

A full-page background image showing a worker in a dark, reflective, full-body protective suit (likely for chemical or heat protection) working in a hazardous industrial environment. The worker is leaning over a piece of machinery, possibly a conveyor belt or a large container, which is covered in a dark, viscous substance. The background is filled with large, glowing orange and yellow structures, possibly molten metal or industrial equipment, creating a dramatic and high-contrast scene. The overall atmosphere is one of intense industrial activity and potential danger.

# Module 2: Safe use of chemicals in the workplace

Safer management of chemicals at work: will it require major changes?

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© S. Compoint - UNEP / Still Pictures  
Capping an oil well, Kuwait



### MODULE OBJECTIVES:

The module aims at:

- Providing guidelines on how to identify problems and situations of chemical risk in the workplace;
- Advising on prioritizing problems to be addressed through preventive action;
- Advising on the preventive measures to be put in place, and the notion of “substitution principle”;
- Identifying steps to ensure workers’ participation.

### LEARNING OUTCOMES:

At the end of the session, the trainee will be familiar with:

- Sources of information about chemicals used at work;
- The different states in which hazardous substances can be found throughout the production process (as primary resources, auxiliary products, sub products, or final products), including in the case of non-intentional releases;
- Interpreting the information on labels and Safety Data Sheets;
- Identifying potential risks related to chemical substances in the workplace; evaluating better their consequences for human health and the environment;
- Steps to elaborate more consistent, complete and effective plans of intervention;
- The notion of “substitution principle”.





## UNIT 1: PREVENTION IS THE CORNERSTONE: ENHANCING A SAFETY AND PREVENTION CULTURE

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### THIS UNIT WILL MAINLY ADDRESS THE FOLLOWING QUESTIONS:

1. How to design a framework for intervention in the workplace?
  2. Where to get useful information on chemicals to this end?
  3. What are management's and the manufacturer/supplier's responsibilities regarding workers' right-to-know?
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The groups most exposed to chemical contamination are, logically, the people who are closer to the source. The first examples that come to mind are industry and agriculture workers. However, workers in the service sector such as hairdressers are significantly exposed as well. Thus, it is not a coincidence if the harmful health effects of many chemical products have been first discovered among workers.

To prevent chemical risks, it is necessary to:

- identify the substances present in the workplace;
- be aware of their risks for health and the environment;
- understand both employers' and employees' perception of risk;
- identify alternatives that bear lesser risk; and
- evaluate the advantages and inconveniences that these alternatives may present from a legal, environmental, occupational and economic perspective, before implementing them.

All workplaces should implement effective safety procedures against chemical hazards, agreed jointly between employers and workers. In some countries, these agreements will be negotiated as **collective bargaining agreements or health and safety agreements between management and workers**. Sometimes these agreements are additional to the minimum obligations imposed on employers by workplace health and safety laws. However, agreements that are not part of a collective bargaining agreement experience implementation problems, as they lack legal power.

**Box 2.1. Collective agreements and collective bargaining**

Collective agreements means all agreements in writing regarding working conditions and terms of employment concluded between an employer, a group of employers or one or more employers' organizations, on the one hand, and one or more representative workers' organizations, or, in the absence of such organizations, the representatives of the workers duly elected and authorized by them in accordance with national laws and regulations, on the other.

*Source: ILO Collective Agreements Recommendation (R91) - 1951*

Collective bargaining serves a dual purpose. It provides a means of determining the wages and conditions of work applying to the group of workers covered by the ensuing agreement through free and voluntary negotiations between the two independent parties concerned. It also enables employers and workers to define by agreement the rules governing their relationship.

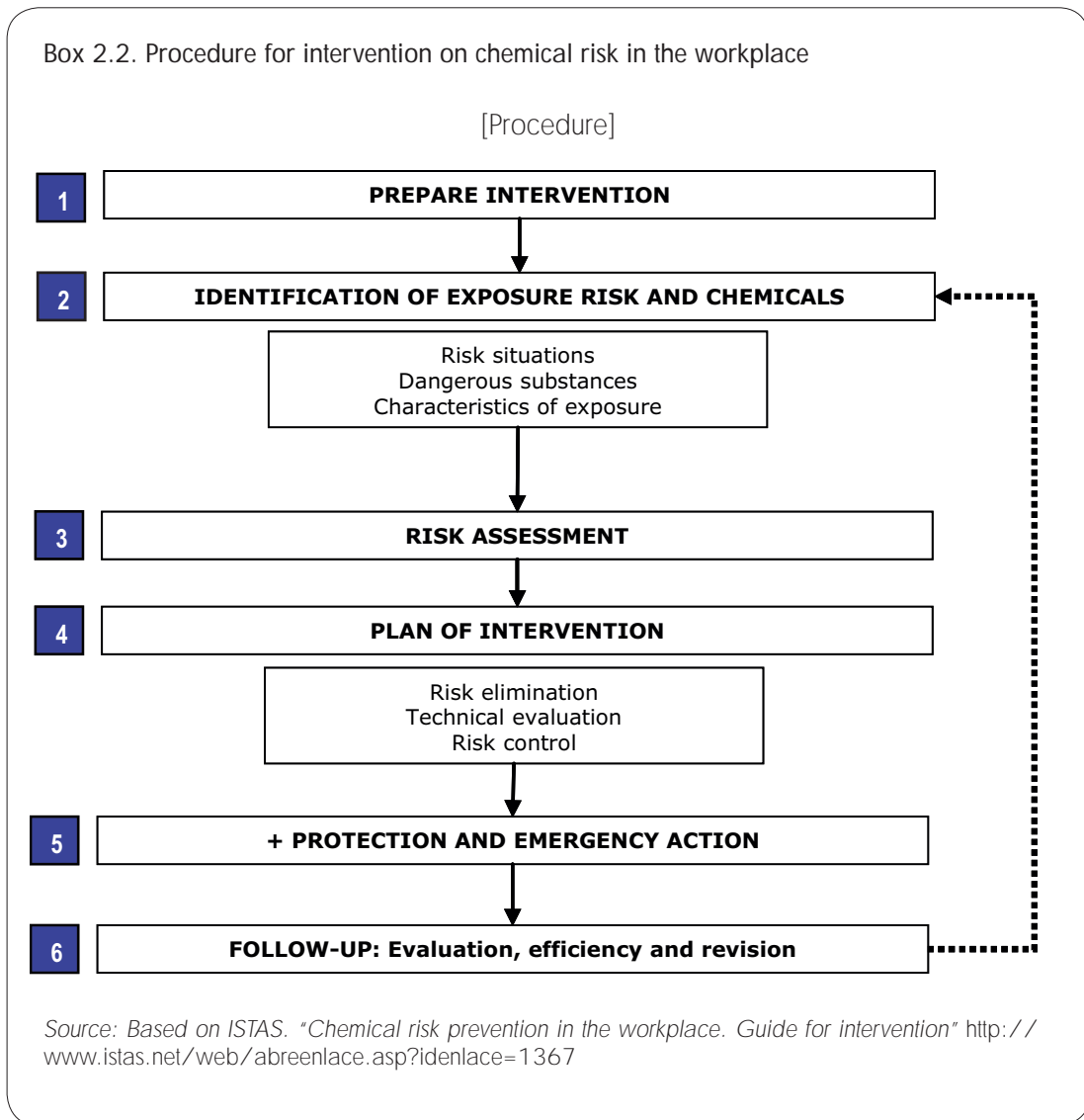
Collective bargaining takes place between an employer, a group of employers or one or more employers' organizations on the one hand and one or more workers' organizations on the other. It may take place at many different levels, with one level sometimes complementing the other: a unit within an enterprise, enterprise level, sectoral, regional and national level.

