. Member States shall take the necessary steps to ensure that employers, workers and workers' representatives are subject to the legal provisions necessary for the implementation of this Directive.

2. In particular, Member States shall ensure adequate controls and supervision.

SECTION II

EMPLOYERS' OBLIGATIONS

Article 5

General provision

1. The employer shall have a duty to ensure the safety and health of workers in every aspect related to the work.

2. Where, pursuant to Article 7 (3), an employer enlists competent external services or persons, this shall not discharge him from his responsibilities in this area.

3. The workers' obligations in the field of safety and health at work shall not affect the principle of the responsibility of the employer.

4. This Directive shall not restrict the option of Member States to provide for the exclusion or the limitation of employers' responsibility where occurrences are due to unusual and unforeseeable circumstances, beyond the employers' control, or to exceptional events, the consequences of which could not have been avoided despite the exercise of all due care.

Member States need not exercise the option referred to in the first subparagraph.

Article 6

General obligations on employers

1. Within the context of his responsibilities, the employer shall take the measures necessary for the safety and health protection of workers, including prevention of occupational risks and provision of information and training, as well as provision of the necessary organization and means.

The employer shall be alert to the need to adjust these measures to take account of changing circumstances and aim to improve existing situations.

2. The employer shall implement the measures referred to in the first subparagraph of paragraph 1 on the basis of the following general principles of prevention:

(a) avoiding risks;

(b) evaluating the risks which cannot be avoided:

(c) combating the risks at source;

(d) adapting the work to the individual, especially as regards the design of work places, the choice of work equipment and the choice of working and production methods, with a view, in particular, to alleviating monotonous work and work at a predetermined work-rate and to reducing their effect on health.

(e) adapting to technical progress;

(f) replacing the dangerous by the non-dangerous or the less dangerous;

(g) developing a coherent overall prevention policy which covers technology, organization of work, working conditions, social relationships and the influence of factors related to the working environment;

(h) giving collective protective measures priority over individual protective measures;

(i) giving appropriate instructions to the workers.

3. Without prejudice to the other provisions of this Directive, the employer shall, taking into account the nature of the activities of the enterprise and/or establishment:

(a) evaluate the risks to the safety and health of workers, *inter alia* in the choice of work equipment, the chemical substances or preparations used, and the fitting-out of work places.

Subsequent to this evaluation and as necessary, the preventive measures and the working and production methods implemented by the employer must:

— assure an improvement in the level of protection afforded to workers with regard to safety and health,

— be integrated into all the activities of the undertaking and/or establishment and at all hierarchical levels;

(b) where he entrusts tasks to a worker, take into consideration the worker's capabilities as regards health and safety;

(c) ensure that the planning and introduction of new technologies are the subject of consultation with the workers and/or their representatives, as regards the consequences of the choice of equipment, the working conditions and the working environment for the safety and health of workers;

(d) take appropriate steps to ensure that only workers who have received adequate instructions may have access to areas where there is serious and specific danger.

4. Without prejudice to the other provisions of this Directive, where several undertakings share a work place, the employers shall cooperate in implementing the safety, health and occupational hygiene provisions and, taking into account the nature of the activities, shall coordinate their actions in matters of the protection and prevention of occupational risks, and shall inform one another and their respective workers and/or workers' representatives of these risks.

5. Measures related to safety, hygiene and health at work may in no circumstances involve the workers in financial cost.

Article 7

Protective and preventive services

1. Without prejudice to the obligations referred to in Articles 5 and 6, the employer shall designate one or more workers to carry out activities related to the protection and prevention of occupational risks for the undertaking and/or establishment.

2. Designated workers may not be placed at any disadvantage because of their activities related to the protection and prevention of occupational risks.

Designated workers shall be allowed adequate time to enable them to fulfil their obligations arising from this Directive.

3. If such protective and preventive measures cannot be organized for lack of competent personnel in the undertaking and/or establishment, the employer shall enlist competent external services or persons.

4. Where the employer enlists such services or persons, he shall inform them of the factors known to affect, or suspected of affecting, the safety and health of the workers and they must have access to the information referred to in Article 10 (2).

5. In all cases:

— the workers designated must have the necessary capabilities and the necessary means,

— the external services or persons consulted must have the necessary aptitudes and the necessary personal and professional means, and

— the workers designated and the external services or persons consulted must be sufficient in number

to deal with the organization of protective and preventive measures, taking into account the size of the undertaking and/or establishment and/or the hazards to which the workers are exposed and their distribution throughout the entire undertaking and/or establishment.

6. The protection from, and prevention of, the health and safety risks which form the subject of this Article shall be the responsibility of one or more workers, of one service or of separate services whether from inside or outside the undertaking and/or establishment.

The worker(s) and/or agency(ies) must work together whenever necessary.

7. Member States may define, in the light of the nature of the activities and size of the undertakings, the categories of undertakings in which the employer, provided he is competent, may himself take responsibility for the measures referred to in paragraph 1.

8. Member States shall define the necessary capabilities and aptitudes referred to in paragraph 5.

They may determine the sufficient number referred to in paragraph 5.

Article 8

First aid, fire-fighting and evacuation of workers, serious and imminent danger

1. The employer shall:

— take the necessary measures for first aid, fire-fighting and evacuation of workers, adapted to the nature of the

activities and the size of the undertaking and/or establishment and taking into account other persons present,

— arrange any necessary contacts with external services, particularly as regards first aid, emergency medical care, rescue work and fire-fighting.

2. Pursuant to paragraph 1, the employer shall, *inter alia,* for first aid, fire-fighting and the evacuation of workers, designate the workers required to implement such measures.

The number of such workers, their training and the equipment available to them shall be adequate, taking account of the size and/or specific hazards of the undertaking and/or establishment.

3. The employer shall:

(a) as soon as possible, inform all workers who are, or may be, exposed to serious and imminent danger of the risk involved and of the steps taken or to be taken as regards protection;

(b) take action and give instructions to enable workers in the event of serious, imminent and unavoidable danger to stop work and/or immediately to leave the work place and proceed to a place of safety;

(c) save in exceptional cases for reasons duly substantiated, refrain from asking workers to resume work in a working situation where there is still a serious and imminent danger.

4. Workers who, in the event of serious, imminent and unavoidable danger, leave their workstation and/or a dangerous area may not be placed at any disadvantage because of their action and must be protected against any harmful and unjustified consequences, in accordance with national laws and/or practices.

5. The employer shall ensure that all workers are able, in the event of serious and imminent danger to their own safety and/or that of other persons, and where the immediate superior responsible cannot be contacted, to take the appropriate steps in the light of their knowledge and the technical means at their disposal, to avoid the consequences of such danger.

Their actions shall not place them at any disadvantage, unless they acted carelessly or there was negligence on their part.

Article 9

Various obligations on employers

1. The employer shall:

(a) be in possession of an assessment of the risks to safety and health at work, including those facing groups of workers exposed to particular risks;

(b) decide on the protective measures to be taken and, if necessary, the protective equipment to be used;

(c) keep a list of occupational accidents resulting in a worker being unfit for work for more than three working days;

(d) draw up, for the responsible authorities and in accordance with national laws and/or practices, reports on occupational accidents suffered by his workers.

2. Member States shall define, in the light of the nature of the activities and size of the undertakings, the obligations to be met by the different categories of undertakings in respect of the drawing-up of the documents provided for in paragraph 1 (a) and (b) and when preparing the documents provided for in paragraph 1 (c) and (d).

Article 10

Worker information

1. The employer shall take appropriate measures so that workers and/or their representatives in the undertaking and/or establishment receive, in accordance with national laws and/or practices which may take account, *inter alia,* of the size of the undertaking and/or establishment, all the necessary information concerning:

(a) the safety and health risks and protective and preventive measures and activities in respect of both the undertaking and/or establishment in general and each type of workstation and/or job;

(b) the measures taken pursuant to Article 8 (2).

2. The employer shall take appropriate measures so that employers of workers from any outside undertakings and/or establishments engaged in work in his undertaking and/or establishment receive, in accordance with national laws and/or practices, adequate information concerning the points referred to in paragraph 1 (a) and (b) which is to be provided to the workers in question.

3. The employer shall take appropriate measures so that workers with specific functions in protecting the safety and health of workers, or workers' representatives with specific responsibility for the safety and health of workers shall have access, to carry out their functions and in accordance with national laws and/or practices, to:

(a) the risk assessment and protective measures referred to in Article 9 (1) (a) and (b);

(b) the list and reports referred to in Article 9 (1) (c) and (d);

(c) the information yielded by protective and preventive measures, inspection agencies and bodies responsible for safety and health.

Article 11

Consultation and participation of workers

1. Employers shall consult workers and/or their representatives and allow them to take part in discussions on all questions relating to safety and health at work.

This presupposes:

— the consultation of workers,

— the right of workers and/or their representatives to make proposals,

— balanced participation in accordance with national laws and/or practices.

2. Workers or workers' representatives with specific responsibility for the safety and health of workers shall take part in a balanced way, in accordance with national laws and/or practices, or shall be consulted in advance and in good time by the employer with regard to:

(a) any measure which may substantially affect safety and health;

(b) the designation of workers referred to in Articles 7 (1) and 8 (2) and the activities referred to in Article 7 (1);

(c) the information referred to in Articles 9 (1) and 10;

(d) the enlistment, where appropriate, of the competent services or persons outside the undertaking and/or establishment, as referred to in Article 7 (3);

(e) the planning and organization of the training referred to in Article 12.

3. Workers' representatives with specific responsibility for the safety and health of workers shall have the right to ask the employer to take appropriate measures and to submit proposals to him to that end to mitigate hazards for workers and/or to remove sources of danger.

4. The workers referred to in paragraph 2 and the workers' representatives referred to in paragraphs 2 and 3 may not be placed at a disadvantage because of their respective activities referred to in paragraphs 2 and 3.

5. Employers must allow workers' representatives with specific responsibility for the safety and health of workers adequate time off work, without loss of pay, and provide them with the necessary means to enable such representatives to exercise their rights and functions deriving from this Directive.

6. Workers and/or their representatives are entitled to appeal, in accordance with national law and/or practice, to the authority responsible for safety and health protection at work if they consider that the measures taken and the means employed by the employer are inadequate for the purposes of ensuring safety and health at work.

Workers' representatives must be given the opportunity to submit their observations during inspection visits by the competent authority.

Article 12

Training of workers

1. The employer shall ensure that each worker receives adequate safety and health training, in particular in the form of information and instructions specific to his workstation or job:

— on recruitment,

— in the event of a transfer or a change of job,

— in the event of the introduction of new work equipment or a change in equipment,

— in the event of the introduction of any new technology.

The training shall be:

— adapted to take account of new or changed risks, and

— repeated periodically if necessary.

2. The employer shall ensure that workers from outside undertakings and/or establishments engaged in work in his undertaking and/or establishment have in fact received appropriate instructions regarding health and safety risks during their activities in his undertaking and/or establishment.

3. Workers' representatives with a specific role in protecting the safety and health of workers shall be entitled to appropriate training.

4. The training referred to in paragraphs 1 and 3 may not be at the workers' expense or at that of the workers' representatives.

The training referred to in paragraph 1 must take place during working hours.

The training referred to in paragraph 3 must take place during working hours or in accordance with national practice either within or outside the undertaking and/or the establishment.

SECTION III

WORKERS' OBLIGATIONS

Article 13

1. It shall be the responsibility of each worker to take care as far as possible of his own safety and health and that of other persons affected by his acts or Commissions at work in accordance with his training and the instructions given by his employer.

2. To this end, workers must in particular, in accordance with their training and the instructions given by their employer:

(a) make correct use of machinery, apparatus, tools, dangerous substances, transport equipment and other means of production;

(b) make correct use of the personal protective equipment supplied to them and, after use, return it to its proper place;

(c) refrain from disconnecting, changing or removing arbitrarily safety devices fitted, e.g. to machinery, apparatus, tools, plant and buildings, and use such safety devices correctly;

(d) immediately inform the employer and/or the workers with specific responsibility for the safety and health of workers of any work situation they have reasonable grounds for considering represents a serious and immediate danger to safety and health and of any shortcomings in the protection arrangements;

(e) cooperate, in accordance with national practice, with the employer and/or workers with specific responsibility for the safety and health of workers, for as long as may be necessary to enable any tasks or requirements imposed by the competent authority to protect the safety and health of workers at work to be carried out;

(f) cooperate, in accordance with national practice, with the employer and/or workers with specific responsibility for the safety and health of workers, for as long as may be necessary to enable the employer to ensure that the working environment and working conditions are safe and pose no risk to safety and health within their field of activity.

SECTION IV

MISCELLANEOUS PROVISIONS

Article 14

Health surveillance

1. To ensure that workers receive health surveillance appropriate to the health and safety risks they incur at work, measures shall be introduced in accordance with national law and/or practices.

2. The measures referred to in paragraph 1 shall be such that each worker, if he so wishes, may receive health surveillance at regular intervals.

3. Health surveillance may be provided as part of a national health system.

Article 15

Risk groups

Particularly sensitive risk groups must be protected against the dangers which specifically affect them.

Article 16

Individual Directives — Amendments —

General scope of this Directive

1. The Council, acting on a proposal from the Commission based on Article 118a of the Treaty, shall adopt individual Directives, *inter alia,* in the areas listed in the Annex.

2. This Directive and, without prejudice to the procedure referred to in Article 17 concerning technical adjustments, the individual Directives may be amended in accordance with the procedure provided for in Article 118a of the Treaty.

3. The provisions of this Directive shall apply in full to all the areas covered by the individual Directives, without prejudice to more stringent and/or specific provisions contained in these individual Directives.

Article 17

Committee

1. For the purely technical adjustments to the individual Directives provided for in Article 16 (1) to take account of:

— the adoption of Directives in the field of technical harmonization and standardization, and/or

— technical progress, changes in international regulations or specifications, and new findings,

the Commission shall be assisted by a committee composed of the representatives of the Member States and chaired by the representative of the Commission.

2. The representative of the Commission shall submit to the committee a draft of the measures to be taken.

The committee shall deliver its opinion on the draft within a time limit which the chairman may lay down according to the urgency of the matter.

The opinion shall be delivered by the majority laid down in Article 148 (2) of the Treaty in the case of decisions which the Council is required to adopt on a proposal from the Commission.

The votes of the representatives of the Member States within the committee shall be weighted in the manner set out in that Article. The chairman shall not vote.

3. The Commission shall adopt the measures envisaged if they are in accordance with the opinion of the committee.

If the measures envisaged are not in accordance with the opinion of the committee, or if no opinion is delivered, the Commission shall, without delay, submit to the Council a proposal relating to the measures to be taken. The Council shall act by a qualified majority.

If, on the expiry of three months from the date of the referral to the Council, the Council has not acted, the proposed measures shall be adopted by the Commission.

Article 18

Final provisions

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 31 December 1992.

They shall forthwith inform the Commission thereof.

2. Member States shall communicate to the Commission the texts of the provisions of national law which they have already adopted or adopt in the field covered by this Directive.

3. Member States shall report to the Commission every five years on the practical implementation of the provisions of this Directive, indicating the points of view of employers and workers.

The Commission shall inform the European Parliament, the Council, the Economic and Social Committee and the Advisory Committee on Safety, Hygiene and Health Protection at Work.

4. The Commission shall submit periodically to the European Parliament, the Council and the Economic and Social Committee a report on the implementation of this Directive, taking into account paragraphs 1 to 3.

Article 19

This Directive is addressed to the Member States.

Done at Luxembourg, 12 June 1989.

For the Council
The President
M. CHAVES GONZALES

ANNEX

List of areas referred to in Article 16 (1)

— Work places
— Work equipment
— Personal protective equipment
— Work with visual display units
— Handling of heavy loads involving risk of back injury
— Temporary or mobile work sites
— Fisheries and agriculture

II

(Acts whose publication is not obligatory)

COUNCIL

COUNCIL DIRECTIVE 92/104/EEC

of 3 December 1992

on the minimum requirements for improving the safety and health protection of workers in surface and underground mineral-extracting industries (twelfth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC)

THE COUNCIL OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Economic Community, and in particular Article 118a thereof,

Having regard to the proposal from the Commission (1), drawn up after consultation with the Safety and Health Commission for the Mining and Other Extractive Industries,

In cooperation with the European Parliament (2),

Having regard to the opinion of the Economic and Social Committee (3),

Whereas Article 118a of the Treaty provides that the Council shall adopt, by means of Directives, minimum requirements for encouraging improvements, especially in the working environment, to guarantee a better level of protection of the safety and health of workers;

Whereas, pursuant to that Article, such Directives must avoid imposing administrative, financial and legal constraints in a way which would hold back the creation and development of small and medium-sized undertakings;

Whereas the improvement of workers' safety, hygiene and health at works is an objective which should not be subordinated to purely economic considerations;

Whereas Council Directive 89/654/EEC of 30 November 1989 concerning the minimum safety and health requirements for the workplace (first individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (4) does not apply to the extractive industries;

Whereas compliance with the minimum requirements designed to guarantee a better standard of safety and health for surface and underground mineral-extracting industries is essential to ensure the safety and health of workers;

Whereas surface and underground mineral-extracting industries constitute an area of activity likely to expose workers to particularly high levels of risk;

Whereas this Directive is an individual Directive within the meaning of Article 16 (1) of Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work (5); whereas, therefore, the provisions of the said Directive apply in full to surface and underground mineral-extracting industries without prejudice to more stringent and/or specific provisions contained in this Directive;

Whereas the ancillary surface installations of surface and underground mineral-extracting industries which are not essential to the surface and underground mineral-extracting industries as defined in Article 2 (a) of this Directive are subject to the provisions of Directive 89/654/EEC;

Whereas, on 3 November 1992, the Council adopted Directive 92/91/EEC on the minimum requirements for improving the safety and health protection of workers in the mineral-extracting industries through drilling (eleventh individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC) (6);

Whereas this Directive is a practical contribution towards creating the social dimension of the internal market,

(1) OJ No C 58, 5. 3. 1992, p. 3.
(2) OJ No C 150, 15. 6. 1992, p. 128, and OJ No C 305, 23. 11. 1992.
(3) OJ No C 169, 6. 7. 1992, p. 28.
(4) OJ No L 393, 30. 12. 1989, p. 1.
(5) OJ No L 183, 29. 6. 1989, p. 1.
(6) OJ No L 348, 28. 11. 1992, p. 9.

HAS ADOPTED THIS DIRECTIVE:

SECTION I

GENERAL PROVISIONS

Article 1

Subject

1. This Directive, which is the twelfth individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC, lays down minimum requirements for the safety and health protection of workers in the surface and underground mineral-extracting industries defined in Article 2 (a).

2. The provisions of Directive 89/391/EEC shall apply in full to the sphere referred to in paragraph 1, without prejudice to more stringent and/or specific provisions contained in this Directive.

Article 2

Definitions

For the purpose of this Directive:

(a) *surface and underground mineral-extracting industries* shall mean all industries practising:

— surface or underground extraction, in the strict sense of the word, of minerals, and/or

— prospecting with a view to such extraction, and/or

— preparation of extracted materials for sale, excluding the activities of processing the materials extracted,

excluding the mineral-extracting industries through drilling defined in Article 2 (a) of Directive 92/91/EEC;

(b) *workplace* shall mean the whole area intended to house workstations, relating to the immediate and ancillary activities and installations of the surface or underground mineral-extracting industries, including overburden dumps and other tips and accommodation, where provided, to which workers have access in the context of their work.

SECTION II

EMPLOYERS' OBLIGATIONS

Article 3

General obligations

1. To safeguard the safety and health of workers, the employer shall take the necessary measures to ensure that:

(a) workplaces are designed, constructed, equipped, commissioned, operated and maintained in such a way that workers can perform the work assigned to them without endangering their safety and/or health and/or those of other workers;

(b) the operation of workplaces when workers are present takes place under the supervision of a person in charge;

(c) work involving a special risk is entrusted only to competent staff and carried out in accordance with the instructions given;

(d) all safety instructions are comprehensible to all the workers concerned;

(e) appropriate first-aid facilities are provided;

(f) any relevant safety drills are performed at regular intervals.

2. The employer shall ensure that a document concerning safety and health, hereinafter referred to as 'safety and health document', covering the relevant requirements laid down in Articles 6, 9 and 10 of Directive 89/391/EEC, is drawn up and kept up to date.

The safety and health document shall demonstrate in particular that:

— the risks to which workers at the workplace are exposed have been determined and assessed,

— adequate measures will be taken to attain the aims of this Directive,

— the design, use and maintenance of the workplace and of the equipment are safe.

The safety and health document must be drawn up before work starts and be revised if the workplace has undergone major changes, extensions or conversions.

3. Where workers from several undertakings are present at the same workplace, each employer shall be responsible for all matters under his control.

The employer who, in accordance with national laws and/or practices, is in charge of the workplace, shall coordinate the implementation of all the measures concerning the safety and health of the workers and shall state, in his safety and health document, the aim of that coordination and the measures and procedures for implementing it.

The coordination shall not affect the responsability of the individual employers as provided for in Directive 89/391/EEC.

4. The employer shall report any serious and/or fatal occupational accidents and situations of serious danger to the competent authorities as soon as possible.

Article 4

Protection from fire, explosions and health-endangering atmospheres

The employer shall take measures and precautions appropriate to the nature of the operation:

— to avoid, detect and combat the starting and spread of fires and explosions, and

— to prevent the occurrence of explosive and/or health-endangering atmospheres.

Article 5

Escape and rescue facilities

The employer shall provide and maintain appropriate means of escape and rescue in order to ensure that workers have adequate opportunities for leaving the workplaces promptly and safely in the event of danger.

Article 6

Communication, warning and alarm systems

The employer shall take the requisite measures to provide the necessary warning and other communication systems to enable assistance, escape and rescue operations to be launched immediately if the need arises.

Article 7

Keeping workers informed

1. Without prejudice to Article 10 of Directive 89/391/EEC, workers and/or their representatives shall be informed of all measures to be taken concerning safety and health at workplaces, and in particular of those relating to the implementation of Articles 3 to 6.

2. The information must be comprehensible to the workers concerned.

Article 8

Health surveillance

1. To ensure that workers receive health surveillance appropriate to the health and safety risks they incur at work, measures shall be introduced in accordance with national law and/or practices.

2. The measures referred to in paragraph 1 shall be such that each worker shall be entitled to, or shall undergo, health surveillance before being assigned to duties related to the activities referred to in Article 2 and subsequently at regular intervals.

3. Health surveillance may be provided as part of a national health system.

Article 9

Consultation of workers and workers' participation

Consultation and participation of workers and/or of their representatives shall take place in accordance with Article 11 of Directive 89/391/EEC on the matters covered by this Directive.

Article 10

Minimum requirements for safety and health

1. Workplaces used for the first time after the date on which this Directive is brought into effect as referred to in Article 13 (1) must satisfy the minimum safety and health requirement laid down in the Annex.

2. Workplaces already in use before the date on which this Directive is brought into effect as referred to in Article 13 (1) must satisfy the minimum safety and health requirements laid down in the Annex as soon as possible and at the latest nine years after that date.

3. When workplaces undergo changes, extensions and/or conversions after the date on which this Directive is brought into effect as referred to in Article 13 (1), the employer shall take the measures necessary to ensure that those changes, extensions and/or conversions are in compliance with the corresponding minimum requirements laid down in the Annex.

SECTION III

OTHER PROVISIONS

Article 11

Adjustments to the Annex

Purely technical adjustments to the Annex in line with:

— the adoption of Directive in the field of technical harmonization and standardization concerning surface or underground mineral-extracting industries,

and/or

— technical progress, changes in international regulations or specifications, and new findings concerning the surface or underground mineral-extracting industries,

shall be adopted in accordance with the procedure laid down in Article 17 of Directive 89/391/EEC.

Article 12

Mineral-extraction by dredging

Member States shall be entitled not to apply this Directive to mineral-extraction by dredging provided that they ensure the protection of the workers concerned in line with the general principles of the protection of the safety and health of workers laid down in this Directive, taking into account the specific risks involved in mineral-extraction by dredging.

Article 13

Final provisions

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 24 months after its adoption. They shall forthwith inform the Commission thereof.

2. When Member States adopt the measures referred to in paragraph 1, the measures shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods of making such a reference shall be laid down by Member States.

3. Member States shall communicate to the Commission the texts of the provisions of national law which they have already adopted, or are to adopt, in the field governed by this Directive.

4. Member States shall report to the Commission every five years on the practical implementation of this Directive, indicating the views of employers and workers.