*Source: [www.ilo.org/public/spanish/dialogue/themes/cb.htm](http://www.ilo.org/public/spanish/dialogue/themes/cb.htm)*

**Occupational health and environmental protections are two sides of the same coin.** This section presents a number of steps to follow to prevent occupational and environmental risks in the workplace, related to the exposure to chemical products and substances. The final objective is to provide advice to workers' representatives, business and industry, as well as other social actors involved in preventing adverse health and safety effects in the workplace.

The main objectives are the:

- Identification of chemical risk situations and problems in the workplace;
- Evaluation of the problems, in terms of priority and importance, to determine the type of preventive action;
- Promotion of concrete prevention practices;
- Enhancement of workers' participation.



## PREPARING A FRAMEWORK FOR "INTERVENTION"

### Situation analysis

Experience has shown that the level of awareness and degree of perception of the people involved are key to the success of any intervention in the workplace.

Those in charge of drafting the plan of intervention must be aware of this before starting any preventive measures against chemical risk, and, if necessary, they must create the conditions that will enhance the overall awareness and degree of perception of these risks in the workplace.

In this case, they should first identify and take into account workers' and, importantly, management's perceptions and attitudes about chemical risk in the workplace. If it appears that there is little concern in the workplace about chemical risk, the first actions should focus on information and sensitization through:

- Providing proof of chemical risk in the workplace;
- Raising awareness on the effects of these chemical products on health and the environment; and
- Identifying options to avoid and reduce risk through responsible attitudes (good practices, use of alternative substances, among others).

### Evaluation or rapid assessment of the workforce and management's perceptions of risk

As indicated previously, the level of awareness and the degree of perception towards chemical hazards is critical to the success of any chemical risk elimination or risk reduction intervention.

### Awareness raising and sensitization

Workers and employers' sensitization to risks caused by chemical products is key for effectively preventing these risks. For the person in charge of designing the plan of intervention, it is very important to raise awareness. This training should enhance the knowledge and skills required for the sound and sustainable management of chemicals, both in the workplace and in the living environment.

### WHERE TO GET INFORMATION?

One of the biggest challenges for workers' and trade union health and safety representatives is to obtain adequate information about chemicals used at work. There are different sources of information, which they should all explore, as a single source will often not tell everything they need to know.



Try to get information from as many of these sources as you can, to get a full picture of chemicals' hazards!

The most important sources of information are the **labels** on containers and the **hazard data sheets**. Other relevant sources include:

- The Union or Health and Safety Representative;

- The manufacturer or supplier of the chemical, through Material Safety Data Sheets (MSDS), labels and/or direct inquiries;
- The Employer;
- Higher Learning and Research Institutions;
- A registrar of Chemicals (normally in Ministry of Agriculture and Ministry of Health);
- International Trade Secretariats, e.g. IUF, ICTU;
- International Chemical Secretariats, e.g. ChemSec;
- Intergovernmental Organizations, Agencies and Programmes, e.g. ILO, UNEP, WHO, IFCS, UNITAR;
- Secretariats of Conventions and Agreements, e.g. Stockholm, Rotterdam, Basel, Bamako, Cartagena;
- Non-Governmental Organizations, e.g. IPEN, PAN Africa, WWF, PAN AP;
- International Campaigns, e.g. Fair Flowers Fair Plants (FFP) programme;
- Survey of the workplace and interviews/consultations of workers;
- National legislation(s): see “right-to-know”.

The latter two sources are of particular relevance:

- **Survey of the workplace and interviews/consultations of workers:** this is an important source of information, which results from a site-visit to the different workplaces and areas and an exercise of consultation with workers. This will also provide a reference against which to compare the information given by the company.

A detailed overview of the places and sites that show a higher level of absenteeism is usually indicative of higher rates of occupational accidents and incidents and points out where the major problems may be.

- **National legislation(s):** Many countries now have **some kind of legislation governing communication of hazard or “right-to-know”**. Under these laws, employers, manufacturers, suppliers and importers of chemicals must provide clear, detailed information about the particular chemical substance or product in question: its possible health effects, including the results of animal tests and surveys of exposed workers, and means of protecting workers from any harmful effect.
  - **Right to Information and Management’s responsibility:** These laws make it the employer’s legal responsibility to provide workers with as much information and training as possible on all chemical substances used. Some unions have negotiated agreements that require the union be given full information on all chemicals used in the workplace. Unfortunately, many employers do not have this information and may not know where to get it. In this case, the health and safety representative should insist that the employer

obtain information from the manufacturer or the supplier of the chemical and make it available to the workers.

- **Right to information and Manufacturer and Supplier's responsibilities:** If the employer cannot obtain the necessary information, a worker or the union may write directly to the manufacturer of the chemical to request the information.



In accordance with the objectives and principles of the ILO Occupational Health and safety Convention, 1981 (n. 155), and Recommendation, 1981 (n.164), Employers should make chemical safety data sheets or similar relevant information of the chemicals used at work available to workers and their representatives.

Manufacturers and suppliers, in particular, are required to provide information through:

### Labels

The label is the basic tool to keep the user informed on the classification of a product's hazard and the most important safety precautions.

Labels must be attached to the container, and correspond to the exact chemical that can be found in the container.

It is highly recommended that chemicals be kept in their original containers. However, when a hazardous chemical has been transferred from its original shipping container, the secondary and all subsequent containers should carry the appropriate warning labels. Labels should be affixed to all containers from the production of the chemical to its disposal.

International, regional, and national classification and labelling systems are already established and tested in practice:

- The United Nations Recommendations on the Transport of Dangerous Goods is widely recognized and used among the UN member states;
- The classification and labelling system of the European Union which is used beyond the EU countries; and
- Several functioning national systems, such as those of Canada and USA, may also be used as models for national systems.

In EU countries the label must clearly show the trade name; the name and the address, including telephone number, of the manufacturer, the importer or the distributor; the chemical name of the substance (in the case of a preparation, the chemical names of the hazardous components); the quantity of the contents of the package or container. Most important, it contains signs and symbols of danger, **international numbers (CAS or ICSC numbers)**,

risk phrases (R-phrases) and safety phrases (S-phrases), which are widely used in many countries from all over the world.

### The globally harmonized system of classification and labelling of chemicals (GHS)

It is important to mention the **Globally Harmonized System of Classification and Labelling of Chemicals (GHS)**, which is an internationally recognized system set to replace the various classification and labelling standards used in different countries.