The Commission shall inform the European Parliament, the Council, the Economic and Social Committee, the Safety and Health Commission for the Mining and Other Extractive Industries and the Advisory Committee on Safety, Hygiene and Health Protection at Work thereof.

Article 14

This Directive is addressed to the Member States.

Done at Brussels, 3 December 1992.

For the Council
The President
G. SHEPHARD

ANNEX

MINIMUM SAFETY AND HEALTH REQUIREMENTS AS REFERRED TO IN ARTICLE 10 OF THE DIRECTIVE

Preliminary note

The obligations laid down in this Annex apply whenever required by the features of the workplace, the activity, the circumstances or a specific risk.

PART A

COMMON MINIMUM REQUIREMENTS APPLICABLE TO SURFACE AND UNDERGROUND MINERAL-EXTRACTING INDUSTRIES AND TO ANCILLARY SURFACE INSTALLATIONS

1. **Supervision and organization**

1.1. *Organization of workplaces*

1.1.1. Workplaces must be so organized as to provide adequate protection against hazards. They must be kept in good order, with any hazardous substances or deposits removed or controlled in order not to endanger the health and safety of workers.

1.1.2. Workstations must be designed and constructed according to ergonomic principles taking into account the need for workers to be able to follow operations taking place at their workstations.

1.1.3. Where workstations are occupied by lone workers, adequate supervision or means of communication must be provided.

1.2. *Person in charge*

A responsible person who has the skills and competence required for this duty, in accordance with the national laws and/or practices, and who has been appointed by the employer, must at all times be in charge of every workplace when workers are present.

The employer may personally assume responsibility for the workplace as referred to in the first subparagraph, if he has the skills and competence required for the purpose, in accordance with national laws and/or practices.

1.3. *Supervision*

To ensure workers' safety and health protection during all operations undertaken, the necessary supervision must be provided by persons having the skills and competence for this duty, in accordance with the national laws and/or practices, having been appointed by the employer or on his behalf and acting on his behalf.

Where required by the safety and health document, a supervisor must visit occupied workstations at least once during each shift.

The employer may personally undertake the supervision referred to in the first and second subparagraphs if he has the skills and competence required for the purpose, in accordance with national laws and/or practices.

1.4. *Competent workers*

When workers are present at any workplace, there must be a sufficient number of workers with the requisite skills, experience and training to perform the tasks assigned to them.

1.5. *Information, instructions and training*

Workers must be given the necessary information, instructions, training and re-training to ensure their health and safety.

The employer must ensure that workers receive comprehensible instructions so as not to endanger their safety and health or those of other workers.

1.6. *Written instructions*

Written instructions specifying rules to be observed to ensure the safety and health of workers and the safe use of equipment must be drawn up for every workplace.

These must include information on the use of emergency equipment and action to be taken in the event of an emergency at or near the workplace.

1.7. *Safe working methods*

Safe working methods must be applied at each workplace or in respect of each activity.

1.8. *Work permits*

Where required by the safety and health document, a system of work permits must be introduced for carrying out both hazardous activities and usually straightforward activities which may interact with other activities to cause serious hazards.

Work permits must be issued by a person in charge before work starts and must specify the conditions to be fulfilled and the precautions to be taken before, during and after work.

1.9. *Regular review of safety and health measures*

The employer must ensure that the measures taken to protect the safety and health of the workers, including the safety and health management system, are regularly reviewed to ensure compliance with this Directive.

2. **Mechanical and electrical equipment and plant**

2.1. *General*

Selection, installation, commissioning, operation and maintenance of mechanical and electrical equipment must take place with due regard for the safety and health of workers, taking into consideration other provisions of this Directive and of Directives 89/392/EEC (1) and 89/655/EEC (2).

If located in an area within which risk of fire or explosion from ignition of gas, vapour or volatile liquid exists, or is likely to exist, equipment must be suitable for use in that area.

Equipment must, if necessary, be fitted with suitable protective devices and fail-safe systems.

2.2. *Specific provisions*

Mechanical equipment and plant must be of adequate strength and free from patent defect and suitable for the purpose for which it is intended.

Electrical equipment and plant must be of sufficient size and power for the purpose for which it is intended.

Mechanical and electrical equipment and installations must be so installed and protected as to prevent danger.

3. **Maintenance**

3.1. *General maintenance*

A suitable scheme should be set up providing for the systematic examination, maintenance and, where appropriate, testing of mechanical and electrical equipment and plant.

All maintenance, examination and testing of any part of the plant and equipment must be carried out by a competent person.

Records of examinations and tests must be made and kept in an appropriate manner.

(1) OJ No L 183, 29. 6. 1989, p. 9. Directive amended by Directive 91/368/EEC (OJ No L 198, 22. 7. 1991, p. 16).
(2) OJ No L 393, 30. 12. 1989, p. 13.

3.2. *Safety equipment maintenance*

Adequate safety equipment must be maintained ready for use and in good working order at all times.

Maintenance must be undertaken with due regard to operations.

4. **Protection from explosion risks, harmful atmospheres and fire hazards**

4.1. *General*

4.1.1. Measures must be taken for assessing the presence of harmful and/or potentially explosive substances in the atmosphere and for measuring the concentration of such substances.

Where required by the safety and health document, monitoring devices measuring gas concentrations at specified places automatically and continuously, automatic alarms and devices to cut off power automatically from electrical installations and internal combustion engines must be provided.

Where automatic measurements are provided for, the values measured must be recorded and kept as stipulated in the safety and health document.

4.1.2. Smoking is forbidden in areas subject to particular fire or explosion hazards.

The use of any open flame and the execution of any work that may give rise to an ignition hazard is prohibited unless adequate safety precautions are taken to prevent the occurrence of fires or explosions.

4.2. *Protection from explosion risks*

4.2.1. All necessary measures must be taken to combat the formation and accumulation of explosive atmospheres.

4.2.2. In areas where there are risks of explosion, all necessary measures must be taken to prevent the ignition of explosive atmospheres.

4.2.3. An explosion prevention plan detailing the equipment and measures required must be prepared.

4.3. *Protection from harmful atmospheres*

4.3.1. Where harmful substances accumulate or may accumulate in the atmosphere, appropriate measures must be taken to ensure:

(a) their suppression at source; or

(b) their extraction at source or removal; or

(c) diliction accumulations of such substances,

in such a way that workers are not at risk.

The system must be capable of dispersing these harmful substances in such a way that workers are not at risk.

4.3.2. Without prejudice to Directive 89/656/EEC [1], appropriate and sufficient breathing and resuscitation equipment must be available in areas where workers may be exposed to atmospheres which are harmful to health.

In such cases, a sufficient number of workers trained to use such equipment must be present at the workplace.

The equipment must be suitably stored and maintained.

4.3.3. Where toxic gases are, or may be, present in the atmosphere, a protection plan detailing the protective equipment available and the preventive measures taken must be available.

4.4. *Protection from fire hazards*

4.4.1. Wherever workplaces are designed, constructed, equipped, commissioned, operated or maintained, adequate measures must be taken to prevent fires from starting and spreading from the sources identified in the safety and health document.

Provision must be made for fast and effective fire-fighting.

[1] OJ No L 393, 30. 12. 1989, p. 18.

4.4.2. Workplaces must be equipped with appropriate fire-fighting equipment and, as necessary, with fire detectors and alarm systems.

4.4.3. Non-automatic fire-fighting equipment must be easily accessible and simple to use and, where necessary, protected from damage.

4.4.4. A fire protection plan detailing the precautions to be taken, in accordance with Articles 3, 4, 5 and 6 of this Directive, to protect against, detect and combat the outbreak and spread of fires must be kept on site.

4.4.5. The fire-fighting equipment must be indicated by signs in accordance with the national regulations transposing Directive 92/58/EEC (1) into law.

Such signs must be placed at appropriate points and be made to last.

5. **Explosives and initiating devices**

Operations involving the storage, transport and use of explosives and initiating devices must be carried out by duly authorized and competent persons.

Such operations must be organized and performed in such a way that there is no risk to workers.

6. **Traffic routes**

6.1. It must be possible to reach workplaces without danger and leave them quickly and safely in an emergency.

6.2. Traffic routes, including stairs, fixed ladders and loading bays and ramps, must be calculated, dimensioned and located to ensure easy, safe and appropriate access for pedestrians or vehicles in such a way as not to endanger workers employed in the vicinity of these traffic routes.

6.3. Routes used for pedestrian traffic and/or goods traffic must be dimensioned in accordance with the number of potential users and the type of undertaking.

If means of transport are used on traffic routes, a sufficient safety clearance must be provided for pedestrians.

6.4. Sufficient clearance must be allowed between vehicle traffic routes and doors, gates, passages for pedestrians, corridors and staircases.

6.5. Traffic and access routes must be clearly identified for the protection of workers.

6.6. Where vehicles or machines enter workplaces, traffic regulations must be established as necessary.

7. **Outdoor workplaces**

7.1. Workstations, traffic routes and other areas or installations outdoors which are occupied or used by the workers in the course of their activity must be organized in such a way that pedestrians and vehicles can circulate safely.

7.2. Workplaces outdoors must be adequately lit by artificial lighting if daylight is not adequate.

7.3. When workers are employed at workstations outdoors, such workstations must as far as possible be arranged so that workers:

(a) are protected against inclement weather conditions and if necessary against falling objects;

(b) are not exposed to harmful noise levels nor to harmful external influences such as gases, vapours or dust;

(c) are able to leave their workstations swiftly in the event of danger or are able to be rapidly assisted;

(d) cannot slip or fall.

(1) OJ No L 245, 26. 8. 1992, p. 23.

8. **Danger areas**

8.1. Danger areas must be clearly indicated.

8.2. If the workplaces contain danger areas in which, owing to the nature of the work, there are risks including that of the worker or objects falling, the places must be equipped, as far as possible, with devices preventing unauthorized workers from entering those areas.

8.3. Appropriate measures must be taken to protect workers authorized to enter danger areas.

9. **Emergency routes and exits**

9.1. In the event of danger, it must be possible for workers to evacuate all workstations quickly and as safely as possible.

9.2. Emergency routes and exits must remain clear and lead by the most direct means to the open air or to a safe area, a safe assembly point or a safe evacuation point.

9.3. The number, distribution and dimensions of the emergency routes and exits depend on the use, equipment and dimensions of the workplaces and the maximum number of persons that may be present.

9.4. Emergency doors must open outwards.

Emergency doors should not be so locked or fastened that they cannot be easily and immediately opened by any person who may require to use them in an emergency.

9.5. Emergency doors must not be locked.

The emergency routes and exits, and the traffic routes and doors giving access to them, must be free from obstruction so that they can be used at any time without hindrance.

9.6. Emergency routes and exits requiring illumination must be provided with emergency lighting of adequate intensity in case the lighting fails.

9.7. Specific emergency routes and exits must be indicated by signs in accordance with the national regulations transposing Directive 92/58/EEC into law.

10. **Means of evacuation and escape**

10.1. Workers must be trained in the appropriate actions to be taken in emergencies.

10.2. Rescue equipment must be provided at readily accessible and appropriately sited places and kept ready for use and must be indicated by signs in accordance with the national regulations transposing Directive 92/58/EEC into law.

11. **Safety drills**

Safety drills must be held at regular intervals at all workplaces at which workers are usually present.

The main purpose of such drills is to train and check the skills of workers to whom specific duties have been assigned in the event of emergency involving the use, handling or operation of emergency equipment.

Where appropriate, workers should also be drilled in the correct use, handling or operation of that equipment.

12. **First-aid facilities**

12.1. First-aid equipment must be available in all places where working conditions require it and must be appropriate to the operation.

This equipment must be indicated by suitable signs and easily accessible.

12.2. One or more first aid rooms must be provided where the size of the premises, type of activity being carried out and frequency of accidents so dictate.

Clearly visible first-aid instruction in the event of accidents must be displayed in these rooms.

12.3. First-aid rooms must be fitted with essential first-aid installations and equipment and be easily accessible to stretchers.

They must be signposted in accordance with the national regulations transposing Directive 92/58/EEC into law.

12.4. In addition, first-aid equipment must be available in all places where working conditions require it.

This equipment must be suitably marked and easily accessible.

12.5. A sufficient number of workers must be trained in the use of the first-aid equipment provided.

13. **Natural and artificial lighting**

13.1. Every workplace must be provided throughout with lighting capable of supplying illumination sufficient to ensure the health and safety of persons therein.

13.2. Workplaces must as far as possible receive sufficient natural light and, bearing in mind the climatic conditions, be equipped with artificial lighting for the protection of workers' safety and health.

13.3. Lighting installations in rooms containing workplaces and in passageways must be placed in such a way that the type of lighting does not present a risk of accident to workers.

13.4. Workplaces in which workers are exposed to risks in the event of failure of artificial lighting must be provided with emergency lighting of adequate intensity.

Where that is impossible, workers must be provided with personal lamps.

14. **Sanitary installations**

14.1. *Changing rooms and lockers*

14.1.1. Appropriate changing rooms must be provided for workers if they have to wear special work clothes and where, for reasons of health or propriety, they cannot be expected to change in another room.

Changing rooms must be easily accessible, be of sufficient capacity and be provided with seating.

14.1.2. Changing rooms must be sufficiently large and have facilities to enable each worker to lock away his/her clothes during working hours.

If circumstances so require (e.g. dangerous substances, humidity, dirt), lockers for work clothes must be separate from those for ordinary clothes.

Provision must be made to enable wet work clothes to be dried.

14.1.3. Provision must be made for separate changing rooms or separate use of changing rooms for men and women.

14.1.4. If changing rooms are not required under 14.1.1, each worker must be provided with a place to store his/her clothes.

14.2. *Showers and washbasins*

14.2.1. Adequate and suitable showers must be provided for workers if required by the nature of the work or for health reasons.

Provision must be made for separate shower rooms or separate use of shower rooms for men and women.

14.2.2. The shower rooms must be sufficiently large to permit each worker to wash without hindrance in conditions of an appropriate standard of hygiene.

The showers must be equipped with hot and cold water.

14.2.3. Where showers are not required under the first subparagraph of 14.2.1, adequate and suitable washbasins with hot and cold water must be provided in the vicinity of the workstations and the changing rooms.

Such washbasins must be separate for, or used separately by, men and women when so required for reasons of propriety.

14.3. *Lavoratories and washbasins*

Separate facilities must be provided in the vicinity of workstations, rest rooms, changing rooms and rooms housing showers or washbasins, with an adequate number of lavatories and washbasins.

Provisions must be made for separate lavatories or separate use of lavatories for men and women.

In the case of underground mineral-extracting industries, the sanitary installations referred to in this section may be located on the surface.

15. **Overburden dumps and other tips**

Overburden dumps, spoil heaps and other tips, as well as settling lagoons, must be designed, constructed, operated and maintained in such a way as to ensure their stability, as well as the safety and health of workers.

16. **Ancillary surface installations** (additional special provisions)

16.1. *Stability and solidity*

Workplaces must be designed, constructed, erected, operated, supervised and maintained to withstand the environmental forces anticipated.

They must have a structure and solidity appropriate to the nature of their use.

16.2. *Floors, walls, ceilings and roofs of rooms*

16.2.1. The floors of workplaces must have no dangerous bumps, holes or slopes and must be fixed, stable and not slippery.

Workplaces containing workstations must be adequately insulated against heat, bearing in mind the type of undertaking involved and the physical activity of the workers.

16.2.2. The surfaces of floors, walls and ceilings in rooms must be such that they can be cleaned or refurbished to an appropriate standard of hygiene.

16.2.3. Transparent or translucent walls, in particular all-glass partitions, in rooms or in the vicinity of workplaces and traffic routes must be clearly indicated and made of safety material or be shielded from such places or traffic routes to prevent workers from coming into contact with walls or being injured should the walls shatter.

16.2.4. Access to roofs made of materials of insufficient strength must not be permitted unless equipment is provided to ensure that the work can be carried out in a safe manner.

16.3. *Room dimensions and air space in rooms — freedom of movement at the workstation*

16.3.1. Workrooms must have sufficient surface area, height and air space to allow workers to perform their work without risk to their safety, health or well-being.

16.3.2. The dimensions of the unoccupied area at the workstation must allow workers sufficient freedom of movement and enable them to perform their work safely.

16.4. *Windows and skylights*

16.4.1. Windows, skylights and ventilation devices which are meant to be opened, adjusted or secured must be designed so that these operations can be carried out safely.

They must not be positioned so as to constitute a hazard to workers when open.

16.4.2. It must be possible to clean windows and skylights without risk.

16.5. *Doors and gates*

16.5.1. The position, number and dimensions of doors and gates, and the materials used in their construction, are determined by the nature and use of the rooms or areas.

16.5.2. Transparent doors must be appropriately marked at a conspicuous level.

16.5.3. Swing doors and gates must be transparent or have see-through panels.

16.5.4. If transparent or translucent surfaces in doors and gates are not made of safety material and if there is a danger that workers may be injured if a door or gate should shatter, the surfaces must be protected against breakage.

16.5.5. Sliding doors must be fitted with a safety device to prevent them from being derailed and falling over unexpectedly.

16.5.6. Doors and gates opening upwards must be fitted with a mechanism to secure them against falling back unexpectedly.

16.5.7. Doors along escape routes must be appropriately marked.

It must be possible to open them from the inside at any time without special assistance.

It must be possible to open the doors when the workplaces are occupied.

16.5.8. Doors for pedestrians must be provided in the immediate vicinity of any gates intended essentially for vehicle traffic, unless it is safe for pedestrians to pass through; such doors must be clearly marked and left permanently unobstructed.

16.5.9. Mechanical doors and gates must function without risk of accident to workers.

They must be fitted with easily identifiable and accessible emergency shut-down devices and, unless they open automatically in the event of a power failure, it must also be possible to open them manually.

16.6. *Ventilation of enclosed workplaces*

16.6.1. Steps shall be taken to ensure that there is sufficient fresh air in enclosed workplaces, having regard to the working methods used and the physical demands placed on the workers.

If a forced ventilation system is used, it must be maintained in working order.

Any breakdown must be indicated by a control system where this is necessary for workers' health.

16.6.2. If air-conditioning or mechanical ventilation installations are used, they must operate in such a way that workers are not exposed to draughts which cause discomfort.

Any deposit or dirt likely to create an immediate danger to the health of workers by polluting the atmosphere must be removed without delay.

16.7. *Room temperature*

16.7.1. During working hours, the temperature in rooms containing workstations must be suitable for human beings, having regard to the working methods being used and the physical demands placed on the workers.

16.7.2. The temperature in rest areas, rooms for duty staff, sanitary facilities canteens and first aid rooms must be appropriate to the particular purpose of such areas.

16.7.3. Windows, skylights and glass partitions should allow excessive effects of sunlight in workplaces to be avoided, having regard to the nature of the work and of the workplace.

16.8. *Rest rooms*

16.8.1. Where the safety or health of workers, in particular because of the type of activity carried out or the presence of more than a certain number of employees, so requires, workers must be provided with an easily accessible rest room.

This provision does not apply if the workers are employed in offices or similar workrooms providing equivalent relaxation during breaks.

16.8.2. Rest rooms must be large enough and equipped with an adequate number of tables and seats with backs for the number of workers.

16.8.3. In rest rooms appropriate measures must be introduced for the protection of non-smokers against discomfort caused by tobacco smoke.

16.8.4. If working hours are regularly and frequently interrupted and there is no rest room, other rooms must be provided in which workers can stay during such interruptions, wherever this is required for the safety or health of workers.

Appropriate measures should be taken for the protection of non-smokers against discomfort caused by tobacco smoke.

17. **Pregnant women and nursing mothers**

Pregnant women and nursing mothers must be able to lie down to rest in appropriate conditions.

18. **Disabled workers**

Workplaces must be organized to take account of disabled workers, if necessary.

This provision applies in particular to the doors, passageways, staircases, showers, washbasins, lavatories and workstations used or occupied directly by disabled workers.

PART B

SPECIAL MINIMUM REQUIREMENTS APPLICABLE TO SURFACE MINERAL-EXTRACTING INDUSTRIES

1. **General**

1.1. Without prejudice to Article 3 (2), the employer who, in accordance with national legislation and/or practice, is responsible for the workplace covered by this Part B must ensure that the safety and health document shows that all relevant measures have been taken to protect the safety and health of workers in both normal and critical situations.

1.2. The safety and health document must be brought up to date regularly and be available for inspection at the workplace.

Work must be carried out in accordance with the safety and health document.

2. **Operation**

2.1. Work must be planned taking into account the elements of the safety and health document which concern the risks of falls or slips of ground.

Consequently, as a preventive measure, the height and slope of overburden-stripping and extraction faces must be appropriate to the nature and stability of the ground and the methods of working.

2.2. Benches and haul roads must be stable enough for the plant used.

They must be constructed and maintained in such a way that plant can be moved safely.

2.3. Before the start or restart of work, stripping and extraction faces above work areas or haul roads must be checked for loose ground or rocks.

Scaling must be carried out where necessary.

2.4. Faces and tips must not be worked in such a way that instability is created.

PART C

SPECIAL MINIMUM REQUIREMENTS APPLICABLE TO UNDERGROUND MINERAL-EXTRACTING INDUSTRIES

1. **General**

1.1. Without prejudice to Article 3 (2), the employer who, in accordance with national legislation and/or practice, is responsible for the workplace covered by this Part C must ensure that the safety and health document shows that all relevant measures have been taken to protect the safety and health of workers in both normal and critical situations.

1.2. The safety and health document must be brought up to date regularly and be available for inspection at the workplace.

Work must be carried out in accordance with the safety and health document.

2. **Plans of underground workings**

2.1. Plans of underground workings drawn to a scale which provides a clear representation must be prepared.

In addition to roadways and winning areas, they must show the known features which may influence working and safety.

They must be readily accessible and must be kept for as long as is necessary for safety purposes.

2.2. Plans of underground workings must be brought up to date periodically and held available at the workplace.

3. **Outlets**

All undergound workings must have access to the surface via at least two separate outlets which are soundly constructed and readily accessible to underground workers.

Mechanical manwinding or manriding facilities must be available for these outlets if considerable physical effort is involved in negotiating them.

4. **Workings**

Workings where underground work is carried out must be constructed, operated, equipped and maintained so that workers can work and move in them with a minimum of risk.

Roadways must be signposted to help workers to find their way about the workings.

5. **Transport**

5.1. Transport facilities must be installed, operated and maintained in such a way as to ensure the safety and health of drivers, users and other persons in the vicinity.

5.2. Mechanical manwinding or manriding facilitites must be properly installed and used in accordance with written instructions.

6. **Support and ground stability**

Support must be provided as soon as possible after excavation, except where the stability of the ground makes it unnecessary for the safety of workers. Support must be installed in accordance with plans and written instructions.

Workings accessible to workers must be inspected regularly for ground stability, and support maintained accordingly.

7. **Ventilation**

7.1. All underground workings to which access is permitted must be ventilated in an appropriate manner.

Continuous ventilation must be provided to maintain, with an adequate safety margin:

— a healthy atmosphere,

— an atmosphere in which the risks of explosion and respirable dust are kept under control,

— an atmosphere in which working conditions are adequate while work is in progress, having regard to the working methods being used and the physical demands placed on the workers.

7.2. Where the requirements of 7.1 cannot be met by natural ventilation, the main ventilation must be provided by means of one or more mechanical fans.

Steps must be taken to ensure stable and continuous ventilation.

The depression of the main fans must be monitored continuously, and an automatic alarm must indicate unscheduled stoppages.

7.3. The ventilation parameters must be measures periodically and recorded.

A ventilation plan containing the pertinent details of the ventilation system must be prepared, brought up to date periodically and held available at the workplace.

8. **Gassy mines**

8.1. An underground working is regarded as gassy if firedamp is likely to be released in such a quantity that the risk of formation of an explosive atmosphere cannot be excluded.

8.2. The main ventilation must be provided by one or more mechanical fans.

8.3. Working must proceed taking account of firedamp emission.

Steps must be taken to eliminate as far as possible the risks arising from firedamp.

8.4. Auxiliary ventilation must be limited to development and salvage work and to places with a direct connection to the main ventilation current.

Production workings may be ventilated by auxiliary systems only if appropriate additional measures are taken to ensure the safety and health of workers.

8.5. The ventilation measurement referred to under 7.3 must be supplemented by firedamp determinations.

Where required by the safety and health document, firedamp levels must also be continuously monitored in return airways from production units using mechanized extraction or underwinning and at the head ends of mechanized blind end workings.