The GHS establishes consistent criteria for classification and labelling of chemicals on a global scale. It covers all hazardous chemicals, including substances and mixtures.

#### Box 2.3. Information on GHS labels

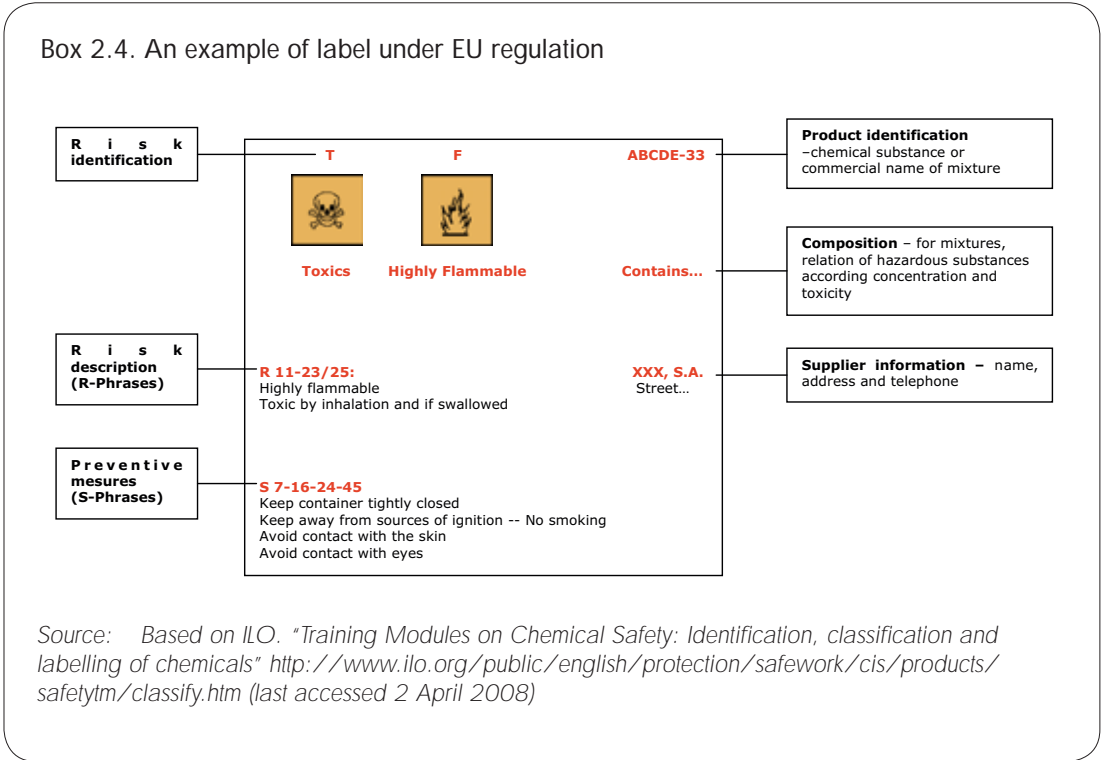
The required information in the GHS labels includes:

- **Symbols (hazard pictograms):** Convey health, physical and environmental hazard information assigned to a GHS hazard class and category. Pictograms include the harmonized hazard symbols plus other graphic elements, such as borders, background patterns or colours to convey specific information. The symbols are similar to current EU symbols, with a few exceptions;
- **Signal Words:** "Danger" or "Warning" used to emphasize hazards and indicate their relative level of severity, assigned to a GHS hazard class and category. Some lower level hazard categories do not use signal words. Only one signal word corresponding to the class of the most severe hazard should be used on a label; and
- **Hazard Statements:** Standard phrases assigned to a hazard class and category that describe the nature of the hazard. An appropriate statement for each GHS hazard should be included on the label for products possessing more than one hazard.

Additional label elements included in the GHS are:

- **Precautionary statements:** measures to minimize or prevent adverse effects;
- **Product identifier:** name or number used for a hazardous product on a label or in the SDS; **supplier identification:** the name, address and telephone number should be provided on the label; and
- **Supplemental information.**

Source: UNECE. "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" [http://www.unece.org/trans/danger/publi/ghs/ghs\\_welcome\\_e.html](http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html) (last accessed 14 April 2008)



Compliance with the GHS is voluntary for each country. However, it is likely that countries that do not adopt the GHS will be at a disadvantage when doing business internationally.

There is no definite international implementation schedule for the GHS. The **United Nations** are targeting its broad international adoption by 2008. Yet, different countries will require different periods to update current regulations or implement new ones.



Every chemical container in the workplace, no matter how small, should have an appropriate, understandable label.

### WHERE TO GET MORE INFORMATION?

- For more information, Globally Harmonized System of Classification and Labelling of Chemicals (GHS) - GHS Pictograms -<http://www.unece.org/trans/danger/publi/ghs/pictograms.html>
- Labelling symbols used in the European Union, the European Economic Area and other countries <http://www.ilo.org/public/english/protection/safework/cis/products/icsc/dasht/symbols/index.htm>  
<http://www.ilo.org/public/english/protection/safework/ghs>
- International Chemical Secretariats, e.g. ChemSec ([www.chemsec.org](http://www.chemsec.org))
- Intergovernmental Organizations, Agencies and Programmes e.g. ILO, UNEP, WHO, IFCS ([www.ifcs.ch](http://www.ifcs.ch)), UNITAR (<http://www.unitar.org>), (include relevant websites)
- Non-Governmental Organizations e.g. IPEN ([www.ipen.org](http://www.ipen.org)), PAN UK, PAN Africa ([www.pan-africa.sn](http://www.pan-africa.sn)), PANNA, WWF (<http://www.wwf.org.uk/chemical>), (<http://www.panda.org/toxics>), PAN AP ([www.panap.net](http://www.panap.net))

### Safety data sheets

**Safety data sheet (or SDS)** is the name given to the Material Safety Data Sheet of the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Safety Data Sheets should contain identification information about the substance (composition, physical, chemical and toxicological hazards), information on specific protection and prevention measures throughout the whole process (production, storage, transport, etc.), measures to undertake in case of an accident (spillage, fire-fighting measures, etc.), as well as contact details of the supplier.

Chemical safety data sheets should be available within the enterprise for every chemical substance that has been classified as hazardous. They should also be available for preparations (products) containing any hazardous substance as a component.

Chemical safety data sheets are published under several names, such as:

- International chemical safety card (ICSC);
- Chemical safety card;
- Chemical info-sheet;
- Material safety data sheet (MSDS);
- Hazard data sheets (HDSs);
- Chemical safety data sheets (CSDSs);
- Product safety data sheet;
- Health and safety data; and
- Safety data sheet (SDS).

Validated data sheets on pure substances are available, for example, from the International Programme on Chemical Safety (IPCS, [www.intox.org](http://www.intox.org)) or from national institutions such as the Canadian Centre for Occupational Safety and Health ([www.ccohs.ca](http://www.ccohs.ca)). These can be used by manufacturers as basic sources of information.