8.6. Only explosives and initiating devices specifically for gassy mines may be used.

8.7. The provisions of 4.1.2 of Part A are replaced as follows:

— Smoking, carrying tobacco for smoking and any objects which may be used to produce a flame are prohibited.

— Flame cutting, welding and other similar operations are permitted only in exceptional circumstances and subject to specific measures ensuring the safety and health of the workers.

9. **Mines containing flammable dusts**

9.1. Coal mines are considered to be susceptible to flammable dusts except where the safety and health document shows that none of the seams being worked contains dust liable to propagate an explosion.

9.2. In mines with flammable dusts the provisions of 8.6 and 8.7 of this Part C apply *mutatis mutandis.*

9.3. Steps must be taken to reduce flammable dust deposits, and to remove neutralize or bind the same.

9.4. Propagation of flammable dust and/or firedamp explosions which are liable to trigger further flammable dust explosions must be limited by installing a system of explosion barriers.

The locations of such explosion barriers must be indicated in a document which is brought up to date periodically and held available at the workplace.

10. **Gas outbursts, rockbursts and water inrushes**

10.1. In zones susceptible to gas outbursts with or without the projection of minerals or rock, rockbursts or water inrushes, an operating plan must be drawn up and implemented so as to ensure, as far as possible, a safe system of work and the protection of workers.

10.2. Measures must be taken to identify risk zones, protect workers in workings approaching or traversing these zones, and control the risks.

11. **Fires, combustions and heatings**

11.1. Provision must be made for the prevention and, where appropriate, the early detection of spontaneaous combustion.

11.2. Flammable materials taken into underground workings must be limited to the quantities which are strictly necessary.

11.3. Where it is necessary to use hydraulic fluids (fluids for the transmission of hydrostatic and/or hydrokinetic mechanical energy), fluids which are difficult to ignite must, as far as possible, be used in order to avoid the risk of fire and its spread.

The hydraulic fluids must satisfy specifications and test conditions relating to fire resistance and hygiene criteria.

Where hydraulic fluids are used which do not satisfy the specifications, conditions and criteria referred to in the second subparagraph, additional precautions must be taken to avoid the increased risk of fire and its spread.

12. **Precautions for withdrawal of workers**

So that they can withdraw in safety, workers must, where necessary, be provided with self-rescue respiratory protection devices which they must always keep within their reach.

Workers must be trained in the use of these devices.

These devices must remain at the site and be checked regularly to ensure that they are in good condition.

13. **Lighting**

The provisions of section 13 of Part A are replaced as follows:

— Workers must be provided with a suitable personal lamp.

— Workstations must as far as possible be equipped with artifical lighting adequate for the protection of workers' safety and health.

— Lighting installations must be placed in such a way that there is no risk of accident to workers as a result of the type of lighting fitted.

14. **Underground workforce accounting**

It must be possible to know exactly who is under ground at any time.

15. **Rescue organization**

In order to enable suitable action to be taken rapidly and effectively in the event of a major incident, an adequate rescue organization must be set up.

The rescue organization must, in order to be able to act at any site where underground extraction or exploratory workings are in progress, have sufficient trained rescue workers and adequate rescue equipment at its disposal.

COUNCIL DIRECTIVE 98/24/EC

of 7 April 1998

on the protection of the health and safety of workers from the risks related to chemical agents at work (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC)

THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 118a thereof,

Having regard to the proposal from the Commission [1], drawn up after consultation with the Advisory Committee on Safety, Hygiene and Health Protection at Work,

Having regard to the opinion of the Economic and Social Committee [2],

Acting in accordance with the procedure laid down in Article 189c of the Treaty [3],

(1) Whereas Article 118a of the Treaty provides that the Council shall adopt by means of Directives minimum requirements for encouraging improvements, especially in the working environment, to guarantee a better level of protection of the safety and health of workers;

(2) Whereas, pursuant to that Article, such Directives shall avoid imposing administrative, financial and legal constraints in a way which would hold back the creation and development of small and medium-sized undertakings;

(3) Whereas the improvement of workers' safety, hygiene and health at work is an objective which should not be subordinated to purely economic considerations;

(4) Whereas the respect of minimum requirements on the protection of the health and safety of workers from the risks related to chemical agents aims to ensure not only the protection of the health and safety of each individual worker but also to provide a level of minimum protection of all workers in the Community which avoids any possible distortion in the area of competition;

(5) Whereas a consistent level of protection from the risks related to chemical agents has to be established for the Community as a whole; whereas that level of protection has to be set not by detailed prescriptive requirements but by a framework of general principles to enable Member States to apply the minimum requirements consistently;

(6) Whereas a work activity involving chemical agents is likely to expose workers to risk;

(7) Whereas Council Directive 80/1107/EEC of 27 November 1980 on the protection of workers from the risks related to exposure to chemical, physical and biological agents at work [4], Council Directive 82/605/EEC of 28 July 1982 on the protection of workers from the risks related to exposure to metallic lead and its ionic compounds at work (first individual Directive within the meaning of Article 8 of Directive 80/1107/EEC) [5] and Council Directive 88/364/EEC of 9 June 9 1988 on the protection of workers by the banning of certain specific agents and/or certain work activities (fourth individual Directive within the meaning of Article 8 of Directive 80/1107/EEC) [6], for the sake of consistency and clarity as well as for technical reasons, should be revised and included in a single Directive laying down minimum requirements for the protection of the health and safety of workers in work activities involving chemical agents; whereas these Directives can be repealed;

(8) Whereas this Directive is an individual Directive within the meaning of Article 16(1) of Council Directive 89/391//EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work [7];

(9) Whereas therefore the provisions of the said Directive apply in full to the exposure of workers to chemical agents, without prejudice to more stringent and/or specific provisions contained in this Directive;

(10) Whereas more stringent and/or specific provisions relating to the transport of hazardous chemical agents are contained in binding international agreements and conventions incorporated into Community provisions on transport of dangerous goods by road, rail, water and air;

[1] OJ C 165, 16. 6. 1993, p. 4.
[2] OJ C 34, 2. 2. 1994, p. 42.
[3] Opinion of the European Parliament of 20 April 1994 (OJ C 128, 9. 5. 1994, p. 167), Council common position of 7 October 1997 (OJ C 375, 10. 12. 1997, p. 2) and Decision of the European Parliament on 17 February 1998 (not yet published in the Official Journal).
[4] OJ L 327, 3. 12. 1980, p. 8. Directive as last amended by Directive 88/642/EEC (OJ L 356, 24. 12. 1988, p. 74).
[5] OJ L 247, 23. 8. 1982, p. 12.
[6] OJ L 179, 9. 7. 1988, p. 44.
[7] OJ L 183, 29. 6. 1989, p. 1.

(11) Whereas in Directive 67/548/EEC [1] and Directive 88/379/EEC [2] on the approximation of the laws, regulations and administrative provisions relating to the classification, packaging and labelling of, respectively, dangerous substances and preparations, the Council laid down a system of criteria for the classification of dangerous substances and preparations;

(12) Whereas the definition of hazardous chemical agent should include any chemical substance which meets these criteria and also any chemical substance which whilst not meeting these criteria may because of its physico-chemical, chemical or toxicological properties, and the way it is used or is present in the workplace, present a risk to the safety and health of workers;

(13) Whereas in Directive 90/492/EEC [3] the Commission defined and laid down a system of specific information on dangerous substances and preparations, in the form of safety data sheets principally intended for industrial users to enable them to take the measures necessary to ensure the protection of the safety and health of workers; whereas Council Directive 92/58/EEC of 24 June 1992 on the minimum requirements for the provision of safety and/or health signs at work (ninth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) [4] establishes a system for marking containers and pipes used for dangerous substances or preparations at work;

(14) Whereas the employer should assess any risk to the safety and health of workers arising from the presence of hazardous chemical agents at the workplace, in order to take the necessary preventive and protective measures set out in this Directive;

(15) Whereas the preventive measures identified by the assessment of risk and taken by the employer should be consistent with the need to protect public health and the environment;

(16) Whereas, to supplement the information available to workers so as to ensure an improved level of protection, it is necessary for workers and their representatives to be informed about the risks which chemical agents can pose for their safety and health and about the measures necessary to reduce or eliminate those risks, and for them to be in a position to check that the necessary protective measures are taken;

(17) Whereas the health surveillance of workers for whom the results of the aforementioned assessment reveal a risk to health, can contribute to the prevention and protection measures to be undertaken by the employer;

(18) Whereas the employer must on a regular basis carry out evaluation and measurements and be aware of new developments in technology with a view to improving the protection of workers's safety and health;

(19) Whereas the latest scientific data should be evaluated by independent scientists to assist the Commission in setting occupational exposure limit values;

(20) Whereas, although in some cases scientific knowledge may not be such that a level of exposure to a chemical agent can be established below which risks to health cease to exist, a reduction in exposure to these chemical agents will nonetheless reduce these risks;

(21) Whereas in Directive 91/322/EEC [5] and Directive 96/94/EC [6] the Commission laid down indicative limit values as provided for by Directive 80/1107/EEC; whereas the former Directives should be maintained as part of the current framework;

(22) Whereas necessary technical adjustments to this Directive should be drawn up by the Commission in cooperation with the Committee set up by Directive 89/391/EEC to assist the Commission in making technical adaptations to individual Directives adopted under the framework of that Directive; whereas the Commission, after first seeking the advice of the Advisory Committee on Safety, Hygiene and Health Protection at Work in accordance with Decision 74/325/EEC [7], should also draw up practical guidelines for the application of this Directive;

(23) Whereas the repeal of Directive 80/1107/EEC must not give rise to the lowering of the present standards of worker protection from chemical, physical and biological agents; whereas standards resulting from the existing Directives on biological agents, the proposed Directive on physical agents, this Directive and any amendments to these texts should reflect and at least maintain the standards laid down in the said Directive;

[1] OJ 196, 16. 8. 1967, p. 1. Directive as last amended by Directive 96/56/EC (OJ L 236, 18. 9. 1996, p. 35).
[2] OJ L 187, 16. 7. 1988, p. 14. Directive as last amended by Commission Directive 96/65/EC (OJ L 265, 18. 10. 1996, p. 15).
[3] OJ L 275, 5. 10. 1990, p. 35.
[4] OJ L 245, 26. 8. 1992, p. 23.
[5] OJ L 177, 5. 7. 1991, p. 22.
[6] OJ L 338, 28. 12. 1996, p. 86.
[7] OJ L 185, 9. 7. 1974, p. 15. Decision as last amended by the 1994 Act of Accession.

(24) Whereas this Directive is a practical contribution towards creating the social dimension of the internal market,

HAS ADOPTED THIS DIRECTIVE:

SECTION I

GENERAL PROVISIONS

Article 1

Objective and scope

1. This Directive, which is the fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC, lays down minimum requirements for the protection of workers from risks to their safety and health arising, or likely to arise, from the effects of chemical agents that are present at the workplace or as a result of any work activity involving chemical agents.

2. The requirements of this Directive apply where hazardous chemical agents are present or may be present at the workplace, without prejudice to the provisions for chemical agents to which measures for radiation protection apply pursuant to Directives adopted under the Treaty establishing the European Atomic Energy Community.

3. For carcinogens at work the provisions of this Directive shall apply without prejudice to more stringent and/or specific provisions contained in Council Directive 90/394/EEC of 28 June 1990 on the protection of workers from the risks related to exposure to carcinogens (sixth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) [1].

4. The provisions of Directive 89/391/EEC shall apply fully to the whole field referred to in this Article, without prejudice to more stringent and/or specific provisions contained in this Directive.

5. As far as the transport of hazardous chemical agents is concerned, the provisions of this Directive shall apply without prejudice to more stringent and/or specific provisions contained in Directive 94/55/EC [2], in Directive 96/49/EC [3], in the provisions of the IMDG Code, IBC Code and IGC Code as defined in Article 2 of Directive 93/75/EEC [4], in the provisions of the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterway and of the Regulation for the Carriage of Dangerous Substances on the Rhine as incorporated in Community law and in the technical instructions for the safe transport of dangerous goods issued, at the date of entry into force of this Directive, by the International Civil Aviation Organisation.