#### Box 2.5. Safety Data Sheets contents according to the Globally Harmonised System of classification

The information in the SDS should be presented using the following 16 headings in the order given below:

1. **Identification:** identifies the substance or mixture and provides the name of the supplier, recommended uses and the contact details for the supplier including an emergency contact;
2. **Hazard identification:** describes the hazards of the substance or mixture and the appropriate warning information -signal word, hazard statement(s) and precautionary statement(s)- associated with these hazards;
3. **Composition/information on ingredients:** identifies the ingredient(s) in the product. This includes the impurities and stabilizing additives that are themselves classified and contribute to the classification of the substance as a whole. This section may also be used to provide information on complex substances;
4. **First-aid measures:** This section describes the initial care that can be given by any untrained individual, without the use of sophisticated equipment and without a wide selection of medications available. If medical attention is required, the instructions should state so, as well as the level of urgency. It may be useful to provide information on the immediate effects, by route of exposure, and indicate the immediate treatment, followed by possible delayed effects with specific medical surveillance required;
5. **Fire-fighting measures:** covers the requirements for fighting a fire caused by the substance or mixture, or arising in its vicinity;
6. **Accidental release measures:** recommends the appropriate response to spills, leaks, or releases in order to prevent or minimize the adverse effects on persons, property and the environment. Distinguish between responses for large and small spills where the spill volume is a significant factor in the hazard. The procedures for containment and recovery may indicate that different practices are required;
7. **Handling and storage:** provides guidance on safe handling practices that minimize the potential hazards to people, property and the environment from the substance or mixture. Emphasizes precautions that are appropriate to the intended use and to the unique properties of the substance or mixture;
8. **Exposure controls/personal protection:** for the purposes of this document "exposure control" means the full range of specific protection and prevention measures to be taken during use in order to minimize worker and environmental exposure;
9. **Physical and chemical properties:** describes the empirical data of the substance or mixture (if possible) in this section;

10. **Stability and reactivity:** describes the reactivity hazards of the substance or mixture in this section. Provides specific test data for the substance or mixture as a whole, where available. However, the information may also be based on general data for the class or family of chemical if such data adequately represent the anticipated hazard of the substance or mixture;
11. **Toxicological information:** used primarily by medical professionals, occupational health and safety professionals and toxicologists, it provides a concise but complete and comprehensible description of the various toxicological (health) effects. The available data used to identify those effects should also be provided;
12. **Ecological information:** provides information to evaluate the environmental impact of the substance or mixture if it were released into the environment. This information can assist in handling spills, and evaluating waste treatment practices and should clearly indicate species, media, units, test duration and test conditions;
13. **Disposal considerations:** provides information for proper disposal, recycling or reclamation of the substance or mixture and/or its container, in order to assist in the determination of safe and environmentally preferred waste management options, consistent with the requirements of the national competent authority;
14. **Transport information:** provides basic classification information for the transporting/shipment of a hazardous substance or mixture by road, rail, sea or air. Where information is not available or relevant, this should be stated;
15. **Regulatory information:** describes any other regulatory information on the substance or mixture that is not provided elsewhere in the SDS (e.g. whether the substance or mixture is subject to the Montreal Protocol, the Stockholm Convention<sup>10</sup> or the Rotterdam Convention<sup>11</sup>); and
16. **Other information:** provides information relevant to the preparation of the SDS in this section. This should incorporate other information that does not belong in sections 1 to 15 of the SDS.

Source: UNECE. "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" [http://www.unece.org/trans/danger/publi/ghs/ghs\\_rev01/01files\\_e.html](http://www.unece.org/trans/danger/publi/ghs/ghs_rev01/01files_e.html) (last accessed 19 December 2007)

## WHAT TO DO?

1. Raise awareness of, and train about, the effects of chemical exposure on occupational health and the environment;
2. Talk to workers to find out their opinions regarding chemical risk in the workplace (see as an example the "Questionnaire" in annex 3 A);
3. Get in contact with management to express concerns related to this issue; and
4. Present workers and employers with the need to assess chemical risk at work, in order to develop measures to minimize, control and reduce these risks.



## UNIT 2: BEING A WORKPLACE DETECTIVE: IDENTIFICATION OF EXPOSURE RISKS AND CHEMICALS

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### THIS UNIT WILL MAINLY ADDRESS THE FOLLOWING QUESTIONS:

1. How to identify “hot spots” for chemical risks and problems in the workplace?
  2. How to accurately map out hazardous substances and materials?
  3. How to characterize exposure to these hazards?
- 

Text books do not give all the answers about workplace risks: barely one in every 100 chemicals used at work has been systematically tested.

Finding out if there is a potential risk in the workplace requires collective vigilance. That means each worker should do his/her own “detective” work. Unions have been instrumental in identifying a number of workplace illnesses, such as cancers.



The best of information is the workforce itself, as workers know their jobs, their workmates and the real hazards.

### IDENTIFICATION OF “HOT SPOTS”: WHERE ARE THE PROBLEMS AND RISKS?

Workers’ exposure to chemical risk and toxic products can take place in different sections and departments on the production line. It can affect a single work post or a large number of positions.

Environmental risk exposure can originate from generating solid polluted wastes, spilling or pouring dangerous substances with water through waste pipes, draining or during accidental discharges or emission of dangerous substances into the air, whether through windows, systems of ventilation or chimneys.

Identification of risk situations can:

- Be limited to the place of work or can refer to a concrete working area (department, number of different tasks for the production process, etc.); and
- Be extended to the whole organization or business to identify all possible risk situations.

To identify “hot spots”, workers need to look at the company’s operations in a different way. Rather than focusing on the end-product, they need to look in details at the storage, handling, and use of chemicals throughout the production process.

To this end, they can walk through the entire process and develop a flowchart that represent the complete production process, or the different tasks and sections that take place at work. This enables the identification of different places where chemical exposure may occur.

Depending on the type of company (sector, size, number of workers, etc.) there are several places and tasks that involve chemicals and result in the generation of chemical waste, dangerous spills, air emissions, etc. In addition, actions and tasks that are carried out in the workplace frequently require the use of several different chemical products, each of which can contain several substances, resulting in “multiple exposure”.

## MAPPING OUT THE HAZARDOUS SUBSTANCES AND MATERIALS

It is recommended to draft and update a comprehensive list of all the products that are used regularly in the workplace. These may be in the form of solid or liquid waste, gas emissions or poured liquids made up of a mix of products, as indicated in section one.

This step involves:

- Systematically identifying all chemical substances that are stored and used in the factory; and
- Creating a structured database than can be used to identify and make improvements on a continuous basis.

This list can be elaborated using the information provided by workers, as well as from the labels on the packages and containers and the safety data sheets (SDS). (Read more in **Where to get information?**). This should provide information about their composition, their physico-chemical properties and their toxicity to human health and the environment.

In drafting this list, workers and their representatives should be aware that hazardous substances can be:

- Found in different natural states: solid, liquid or gaseous;
- Involved in the production processes as primary resources, auxiliary products, intermediate products, sub products and/or non-intentional releases, or even, the final product; and
- Used or generated regularly or sporadically as a result of cleaning tasks, maintenance tests, etc.

The inventory should include the following information:

- The products used at different stages of the production process;
- Their compositions, especially the active ingredients they contain;
- The dangers for the environment;

- The potential health risks; and
- Gender specific health risks.

#### Box 2.6. The “dirty five” group!

The common chemical groups that causes major health risks are:

**DUSTS, FUMES AND GASES** - Dust may be just a nuisance, but it can present serious risks. The potential danger depends on the type of material in the dust, and on the amount and the size of the particles. Asbestos falls into this category.

Exposure to metal fumes can cause damage to the body. “Metal fume fever” is a known health effect of inhaling metal fumes, especially if they contain zinc. It usually appears on the day following that of exposure.

Gases do not necessarily have a warning odour at a dangerous concentration level. The odour may be detected only at very high concentrations in the air. Gases may have an irritating effect, or they may enter the blood circulation and cause internal damage. Sulphur oxides, nitrogen oxides, chlorine and ammonia are toxic gases widely used in industry.

**SOLVENTS** - Most solvents are liquid organic chemicals. They are used because of their ability to dissolve other substances, particularly fat and grease, which are insoluble in water. Many of them evaporate rapidly at ambient temperatures. They are often flammable.

Many solvents have a narcotic effect and may cause dizziness, headache, reduced comprehension or tiredness. Some solvents are very hazardous to the liver, kidneys, bone marrow or nervous system. Benzene, carbon tetrachloride and carbon disulphide belong to the category of solvents that should be substituted with less dangerous ones.

**METALS** - Metals can enter the body in the form of dust and fumes (in grinding or welding) or even through the skin.

Lead is used in various industries: battery, glass and mining sectors, for example. Mercury is present in many pesticides and pickling baths. Nickel is present mixed with other metals in various alloys. Chromium compounds are widely used in industry, and may cause birth defects if mothers are exposed to them during pregnancy.

**ACIDS AND BASES** - Strong acids and bases are mostly used as water solutions. They are corrosive to human tissue. Working with acids or bases can give rise to mists that have the same corrosive properties as the solutions.

Serious damage can result when treating metal pieces in an acid bath (with phosphoric acid for example).

**PESTICIDES** - Pesticides are intended to destroy or control pests of all kind. They are used in industry, for example, to impregnate wood, and in agriculture to control insects, weed, fungi, and rats. There are many different types of pesticide compounds or mixtures.

Insecticides are divided into the following broad groups, among them organophosphorous compounds (often acutely poisonous to both insects and humans), organochlorine compounds and carbamates (insecticides and fungicides).

*Source: ILO. “Training Modules on Chemical Safety: Introduction to Safety in the use of chemicals”  
<http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/introduc.htm>  
 (last accessed 2 April 2008)*

## IDENTIFICATION OF EXPOSURE CHARACTERISTICS

After identifying where the problems are, what the dangerous substances are, and what damage they entail, it is necessary to further define the **magnitude and severity** of risk in each situation.



Magnitude and Severity of a Risk = Hazard + Exposure

The **hazard potential** of a substance (toxicological and ecotoxicological hazard) depends on its physico-chemical properties. To determine the **risks** associated with its use, the circumstances and conditions of use that make the risk possible, i.e., the **risk factors**, must be known.

Eventually, regardless of the conditions of usage and the prevention measures taken some chemicals should still be banned. These substances belong to **black list of chemicals**, and their elimination is a priority for trade union action.

**Box 2.7. Example of trade unions' Black List of chemicals**

Family	Associated EU R-Phrases
Carcinogenics	R 40, R 45, R 49
Mutagens	R 46, R 68
Toxics to reproduction	R 60, R 61, R 62, R 63
Endocrine disrupters	There are no R-Phrases associated
Sensitizers	R 42, R 43, R 42/43
Neurotoxics	R 67 and others which do not have R-Phrases associated
Toxic, persistent and bioaccumulative substances	R 53 and 58 and others which do not have R-Phrases associated

Source: Based on the list elaborated by ISTAS. Union Institute of Work, Environment and Health of CCOO

This means to lay out the dangerous properties of substances in relation to their conditions of use or handling, i.e. the risk factors.

The risk factors, i.e. the conditions of use and handling, include:

- **Work organization and rhythm of work.** Experience shows that these are the two conditions that most determine chemical risk, as overexposure and unnecessary exposure are the cause of many accidents;
- **Physical activity** accelerates the breathing rhythm and therefore enables a larger amount of toxics to penetrate into the organism (inhalation is the major route of entry);
- **Working hours:** Prolonging the number of working hours increases the duration of exposure to contaminants;
- **Micro-clime:** Working conditions such as temperature, humidity and ventilation can increase exposure. High temperature fosters the evaporation of volatile substances. High humidity can foster the presence of hydrosoluble substances in the air;
- **Specific individual conditions:** Younger or older workers, pregnant or breastfeeding women, workers with weak or sensitive health, etc are likely to be more sensitive;
- **Lack of information** among workers about the products they use or lack of adequate training about chemical risk; and
- Whether there are or not **effective measures to control** occupational and environmental exposure.

The best way to identify each risk situation is to undertake regular visits and inspections through the different stages and posts of production, as well as to talk regularly to affected workers.

This information will be summarized in a flow chart indicating the types of risk and their causes at each stage of the production process, detailing the post and level in the production process concerned.

## WHAT TO DO?

### Identification of risk situations:

A good way to proceed is to organize the collection of information according to the following steps. **Annex 2 Card 1A and annex 2 card 1B** can be of help:

1. Divide the physical space or productive process into smaller units and sections of analysis. Sort them into a diagram or map (see as an example **annex 2 card 1A**).
2. Identify the processes and tasks where chemicals are used or simply present.
3. Identify the processes or tasks that generate emissions, spills or waste by-products of chemical substances.
4. Collect the information on a sheet (see as an example **annex 2 card 1B**) including all the products present in the production process, whether they are dangerous or not, and all the resulting products and wastes.

### Identification of hazardous substances:

1. Organize information collection keeping in mind the particular problem to solve: to avoid the possible harm that chemical substances present in the workplace can cause.
2. Remember that chemical substances can be present in the workplace, either because they are produced or used there, or are waste products that result from non-intentional releases.
3. To know the existing risks in each situation or task, all products must be listed, relevant information must be collected and structured, (see as an example **annex 2 card 2**) and should include:
  - The name of the product or mix;
  - The active ingredients that compose it;
  - Human security and safety risks; and
  - Environmental risks.

### Identification of characteristics of exposure:

1. Collect and organize information in a way that clearly identifies the production process: tasks, associated risks, etc. (see as an example **annex 2 card 3**)
2. Make a brief description of each risk, taking into account the information on the products and substances, and the information about related reasons and factors of risk. (see an example **annex 2 card 2**) (see as an example **annex 3 A** and **annex 3 B**)
3. Try to establish a relationship between risks and their causes.