Article 2

Definitions

For the purpose of this Directive, the terms used shall have the following meanings:

(a) 'Chemical agent' means any chemical element or compound, on its own or admixed, as it occurs in the natural state or as produced, used or released, including release as waste, by any work activity, whether or not produced intentionally and whether or not placed on the market;

(b) 'Hazardous chemical agent' means:

(i) any chemical agent which meets the criteria for classification as a dangerous substance according to the criteria in Annex VI to Directive 67/548/EEC, whether or not that substance is classified under that Directive, other than those substances which only meet the criteria for classification as dangerous for the environment;

(ii) any chemical agent which meets the criteria for classification as a dangerous preparation within the meaning of Directive 88/379/EEC, whether or not that preparation is classified under that Directive, other than those preparations which only meet the criteria for classification as dangerous for the environment;

(iii) any chemical agent which, whilst not meeting the criteria for classification as dangerous in accordance with (i) and (ii), may, because of its physicochemical, chemical or toxicological properties and the way it is used or is present in the workplace, present a risk to the safety and health of workers, including any chemical agent assigned an occupational exposure limit value under Article 3.

(c) 'Activity involving chemical agents' means any work in which chemical agents are used, or are intended to be used, in any process, including production, handling, storage, transport or disposal and treatment, or which result from such work;

[1] OJ L 196, 26. 7. 1990, p. 1.
[2] Council Directive 94/55/EC of 21 November 1994 on the approximation of the laws of the Member States with regard to the transport of dangerous goods by road (OJ L 319, 12. 12. 1994, p. 7). Directive as amended by Commission Directive 96/86/EC (OJ L 335, 24. 12. 1996, p. 43).
[3] Council Directive 96/49/EC of 23 July 1996 on the approximation of the laws of the Member States with regard to the transport of dangerous goods by rail (OJ L 235, 17. 9. 1996, p. 25). Directive as amended by Commission Directive 96/87/EC (OJ L 335, 24. 12. 1996, p. 45).
[4] Council Directive 93/75/EEC of 13 September 1993 concerning minimum requirements for vessels bound for or leaving Community ports and carrying dangerous or polluting goods (OJ L 247, 5. 10. 1993, p. 19). Directive as last amended by Commission Directive 97/34/EC (OJ L 158, 17. 6. 1997, p. 40).

(d) 'Occupational exposure limit value' means, unless otherwise specified, the limit of the time-weighted average of the concentration of a chemical agent in the air within the breathing zone of a worker in relation to a specified reference period;

(e) 'Biological limit value' means the limit of the concentration in the appropriate biological medium of the relevant agent, its metabolite, or an indicator of effect;

(f) 'Health surveillance' means the assessment of an individual worker to determine the state of health of that individual, as related to exposure to specific chemical agents at work;

(g) 'Hazard' means the intrinsic property of a chemical agent with the potential to cause harm;

(h) 'Risk' means the likelihood that the potential for harm will be attained under the conditions of use and/or exposure.

Article 3

Occupational exposure limit values and biolgocial limit values

1. The Commission shall evaluate the relationship between the health effects of hazardous chemical agents and the level of occupational exposure by means of an independent scientific assessment of the latest available scientific data.

2. On the basis of the evaluation described in paragraph 1, the Commission, after first consulting the Advisory Committee on Safety, Hygiene and Health protection at Work, shall propose European objectives in the form of indicative occupational exposure limit values for the protection of workers from chemical risks, to be set at Community level.

These limit values shall be established or revised, taking into account the availability of measurement techniques, in accordance with the procedure laid down in Article 17 of Directive 89/391/EEC. Member States shall keep workers' and employers' organisations informed of indicative occupational exposure limit values set at Community level.

3. For any chemical agent for which an indicative occupational exposure limit value is established at Community level, Member States shall establish a national occupational exposure limit value, taking into account the Community limit value, determining its nature in accordance with national legislation and practice.

4. Binding occupational exposure limit values may be drawn up at Community level and, in addition to the factors considered when establishing indicative occupational exposure limit values, shall reflect feasibility factors while maintaining the aim of ensuring the health of workers at work. Such limit values shall be established in accordance with Article 118a of the Treaty and laid down in Annex I to this Directive.

5. For any chemical agent for which a binding occupational exposure limit value is established. Member States shall establish a corresponding national binding occupational exposure limit value based on, but not exceeding, the Community limit value.

6. Binding biological limit values may be drawn up at Community level on the basis of the evaluation described in paragraph 1 and of the availability of measurement techniques, and shall reflect feasibility factors while maintaining the aim of ensuring the health of workers at work. Such limit values shall be established in accordance with the procedure laid down in Article 118a of the Treaty and laid down in Annex II to this Directive, together with other relevant health surveillance information.

7. For any chemical agent for which a binding biological limit value is established, Member States shall establish a corresponding national binding biological limit value based on, but not exceeding, the Community limit value.

8. Where a Member State introduces or revises a national occupational exposure limit value or a national biological limit value for a chemical agent, it shall inform the Commission and other Member States thereof together with the relevant scientific and technical data. The Commission shall undertake the appropriate action.

9. On the basis of the reports provided by the Member States under Article 15, the Commission shall carry out an assessment of the way in which Member States have taken account of Community indicative limit values when establishing the corresponding national occupational exposure limit values.

10. Standardised methods for the measurement and evaluation of workplace air concentrations in relation to occupational exposure limit values shall be developed in accordance with Article 12(2).

SECTION II

EMPLOYERS' OBLIGATIONS

Article 4

Determination and assessment of risk of hazardous chemical agents

1. In carrying out the obligations laid down in Articles 6(3) and 9(1) of Directive 89/391/EEC, the employer shall first determine whether any hazardous chemical agents are present at the workplace. If so, he shall then assess any risk to the safety and health of workers arising from the presence of those chemical agents, taking into consideration the following:

— their hazardous properties,

— information on safety and health that shall be provided by the supplier, (e.g. the relevant safety data sheet in accordance with the provisions of Directive 67/548/EEC or Directive 88/379/EEC),

— the level, type and duration of exposure,

— the circumstances of work involving such agents, including their amount,

— any occupational exposure limit values or biological limit values established on the territory of the Member State in question,

— the effect of preventive measures taken or to be taken,

— where available, the conclusions to be drawn from any health surveillance already undertaken.

The employer shall obtain additional information which is needed for the risk assessment from the supplier or from other readily available sources. Where appropriate, this information shall comprise the specific assessment concerning the risk to users established on the basis of Community legislation on chemical agents.

2. The employer must be in possession of an assessment of the risk in accordance with Article 9 of Directive 89/391/EEC, and shall identify which measures have been taken in accordance with Articles 5 and 6 of this Directive. The risk assessment shall be documented in a suitable form according to national law and practice, and may include a justification by the employer that the nature and extent of the risks related to chemical agents make a further detailed risk assessment unnecessary. The risk assessment shall be kept up-to-date, particularly if there have been significant changes which could render it out-of-date, or when the results of health surveillance show it to be necessary.

3. Certain activities within the undertaking or establishment, such as maintenance, in respect of which it is foreseeable that there is a potential for significant exposure, or which may result in deleterious effects to safety and health for other reaons, even after all technical measures have been taken, shall be included in the risk assessment.

4. In the case of activities involving exposure to several hazardous chemical agents, the risk shall be assessed on the basis of the risk presented by all such chemical agents in combination.

5. In the case of a new activity involving hazardous chemical agents, work shall only commence after an assessment of the risk of that activity has been made and any preventive measures identified have been implemented.

6. Practical guidelines for the determination and assessment of risk, and for their review and, if necessary, adjustment, shall be developed in accordance with Article 12(2).

Article 5

General principles for prevention of risks associated with hazardous chemical agents and application of this Directive in relation to assessment of risks

1. In carrying out his obligation to ensure the health and safety of workers in any activity involving hazardous chemical agents the employer shall take the necessary preventive measures set out in Article 6(1) and (2) of Directive 89/391/EEC and include the measures set out in this Directive.

2. Risks to the health and safety of workers at work involving hazardous chemical agents shall be eliminated or reduced to a minimum by:

— the design and organisation of systems of work at the workplace,

— the provision of suitable equipment for work with chemical agents and maintenance procedures which ensure the health and safety of workers at work,

— reducing to a minimum the number of workers exposed or likely to be exposed,

— reducing to a minimum the duration and intensity of exposure,

— appropriate hygiene measures,

— reducing the quantity of chemical agents present at the workplace to the minimum required for the type of work concerned,

— suitable working procedures including arrangements for the safe handling, storage and transport within the workplace of hazardous chemical agents and waste containing such chemical agents.

Practical guidelines for preventive measures to control risk shall be developed in accordance with Article 12(2).

3. Where the results of the assessment referred to in Article 4(1) reveal a risk to the safety and health of workers, the specific protection, prevention and monitoring measures laid down in Articles 6, 7 and 10 shall be applied.

4. Where the results of the risk assessment referred to in Article 4(1) show that, because of the quantities of a hazardous chemical agent present in the workplace, there is only a slight risk to the safety and health of workers, and the measures taken in accordance with paragraphs 1 and 2 of this Article are sufficient to reduce that risk, the provisions of Articles 6, 7 and 10 shall not apply.

Article 6

Specific protection and prevention measures

1. The employer shall ensure that the risk from a hazardous chemical agent to the safety and health of workers at work is eliminated or reduced to a minimum.

2. In applying paragraph 1, substitution shall by preference be undertaken, whereby the employer shall avoid the use of a hazardous chemical agent by replacing it with a chemical agent or process which, under its condition of use, is not hazrdous or less hazardous to workers' safety and health, as the case may be.

Where the nature of the activity does not permit risk to be eliminated by substitution, having regard to the activity and risk assessment referred to in Article 4, the employer shall ensure that the risk is reduced to a minimum by application of protection and prevention measures, consistent with the assessment of the risk made pursuant to Article 4. These will include, in order of priority:

(a) design of appropriate work processes and engineering controls and use of adequate equipment and materials, so as to avoid or minimise the release of hazardous chemical agents which may present a risk to workers' safety and health at the place of work;

(b) application of collective protection measures at the source of the risk, such as adequate ventilation and appropriate organizational measures;

(c) where exposure cannot be prevented by other means, application of individual protection measures including personal protective equipment.

Practical guidelines for protection and prevention measures to control risk shall be developed in accordance with Article 12(2).

3. The measures referred to in paragraph 2 of this Article shall be accompanied by health surveillance in accordance with Article 10 if it is appropriate to the nature of the risk.

4. Unless the employer clearly demonstrates by other means of evaluation that, in accordance with paragraph 2, adequate prevention and protection have been achieved, the employer shall carry out on a regular basis, and when any change occurs in the conditions which may affect workers' exposure to chemical agents, such measurements of chemical agents which may present a risk to worker's health at the workplace as are necessary, in particular in relation to the occupational exposure limit values.

5. The employer shall take into account the results of the procedures referred to in paragraph 4 of this Article in carrying out the obligations laid down in or resulting as a consequence of Article 4.

In any event, where an occupational exposure limit value effectively established on the territory of a Member State has been exceeded, the emloyer shall immediately take steps, taking into account the nature of that limit, to remedy the situation by carrying out preventive and protective measures.

6. On the basis of the overall assessment of and general principles for the prevention of risks in Articles 4 and 5, the employer shall take technical and/or organisational measures appropriate to the nature of the operation, including storage, handling and segregation of incompatible chemical agents, providing protection of workers against hazards arising from the physico-chemical properties of chemical agents. In particular he shall take measures, in order of priority, to:

(a) prevent the presence at the workplace of hazardous concentrations of inflammable substances or hazardous quantities of chemically unstable substances or, where the nature of the work does not allow that,

(b) avoid the presence of ignition sources which could give rise to fires and explosions, or adverse conditions which could cause chemically unstable substances or mixtures of substances to give rise to harmful physical effects, and

(c) mitigate the detrimental effects to the health and safety of workers in the event of fire or explosion due to the ignition of inflammable substances, or harmful physcial effects arising from chemically unstable substances or mixtures of substances.

Work equipment and protective systems provided by the employer for the protection of workers shall comply with the relevant Community provisions on design, manufacture and supply with respect to health and safety. Technical and/or organisational measures taken by the employer shall take account of and be consistent with the equipment group categorisation in Annex I to Directive 94/9/EC of the European Parliament and of the Council of 23 March 1994 on the approximation of the laws of the Member States concerning equipment and protective systems intended for use in potentially explosive atmospheres ([1]).

The employer shall take measures to provide sufficient control of plant, equipment and machinery or provision of explosion suppression equipment or explosion pressure relief arrangements.

Article 7

Arrangements to deal with accidents, incidents and emergencies

1. Without prejudice to the obligations laid down in Article 8 of Directive 89/391/EEC, the employer shall, in order to protect the safety and health of workers from an accident, incident or emergency related to the presence of hazardous chemical agents at the workplace, establish procedures (action plans) which can be put into effect when any such event occurs, so that appropriate action is taken. These arrangements shall include any relevant safety drills which are to be performed at regular intervals, and the provision of appropriate first aid facilities.

2. In the case of the occurence of an event such as is mentioned in paragraph 1, the employer shall immediately take steps to mitigate the effects of the event and to inform the workers concerned thereof.

In order to restore the situation to normal:

— the employer shall implement appropriate measures to remedy the situation as soon as possible,

— only those workers who are essential to the carrying out of repairs and other necessary work shall be permitted to work in the affected area.

3. The workers who are permitted to work in the affected area shall be provided with appropriate protective clothing, personal protective equipment, specialised safety equipment and plant which they must use as long as the situation persits; that situation shall not be permanent.

Unprotected persons shall not be permitted to remain in the affected area.

4. Without prejudice to Article 8 of Directive 89/391/EEC the employer shall take the measures necessary to provide the warning and other communication systems required to signal an increased risk to safety and health, to enable an appropriate response and to launch remedial actions, assistance, escape and rescue operations immediately if the need arises.

5. The employer shall ensure that information on emergency arrangements involving hazardous chemical agents is available. The relevant internal and external accident and emergency services shall have access to this information. It shall include the following:

— advance notice of relevant work hazards, hazard identification arrangements, precautions and procedures, so that the emergency services can prepare their own response procedures and precautionary measures; and

— any available information concerning specific hazards arising, or likely to rise, at the time of an accident or emergency, including information on procedures prepared prusuant to this Article.

Article 8

Information and training for workers

1. Without prejudice to Articles 10 and 12 of Directive 89/391/EEC the employer shall ensure that workers and/or their representatives are provided with:

— the data obtained pursuant to Article 4 of this Directive, and further informed whenever a major alteration at the workplace leads to a change in these data,

— information on the hazardous chemical agents occurring in the workplace, such as the identity of those agents, the risks to safety and health, relevant occupational exposure limit values and other legislative provisions,

— training and information on appropriate precautions and actions to be taken in order to safeguard themselves and other workers at the workplace,

— access to any safety data sheet provided by the supplier in accordance with Article 10 of Directive 88/379/EEC and Article 27 of Directive 92/32/EEC ([2]);

and that the information is:

— provided in a manner appropriate to the outcome of the risk assessment pursuant to Article 4 of this Directive. This may vary from oral communication to individual instruction and training supported by information in writing, depending on the nature and degree of the risk revealed by the assessment required by the said Article,

— updated to take account of changing circumstances.

([1]) OJ L 100, 19. 4. 1994, p. 1.

([2]) OJ L 154, 5. 6. 1992, p. 1.

2. Where containers and pipes for hazardous chemical agents used at work are not marked in accordance with the relevant Community legislation on the labelling of chemical agents and on safety signs at the workplace, the employer shall, without prejudice to the derogations provided for in the abovementioned legislation, ensure that the contents of the containers and pipes, together with the nature of those contents and any associated hazards, are clearly identifiable.

3. Member States may take measures necessary to ensure that employers may, preferably from the producer or supplier, obtain on request all information on hazardous chemical agents needed to apply Article 4(1) of this Directive, insofar as Directives 67/548/EEC and 88/379/EEC do not include any obligation to provide information.

SECTION III

MISCELLANEOUS PROVISIONS

Article 9

Prohibitions

1. To prevent the exposure of workers to health risks from certain chemical agents and/or certain activities involving chemical agents, the production, manufacture or use at work of the chemical agents and the activities set out in Annex III shall be prohibited to the extent specified therein.

2. Member States may permit derogations from requirements of paragraph 1 in the following circumstances:

— for the sole purpose of scientific research and testing, including analysis,

— for activities intended to eliminate chemical agents that are present in the form of by-products or waste products,

— for the production of the chemical agents referred to in paragraph 1 for use as intermediates, and for such use.

The exposure of workers to chemical agents referred to in paragraph 1 must be prevented, in particular by providing that the production and earliest possible use of such chemical agents as intermediates must take place in a single closed system, from which the aforesaid chemical agents may be removed only to the extent necessary to monitor the process or service the system.

Member States may provide for systems of individual authorisations.

3. When derogations are permitted pursuant to paragraph 2, the competent authority shall request the employer to submit the following information:

— the reason for requesting the derogation,

— the quantity of the chemical agent to be used annually,

— the activities and/or reactions or processes involved,

— the number of workers liable to be involved,

— the precautions envisaged to protect the safety and health of workers concerned,

— the technical and organisational measures taken to prevent the exposure of workers.

4. The Council, in accordance with the procedure laid down in Article 118a of the Treaty, may amend the list of prohibitions under paragraph 1 of this Article, to include further chemical agents or activities.

Article 10

Health surveillance

1. Without prejudice to Article 14 of Directive 89/391/EEC, Member States shall introduce arrangements for carrying out appropriate health surveillance of workers for whom the results of the assessment referred to in Article 4 of this Directive reveal a risk to health. These arrangements, including the requirements specified for health and exposure records and their availability, shall be introduced in accordance with national laws and/or practice.

Health surveillance, the results of which shall be taken into account in applying preventive measures in the specific workplace, shall be appropriate where:

— the exposure of the worker to a hazardous chemical agent is such that an identifiable disease or adverse health effect may be related to the exposure, and

— there is a likelihood that the disease or effect may occur under the particular conditions of the worker's work, and

— the technique of investigation is of low risk to workers.

Furthermore, there shall be valid techniques for detecting indications of the disease or effect.

Where a binding biological limit value has been set as indicated in Annex II, health surveillance shall be a compulsory requirement for work with the hazardous chemical agent in question, in accordance with the procedures in that Annex. Workers shall be informed of this requirement before being assigned to the task involving risk of exposure to the hazardous chemical agent indicated.

2. Member States shall establish arrangements to ensure that for each worker who undergoes health surveillance in accordance with the requirements of paragraph 1, individual health and exposure records are made and kept up-to-date.

3. Health and exposure records shall contain a summary of the results of health surveillance carried out and of any monitoring data representative of the exposure of the individual. Biological monitoring and related requirements may form part of health surveillance.

Health and exposure records shall be kept in a suitable form so as to permit consultation at a later date, taking into account any confidentiality.

Copies of the appropriate records shall be supplied to the competent authority on request. The individual worker shall, at his request, have access to the health and exposure records relating to him personally.

Where an undertaking ceases to trade, the health and exposure records shall be made available to the competent authority.

4. Where, as a result of health surveillance:

— a worker is found to have an identifiable disease or adverse health effect which is considered by a doctor or occupational health-care professional to be the result of exposure at work to a hazardous chemical agent, or

— a binding biological limit value is found to have been exceeded,

the worker shall be informed by the doctor or other suitably qualified person of the result which relates to him personally, including information and advice regarding any health surveillance which he should undergo following the end of the exposure, and

the employer shall:

— review the risk assessment made pursuant to Article 4(1),

— review the measures provided to eliminate or reduce risks pursuant to Articles 5 and 6,

— take into account the advice of the occupational health-care professional or other suitably qualified person or the competent authority in implementing any measures required to eliminate or reduce risk in accordance with Article 6, including the possibility of assigning the worker to alternative work where there is no risk of further exposure, and

— arrange continued health surveillance and provide for a review of the health status of any other worker who has been similarly exposed. In such cases the competent doctor or occupational health-care professional or the competent authority may propose that exposed persons undergo a medical examination.

Article 11

Consultation and participation of workers

Consultation and participation of workers and/or their representatives shall take place in accordance with Article 11 of Directive 89/391/EEC on the matters covered by this Directive, including the Annexes hereto.

Article 12

Adaptation of the Annexes, preparation and adoption of technical guidance

1. Adjustments of a strictly technical nature to the Annexes in line with:

— the adoption of Directives in the field of technical harmonisation and standardisation concerning chemical agents, and/or

— technical progress, changes in international standards or specifications and new findings concerning chemical agents,

shall be adopted in accordance with the procedure laid down in Article 17 of Directive 89/391/EEC.

2. The Commission shall draw up practical guidelines of a non-binding nature. These guidelines shall address the topics referred to in Articles 3, 4, 5 and 6, and Annex II, section 1.

The Commission shall first consult the Advisory Committee on Safety, Hygiene and Health Protection at Work in accordance with Decision 74/325/EEC.

In the context of the application of this Directive, Member States shall take account as far as possible of these guidelines in drawing up their national policies for the protection of the health and safety of workers.

Article 13

Repeal and amendment of earlier Directives

1. Directives 80/1107/EEC, 82/605/EEC and 88/364/EEC shall be repealed on the date referred to in Article 14(1).

2. Council Directive 83/477/EEC of 19 September 1983 on the protection of workers from the risks related to exposure to asbestos at work (second individual Directive within the meaning of Article 8 of Directive 80/1107/EEC) [1], is amended as follows:

(a) in the first sentence of Article 1(1), the following words shall be deleted:

'which is the second individual Directive within the meaning of Article 8 of Directive 80/1107/EEC';

(b) Article 9(2) shall be replaced by the following:

'2. The amendments necessary to adapt the Annexes to this Directive to technical progress shall be adopted in accordance with the procedure laid down in Article 17 of Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at the workplace (*).

(*) OJ L 183, 29. 6. 1989, p. 1.';

(c) in the second subparagraph of Article 15(1) the words 'in accordance with the procedure set out in Article 10 of Directive 80/1107/EEC' shall be replaced by

'in accordance with the procedure laid down in Article 17 of Directive 89/391/EEC'.

3. Council Directive 86/188/EEC of 12 May 1986 on the protection of workers from the risks related to exposure to noise at work [2] is amended as follows:

(a) in Article 1(1), the following words shall be deleted:

'which is the third individual Directive within the meaning of Directive 80/1107/EEC';

(b) in Article 12(2), the second subparagraph shall be replaced by the following:

'Annexes I and II shall be adapted to technical progress in accordance with the procedure laid down in Article 17 of Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at the workplace (*).

(*) OJ L 183, 29. 6. 1989, p. 1.'

4. Any other reference in Directive 83/477/EEC and Directive 86/188/EEC to Directive 80/1107/EEC shall be obsolete from the date of repeal of the said Directive.

5. Directives 91/322/EEC and 96/94/EC remain in force.

SECTION IV

Final provisions

Article 14

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive not later than 5 May 2001. They shall forthwith inform the Commission thereof.

When Member States adopt these measures, they shall contain a reference to this Directive or shall be accompanied by such reference on the occasion of their official publication. The methods for making such reference shall be laid down by Member States.

2. Member States shall communicate to the Commission the texts of the provisions of national law which they have already adopted or which they adopt in the field governed by this Directive.

Article 15

Member States shall report to the Commission every five years on the practical implementation of this Directive, indicating the views of employers and workers.

The Commission shall inform the European Parliament, the Council and the Economic and Social Committee thereof.

Article 16

This Directive shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Communities*.

Article 17

This Directive is addressed to the Member States.

Done at Luxembourg, 7 April 1998.

For the Council

The President

D. BLUNKETT

[1] OJ L 263, 24. 9. 1983, p. 25. Directive as amended by Directive 91/382/EEC (OJ L 206, 29. 7. 1991, p. 16).
[2] OJ L 137, 24. 5. 1986, p. 28.

ANNEX I

LIST OF BINDING OCCUPATIONAL EXPOSURE LIMIT VALUES

Name of agent	EINECS No [1]	CAS No [2]	Occupational exposure limit value 8 h [3]		Occupational exposure limit value Short-term [4]	
			mg/m³ [5]	ppm [6]	mg/m³	ppm
Inorganic lead and its compounds			0,15			

[1] EINECS: European Inventory of Existing Commercial Chemical Substances.

[2] CAS: Chemical Abstracts Service.

[3] Measured or calculated in relation to a reference period of eight hours, time-weighted average.

[4] A limit value above which exposure should not occur, and which is related to a 15 minute period unless otherwise specified.

[5] mg/m³ = milligrams per cubic metre of air at 20 °C and 101,3 kPa.