## UNIT 3: IS YOUR JOB PUTTING YOU AT RISK? QUALITATIVE RISK ASSESSMENT

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### THIS UNIT WILL MAINLY ADDRESS THE FOLLOWING ISSUES:

1. What are the potential risks in the workplace?
  2. What is a qualitative risk assessment?
- 

Risk assessment aims at obtaining the necessary information to make an appropriate decision on whether and how preventive measures should be adopted.

Technical assessments are not always necessary to **evaluate**, act, eliminate or control a risk. Actually, on many occasions, the risk is so obvious and its solution so evident that any prior formal evaluation is simply a waste of time and money.

In this section it is not expected that a technical evaluation of the risks will be carried out, nor taking samples and developing measurements of the contaminants or other technical actions. On the contrary, it is proposed that the importance of the identified risks along with the need to act on them be evaluated from available documentation and the information collected during the visits and the talks/interviews undertaken with workers. This method is called **qualitative assessment**.

It will be useful to analyse the information collected until then, based on:

- Hazardous properties of substances (toxicity, etc.);
- Exposure characteristics: level, type, duration;
- Conditions of use and factors of risk;
- Record of inconveniences or illnesses related to exposure to chemical products;
- Existence of wastes, emissions or non control of spillage; and
- Workers' opinions on the risk.

Among the different qualitative models available to evaluate risk, many Unions propose to use the **Column Model**, which is considered as one of the easiest and the handiest. Based on the R-phrases (**see annex 1-B**), the Column Model permits to classify each substance according to different levels of risk. In case of doubt, the immediate higher level of classification should be systematically selected.

**Box 2.8. The Column Model**  
**In case of doubt, the immediate higher level of classification should be systematically selected.**

Risks: level/ type	Acute health hazards (single affection)	Chronic health hazards (repeated affection)	Environmental Hazards	Fire and explosion hazards	Exposure potential	Hazards caused by procedure
Very high	R26, R27, R28, R32	R45, R49	R50, R51, R53, R54, R55, R56, R57, R58, R59	R2, R3, R12, R17	Gases; Liquids which evaporate at room temperature; Dust producing solids; Aerosols.	Open processing; Possibility of direct skin contact; Application on large area.
High	R23, R24, R25, R29, R31, R32, R42, R43	R33, R40, R60, R61, R68		R1, R4, R5, R6, R7, R8, R9, R11, R15, R16, R18, R19, R30, R44	Liquids which evaporate between 30 and 50°C	
Medium	R20, R21, R22, R34, R41, R64,	R63	R52, R53	R10	Liquids which evaporate between 50 and 150°C	Closed processing but exposure possibilities e.g. when filling sampling or cleaning
Low	R36, R37, R38, R65, R66, R67	Others (no R-Phrase associate, but hazardous		Hardly flammable substances/ preparations (55- 100°C)	Liquids which evaporate at more than 150°C	
Negligible	Harmless substances by experience (e.g. sugar, water, paraffin and similar)			Inflammable or very hardly flammable substances/ preparations (100°C)	Liquids which evaporate at more than 200°C	Tightly closed equipment; Closed equipment, with exhaust facilities at points of emission.

Source: Based on the classification provided by Berufsgenossenschaftliches Institut für Arbeitssicherheit (BIA) [www.hvbg.de/bia](http://www.hvbg.de/bia)

### WHAT TO DO?

1. Check the hazard potential of the existing chemical substances (see as an example annex 2 card 4);
2. Carry out regular inspections with standard checklists for particular chemicals and chemical processes;
3. Investigate workers' complaints;
4. Use accident and sickness records;
5. Survey regularly workers' health;
6. Monitor environmental and biological parameters;
7. Investigate the causes of accidents and their prevention; and
8. Develop a workplace chemical register.



## UNIT 4: GET PRIORITIES RIGHT! PLAN OF INTERVENTION

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### THIS UNIT WILL MAINLY ADDRESS THE FOLLOWING QUESTIONS:

1. What are the principles for operational control of chemical hazards?
  2. What control measures should be implemented for safe storage, disposal, and treatment of chemical waste?
  3. What control measures are needed to guarantee safe transport of chemicals?
- 

### CONTROLLING THE HAZARD: PRINCIPLES FOR OPERATIONAL CONTROL

The general objective in the control of hazards relating to chemicals in the workplace is to eliminate risks or reduce the potential hazard to the lowest possible level in relation to their contact with workers or the environment, as well as to minimize the possibility of a fire or an explosion.

1. Ideally, the best means of preventing diseases, injuries, fires and explosions caused by chemicals would be to rid the working environment of such chemicals, eliminating risks through application of the precautionary principle. No severely hazardous chemical should be authorized in the workplace, regardless of whether or not a substitute exists;
2. When strict prevention is not possible, the risk may be reduced or eliminated through substitution. However, no substitute is 100% safe.
3. When prevention and substitution are not feasible, risks should be reduced via control mechanisms that include the following options:
  - Engineering controls – enclosing, isolation, silencer, etc.;
  - Management controls – warnings, e.g. do not smoke while spraying;
  - Personal Protective Equipment (PPE) – e.g. gloves, goggles, coveralls, apron, masks, etc; and
  - Personal and environmental hygiene.

### Substitution of hazardous chemicals or processes with less hazardous ones

Extremely hazardous chemicals should be removed from the workplace even where substitutes are not available.

Elimination of hazardous substances can take place in two different ways, through:

- **Substitution** for other substances that are less hazardous; or
- **Modification** of the production process.

However, care must be taken to obtain all available information on proposed alternative chemicals. Indeed, substitutes may turn out to be just as hazardous as or even more hazardous than the materials they replace. As noted in the graphic, below, there are a number of direct and indirect benefits associated with actions that are taken to reduce and eliminate hazardous substances. More can be found about substitution guidelines in unit 5.

#### Box 2.9. Benefits associated with reducing or eliminating hazardous substances in the workplace

- Reduce occupational health risks;
- Reduce damage (illnesses, accidents) and absenteeism;
- Reduce environmental risks;
- Improve security;
- Reduce costs related to risks.

- Improve the image of the enterprise/company;
- Improve labour relations;
- Motivate the creation of some posts/sections/departments within the enterprise such as occupational and health departments, environmental department, etc.;
- Improve on productivity and profitability of the company through decrease in medical expenses, absenteeism, presenteeism, etc.

*Presenteeism is defined as lost productivity that occurs when employees come to work but perform below par due to any kind of illness or emotional problems (anxiety, stress), based on Paul Hemp, Presenteeism: At Work-But Out of It – Harvard Business Review HBR.*

*Source: Based on ISTAS. "Chemical risk prevention in the workplace. Guide for intervention" <http://www.istas.net/web/abreenlace.asp?idenlace=1367>*

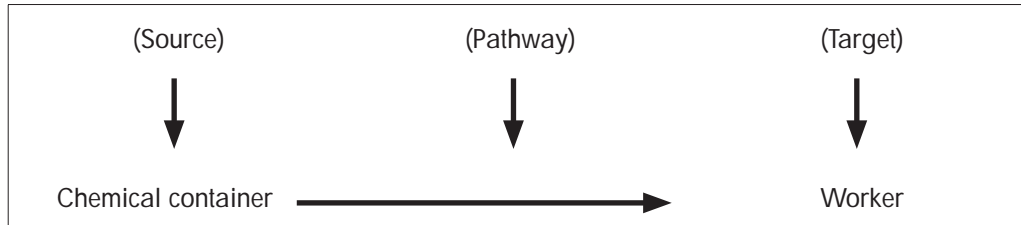
## Engineering controls and ventilation

If a chemical hazard cannot be eliminated from the workplace by resorting to substitution, then the next best solution is to physically enclose or isolate the hazard to prevent it from coming into contact with either workers or the environment. This is known as **total enclosure** or **containment** of a process.

However, with this option, the source of the hazard should be monitored first; if this is not possible then the pathway should be monitored, before the worker is.

For example, open tanks from where chemical vapours can escape into the workplace air can be replaced with closed tanks with inlet and outlet ports for filling and emptying. **Ventilation** systems are a means of removing contaminated air from the workplace. However, attention should be paid to the filters used, as it can easily happen that chemical vapours are released into the environment, polluting the water and soil which workers and other come into contact with in many other ways. Proper calibration of spray equipment is another example of engineering control.

Box 2.10. Description of total enclosure or containment of a process



Source: Based on input of Yahya Msangi

### Management controls

Management control measures to control occupational and environmental exposure should only be considered when there is no possibility to eliminate the risk. Different management control mechanism can be applied to reduce exposure to chemicals:

- **Restricted entries:** Only those directly involved with a chemical process should be exposed to any chemical hazard. Maintenance workers, electricians, cleaners or any other workers should do their work when the chemical hazard is not present.
- **Special attention to high-risk groups:** The risk to high-risk groups, e.g. **maintenance workers, pregnant and nursing women, spray teams, young and health sensitive workers**, is often ignored or seriously underestimated when planning chemical control measures. These workers may be more highly exposed because of the nature of their duties, biological and physiological factors or state of health.

Specific provisions for the protection of high-risk workers must be included in any chemical safety procedure.

- **Job rotation:** In certain circumstances, the reduction in the duration or the frequency of exposure of workers is achieved by job rotation. However, it is simply not acceptable to expose more workers less often to significantly high levels as an alternative to reducing exposure levels.
- **Observing re-entry intervals in sprayed places:** Management should make sure it has all information on recommended re-entry intervals for all chemical and these are displayed at entry points of all sprayed places. Management must educate workers on the importance of observing re-entry intervals.

### Use of personal protective equipment and personal hygiene

Whereas engineering controls place a barrier around a hazardous process or chemical, personal protective equipment is often used to create a "barrier" around a worker, thus preventing his/her exposure to chemicals. The use of **personal protective equipment (PPE)**

should only come as additional protection after the methods outlined above (substitution and engineering controls) have first been considered and implemented.

Personal protective equipment is rated as the least effective method of protection and is often uncomfortable or difficult to work with. Personal protective equipment against chemicals includes:

- Face shields, goggles and safety glasses;
- Gloves;
- Rubber boots;
- Plastic or rubber overalls and aprons;
- Hard hats;
- Respirators; and
- Dust masks.

A personal protective equipment programme requires the following steps and resources:

- the correct equipment - e.g. a respirator designed to protect against dust is useless if the hazardous chemical is present as a gas; moreover many solvents can rapidly penetrate natural rubber gloves;
- A thorough training programme for workers who are required to use the equipment, with follow-up training at regular intervals;
- Tests to ensure that equipment fits correctly; such tests are particularly important for face masks and respirators;
- A regular equipment maintenance and storage programme. This includes regular cleaning of equipment, inspection to ensure that it is operating correctly and regular replacement of items such as gloves or disposable parts such as respirator filters (which should be replaced at regular time intervals rather than only when they have become clogged); and
- A personal set of equipment for each worker, and a secure and clean place in which to store it.



Personal protective equipment should be appropriate to the hazard. Great care should be taken to fit the equipment to the worker. Equipment should not be perceived as a nuisance or a trouble to develop tasks, otherwise it will not be used.

In some situations, the use of personal protective equipment cannot be avoided. This applies particularly to eye goggles, face shields, boots and hard hats. Because these items are designed to protect the worker against accidents and unexpected exposures, they must be worn at all times.

**Personal hygiene** is very important to protect the body against anything harmful remaining on it for long periods, especially since it can be absorbed through the skin. Examples of actions that can be taken are: to keep fingernails clean and short, not to carry contaminated items such as dirty rags or tools in the pockets of personal clothing, and to remove and wash separately any contaminated item of personal protective clothing daily.

#### Box 2.11. Use of PPE

##### Pesticide spraying

For some jobs, such as pesticide spraying by hand, no other means of protection is possible. In this case, protective clothing, gloves and respirator masks must be worn.

##### Wood dust

Wood dust consists of tiny particles of wood produced during processing and handling of wood, chipboard, hardboard etc. It can be harmful to health and can explode with disastrous results. Exposure has been associated with the following health problems: skin disorders; obstruction in the nose; a type of asthma; and a rare type of nasal cancer.

It is a sub product, the result of an industrial process, and cannot be substituted. Thus, the only way of reducing risk from wood dust is to:

- Provide personal protective equipment, such as eye protection, overalls and gloves. Make sure it is suitable and kept in good order. Launder overalls and aprons regularly.
- Make good washing facilities available, with hot and cold water, soap and towels and encourage a high standard of personal hygiene.
- Provide vacuum cleaning equipment to remove dust from clothing, where this is a problem. Prevent the use of compressed airlines.

Make sure workers are adequately instructed, trained and supervised. This is essential if they are to understand the precautions necessary, and their duties and responsibilities in applying them.

Source: Based on the UK Health and Safety Executive Committee  
<http://www.hse.gov.uk/woodworking/dust.htm>

At the same time, it is equally important to avoid inhaling or ingesting small, even minute, quantities of chemicals because of their harmful effects on health. This concern reinforces the importance of drinking, eating or smoking away from possible exposure areas.

### Technical evaluation: occupational and environmental Surveillance

Since **elimination of chemical risks is a long-term task**, technical evaluations on the occupational and environmental risks should be undertaken. To develop this evaluation the assistance of experts (doctors and others) is necessary to carry out medical examinations on workers (blood tests, urine tests, etc). The same applies to environmental tests.

There are two types of technical evaluation: **environmental monitoring (ecotoxicological monitoring)** to measure the level of contaminants in the environment (air, water, soil, fauna and flora) and **biological monitoring** of individual workers to test for degree of exposure, whether dermal, respiratory, via ingestion, etc.

The results of these samples should be compared with the threshold limit value (TLV) and Time Weighted Average (TWA) - average exposure on the basis of a 8h/day, 40h/week work schedule - to see whether or not a worker's exposure is under or above what is recommended, and to act accordingly.