[6] ppm = parts per million by volume in air (ml/m³).

ANNEX II

BINDING BIOLOGICAL LIMIT VALUES AND HEALTH SURVEILLANCE MEASURES

1. **Lead and its ionic compounds**

1.1. Biological monitoring must include measuring the blood-lead level (PbB) using absorption spectrometry or a method giving equivalent results. The binding biological limit value is:

70 μg Pb/100 ml blood

1.2 Medical surveillance is carried out if:

— exposure to a concentration of lead in air is greater than 0,075 mg/m^3, calculated as a time-weighted average over 40 hours per week, or

— a blood-lead level greater than 40 μg Pb/100 ml blood is measured in individual workers.

1.3 Practical guidelines for biological monitoring and medical surveillance must be developed in accordance with Article 12(2). These must include recommendations of biological indicators (e.g. ALAU, ZPP, ALAD) and biological monitoring strategies.

ANNEX III

PROHIBITIONS

The production, manufacture or use at work of the chemical agents and activities involving chemical agents set out below are prohibited. The prohibition does not apply if the chemical agent is present in another chemical agent, or as a constituent of waste, provided that its individual concentration therein is less than the limit specified.

(a) **Chemical Agents**

EINECS No (1)	CAS No (2)	Name of agent	Concentration limit for exemption
202-080-4	91-59-8	2-naphthylamine and its salts	0,1 % w/w
202-177-1	92-67-1	4-aminodiphenyl and its salts	0,1 % w/w
202-199-1	92-87-5	Benzidine and its salts	0,1 % w/w
202-204-7	92-93-3	4-nitrodiphenyl	0,1 % w/w

(1) EINECS: European Inventory of Existing Commercial Chemical Substances
(2) CAS: Chemical Abstracts Service

(b) **Work activities**

None.

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COMMISSION DIRECTIVE 2000/39/EC

of 8 June 2000

establishing a first list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

(Text with EEA relevance)

(OJ L 142 , 16.6.2000, p. 47)

Amended by:

		Official Journal		
		No	page	date
►**M1**	Commission Directive 2006/15/EC of 7 February 2006	L 38	36	9.2.2006

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COMMISSION DIRECTIVE 2000/39/EC

of 8 June 2000

establishing a first list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

(Text with EEA relevance)

THE COMMISSION OF THE EUROPEAN COMMUNITIES,

Having regard to the Treaty establishing the European Community,

Having regard to Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work ([1]), and in particular Article 3(2) thereof,

Having regard to the opinion of the Advisory Committee on safety, hygiene and health protection at work,

Whereas:

(1) Pursuant to Directive 98/24/EC, the Commission is to propose European objectives in the form of indicative occupational exposure limit values for the protection of workers from chemical risks, to be set at Community level.

(2) The Commission, in carrying out this task, is assisted by the Scientific Committee for occupational exposure limits to chemical agents (SCOEL), instituted by Commission Decision 95/320/EC ([2]).

(3) For any chemical agent for which indicative occupational exposure limit values are established at Community level, Member States are required to establish a national occupational exposure limit value, taking into account the Community limit value, determining its nature in accordance with national legislation and practice.

(4) Indicative occupational exposure limit values should be regarded as an important part of the overall approach to ensuring the protection of the health of workers at the workplace, against the risks arising from hazardous chemicals.

(5) A first and a second list of indicative occupational exposure limit values were established by Commission Directives 91/322/EEC ([3]) and 96/94/EC ([4]) in the framework of Council Directive 80/1107/EEC of 27 November 1980 on the protection of workers from the risks related to exposure to chemical, physical and biological agents at work ([5]).

(6) Directive 80/1107/EEC has been repealed with effect from 5 May 2001 by Directive 98/24/EC.

(7) It is appropriate to reenact, in the framework of Directive 98/24/EC, the indicative occupational exposure limit values which had been established by Directives 91/322/EEC and 96/94/EC in the framework of Directive 80/1107/EEC.

(8) The list set out in the Annex contains the substances set out in the Annex to Directive 96/94/EC and incorporates a number of other agents for which indicative occupational exposure limit values have been recommended by SCOEL, following the evaluation of the latest available scientific data on occupational health effects and taking into account the availability of measuring techniques. In view of the foregoing and in the interests of clarity Directive 96/94/EC should be recast.

([1]) OJ L 131, 5.5.1998, p. 11.
([2]) OJ L 188, 9.8.1995, p. 14.
([3]) OJ L 177, 5.7.1991, p. 22.
([4]) OJ L 338, 28.12.1996, p. 86.
([5]) OJ L 327, 3.12.1980, p. 8.

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(9) It is necessary to establish short-term exposure limit values for certain substances to take account of effects arising from short-term exposure.

(10) For some agents, it is necessary to have regard also to the possibility of penetration through the skin, in order to ensure the best possible level of protection.

(11) This Directive constitutes a practical step towards the achievement of the social dimension of the internal market.

(12) The measures provided for in this Directive are in accordance with the opinion of the Committee instituted by Article 17 of Council Directive 89/391/EEC of 12 June 1989 on the introduction of measures to encourage improvements in the safety and health of workers at work ([1]),

HAS ADOPTED THIS DIRECTIVE:

Article 1

Community indicative occupational exposure limit values are hereby established for the chemical agents set out in the Annex.

Article 2

Member States shall establish national occupational exposure limit values for the chemical agents listed in the Annex, taking into account the Community values.

Article 3

1. Member States shall bring into force the laws, regulations and administrative provisions necessary to comply with this Directive by 31 December 2001 at the latest. They shall forthwith inform the Commission thereof.

When Member States adopt these provisions, they shall contain a reference to this Directive or be accompanied by such a reference at the time of their official publication. Member States shall determine how such reference is to be made.

2. Member States shall communicate to the Commission the text of the provisions of national law which they adopt in the field covered by this Directive.

Article 4

Directive 96/94/EC is repealed with effect from the date referred to in Article 3(1).

Article 5

This Directive shall enter into force on the 20th day following its publication in the *Official Journal of the European Communities*.

Article 6

This Directive is addressed to the Member States.

([1]) OJ L 183, 29.6.1989, p. 1.

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ANNEX

INDICATIVE OCCUPATIONAL EXPOSURE LIMIT VALUES

Einecs (1)	CAS (2)	Name of agent	Limit values				Notation (3)
			Eight hours (4)		Short-term (5)		
			mg/m³ (6)	ppm (7)	mg/m³ (6)	ppm (7)	
200-467-2	60-29-7	Diethylether	308	100	616	200	—
200-662-2	67-64-1	Acetone	1 210	500	—	—	—
200-663-8	67-66-3	Chloroform	10	2	—	—	Skin
200-756-3	71-55-6	1,1,1-Trichloroethane	555	100	1 110	200	—
200-834-7	75-04-7	Ethylamine	9,4	5	—	—	—
200-863-5	75-34-3	1,1-Dichloroethane	412	100	—	—	Skin
200-870-3	75-44-5	Phosgene	0,08	0,02	0,4	0,1	—
200-871-9	75-45-6	Chlorodifluoromethane	3 600	1 000	—	—	—
201-159-0	78-93-3	Butanone	600	200	900	300	—
201-176-3	79-09-4	Propionic acid	31	10	62	20	—
202-422-2	95-47-6	o-Xylene	221	50	442	100	Skin
202-425-9	95-50-1	1,2-Dichlorobenzene	122	20	306	50	Skin
202-436-9	95-63-6	1,2,4-Trimethylbenzene	100	20	—	—	—
202-704-5	98-82-8	Cumene	100	20	250	50	Skin
202-705-0	98-83-9	2-Phenylpropene	246	50	492	100	—
202-849-4	100-41-4	Ethylbenzene	442	100	884	200	Skin
203-313-2	105-60-2	e-Caprolactam, (dust and vapour)	10	—	40	—	—
203-388-1	106-35-4	Heptan-3-one	95	20	—	—	—
203-396-5	106-42-3	p-Xylene	221	50	442	100	Skin
203-400-5	106-46-7	1,4-Dichlorobenzene	122	20	306	50	—
203-470-7	107-18-6	Allyl alcohol	4,8	2	12,1	5	Skin
203-473-3	107-21-1	Ethylene glycol	52	20	104	40	Skin
203-539-1	107-98-2	1-Methoxypropanol-2	375	100	568	150	Skin
203-550-1	108-10-1	4-Methylpentan-2-one	83	20	208	50	—
203-576-3	108-38-3	m-Xylene	221	50	442	100	Skin
203-603-9	108-65-6	2-Methoxy-1-methylethylacetate	275	50	550	100	Skin
203-604-4	108-67-8	Mesitylene (Trimethylbenzenes)	100	20	—	—	—

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203-631-1	108-94-1	Cyclohexanone	40,8	10	81,6	20	Skin
203-632-7	108-95-2	Phenol	7,8	2	—	—	Skin
203-726-8	109-99-9	Tetrahydrofuran	150	50	300	100	Skin
203-737-8	110-12-3	5-Methylhexan-2-one	95	20	—	—	—
203-767-1	110-43-0	Heptan-2-one	238	50	475	100	Skin
203-808-3	110-85-0	Piperazine	0,1	—	0,3	—	—
203-905-0	111-76-2	2-Butoxyethanol	98	20	246	50	Skin
203-933-3	112-07-2	2-Butoxyethyl acetate	133	20	333	50	Skin
204-065-8	115-10-6	Dimethylether	1 920	1 000	—	—	—
204-428-0	120-82-1	1,2,4-Trichlorobenzene	15,1	2	37,8	5	Skin
204-469-4	121-44-8	Triethylamine	8,4	2	12,6	3	Skin
204-662-3	123-92-2	Isopentylacetate	270	50	540	100	—
204-697-4	124-40-3	Dimethylamine	3,8	2	9,4	5	—
204-826-4	127-19-5	N,N-Dimethylacetamide	36	10	72	20	Skin
205-480-7	141-32-2	n-Butylacrylate	11	2	53	10	—

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Einecs (1)	CAS (2)	Name of agent	Limit values				Notation (3)
			Eight hours (4)		Short-term (5)		
			mg/m³ (6)	ppm (7)	mg/m³ (6)	ppm (7)	
205-563-8	142-82-5	n-Heptane	2 085	500	—	—	—
208-394-8	526-73-8	1,2,3-Trimethylbenzene	100	20	—	—	—
208-793-7	541-85-5	5-Methylheptan-3-one	53	10	107	20	—
210-946-8	626-38-0	1-Methylbutylacetate	270	50	540	100	—
211-047-3	628-63-7	Pentylacetate	270	50	540	100	—
	620-11-1	3-Pentylacetate	270	50	540	100	—
	625-16-1	Amylacetate, tert	270	50	540	100	—
215-535-7	1330-20-7	Xylene, mixed isomers, pure	221	50	442	100	Skin
222-995-2	3689-24-5	Sulphotep	0,1	—	—	—	Skin
231-634-8	7664-39-3	Hydrogen fluoride	1,5	1,8	2,5	3	—
231-131-3	7440-22-4	Silver, metallic	0,1	—	—	—	—
231-595-7	7647-01-0	Hydrogen chloride	8	5	15	10	—
231-633-2	7664-38-2	Orthophosphoric acid	1	—	2	—	—
231-635-3	7664-41-7	Ammonia, anhydrous	14	20	36	50	—
231-954-8	7782-41-4	Fluorine	1,58	1	3,16	2	—
231-978-9	7783-07-5	Dihydrogen selenide	0,07	0,02	0,17	0,05	—
233-113-0	10035-10-6	Hydrogen bromide	—	—	6,7	2	—
247-852-1	26628-22-8	Sodium azide	0,1	—	0,3	—	Skin
252-104-2	34590-94-8	(2-Methoxymethylethoxy)-propanol	308	50	—	—	Skin
		Fluorides, inorganic	2,5	—	—	—	—

(1) Einecs: European inventory of existing chemical substances.
(2) CAS: Chemical abstract service registry number.
(3) A skin notation assigned to the OEL identifies the possibility of significant uptake through the skin.
(4) Measured or calculated in relation to a reference period of eight-hours time-weighted average.
(5) A limit value above which exposure should not occur and is related to a 15-minute period, unless otherwise specified.
(6) mg/m³: milligrams per cubic metre of air at 20 °C and 101,3 KPa.
(7) ppm: parts per million by volume in air (ml/m³).