As noted in an earlier section, TLVs are good tools for practical action in case the result exceeds recommended levels. However, while being under the TLV is important, it is not a full guarantee of safety. Even when the results of environmental monitoring controls are under 50% of the reference threshold limit value (called as Level of Action), preventive measures such as the revision of the proper functioning of the systems implemented, realization of new controls, job rotation, among others, may still be required to avoid possible contamination.

## CONTROL MEASURES FOR STORAGE, DISPOSAL AND TREATMENT OF WASTE AND SPILLAGE

### Control measures for the storage of hazardous chemicals

Safety Data Sheets from the manufacturers or suppliers of chemicals should give specific instructions on the storage of each chemical. These instructions must be strictly respected, as storage requirements vary according to the nature of the chemical. Incorrect storage can have disastrous results, e.g. fire, explosion or release of toxic chemicals.

Several factors need to be taken into account in reviewing the Safety Data Sheets:

- Certain chemicals require must not be stored together (**need for isolation**), given the possibility that vapours or leaks may, if they intermingle, lead to an explosion.
- The chemicals must be kept away from food, drink and animal feed, and stored at a temperature below their **flash points**. The storage temperature must obviously be below the auto-ignition temperature. Chemicals with flash points below 34°C are especially dangerous.
- SDSs often specify a "well-ventilated" storeroom for particular chemicals, and it is essential to comply with this requirement. More specific guidance on the amount of ventilation required can be obtained from the manufacturers of the chemicals, and

the actual levels of ventilation in the workplace can be checked by an industrial hygienist or ventilation engineer.

- Chemicals may react with the material from which **containers** are made. It is thus important to have information about the type of container used, which should be specified on the SDS. This is especially important if chemicals may be transferred from one container to another. There may be additional requirements, such as pressure relief valves, which are relevant to the storage of particular chemicals.
- The **type of flooring** should also be specified, as it must be resistant to, and not potentially reactive with, the chemical being stored.
- The low walls or embankments (referred to as **dykes or bunding**) that are constructed around the storage area should be sufficiently high to contain any leaks that may occur from storage containers, as well as any water or foam that may be sprayed in the event of a fire.
- **Alarms** also are recommended in areas where potentially dangerous chemicals are stored in order to give early warning of releases of those chemicals.

### Control measures for the treatment and disposal of chemical waste

Given that enormous volumes of waste are generated in the production and use of chemicals, waste disposal is a key issue in health and environmental protection. As with protection of the workplace, a hierarchy of controls should be applied when dealing with chemical waste, as follows (see box 2.12. for more details):

- Reduction of waste at the source;
- Segregation of waste;
- Recovery and recycling;
- Waste exchange;
- Incineration;
- Immobilization of intractable wastes;
- Landfill storage;
- Discharge into sewer; and
- Other forms of temporary or final storage.

The volume and toxicity of hazardous waste can be reduced by modifying a process or by improving process controls.

**Box 2.12. Different waste treatments**

**Recycling:** The best-known form of recycling is the recovery of useful fractions for reuse. These processes are usually carried out by specialist recovery operators off-site and involve recovery of materials such as oils and solvents, as well as other valuable materials, such as silver in photographic waste.

**Waste exchanges:** A considerable amount of waste is suitable for exchange. The aim of the exchange is to put potential users of waste materials in touch with industries that produce the waste, and vice versa. Waste exchanges reduce the volume of wastes requiring landfill or incineration.

**Incineration:** This process involves burning wastes in special high-temperature (1,200°C) incinerators. Incineration effectively destroys many organic wastes. Additionally, the energy in solvent and fuel waste can be exploited in the process. However, inorganic chemicals such as plastics are likely to cause pollution problems when incinerated, as dangerous dioxins and furans may be formed if some organic materials are incinerated improperly, e.g., at very low temperatures.

**Encapsulation:** The waste is sealed within a stable, inert material to prevent contact with the environment and prevent movement (migration). If the encapsulating jacket were broken, the waste could leach away. Encapsulation is better suited to those wastes that, while posing a handling hazard, are relatively inert once buried (e.g. asbestos).

**Landfill:** Landfills are used for most residual solids or pastes because they are of smaller volume and less likely to migrate through the soil. A number of solid hazardous wastes require the higher degree of safety afforded by secure landfill, whereby waste is poured into small cells lined with an impermeable clay or synthetic material, and subsequently buried under a layer of soil. However, there are potential problems of infiltration by rainwater and it is not always easy to ensure permanent maintenance of the cell if the company relocates its operations or closes its business.

**Disposal of less hazardous waste to the sewer:** This is generally not recommended. Improper disposal to the sewer can disrupt the biological treatment of sewage and represent a hazard at sewer outfalls. In addition, toxic chemicals (e.g. heavy metals) may accumulate in the sewage sludge and create hazards when they are disposed of.

**Storage of intractable wastes:** A large volume of hazardous waste is currently stored - usually in steel drums on industrial sites, awaiting the development of satisfactory disposal methods - because it is too toxic to be legally disposed into air, water or landfill sites. Most drums are stored in the open, and many contain corrosive materials. There is an added risk of hazard from fires, structural damage and vandalism of such toxic waste stores. It is likely that some of these drums will corrode and leak. In some countries, such stores must be registered with authorities who, in turn, have a duty to inspect them.

*Source: United Nations Environment Programme (UNEP) / International Labour Organization (ILO) / World Health Organization (WHO). "Users' Manual for the International Programme On Chemical Safety (IPCS)"., Health And Safety Guides <http://www.inchem.org/documents/hsg/hsg/hsgguide.htm> (last accessed 2 April 2008)*

### Control measures for spillage

Many spills can be prevented by thorough planning of work, provision of suitable equipment, regular preventive maintenance and good training of workers. Any spillage that do happen should be thoroughly investigated and remedial action taken to prevent their recurrence.

Employers should ensure that they have the necessary plans and equipment to deal with spillages, that the workforce and their representatives have been consulted about all such planning, and that the necessary training is carried out regularly.

When a spillage occurs, suitable precautions must first be taken to protect workers from the dangers of the chemical (fumes, burns, etc.) before steps are taken to deal with the spillage itself.

Some general measures that may apply include the following:

- Use self-contained breathing apparatus and full protective clothing, when applicable;
- Remove ignition sources;
- Do not smoke;
- Evacuate the area, if necessary at one's own initiative, as every single worker has the right to remove himself/herself from imminent danger;
- Collect leaking liquid in sealable containers;
- Prevent liquid from spreading or contaminating other areas, vegetation, waterways and cargo, with a barrier of the most suitable available material, e.g. soil or sand;
- In some cases (e.g. hydrazine), a foam can be applied to slow down vaporization;
- Absorb spills in sand, soil, moist sawdust or other inert material and transfer them to a suitable container; then remove to a safe place, and dispose of them in accordance with local regulations;
- Sweep up solid products, and transfer to a suitable container; and
- Depending on the chemical, do not allow run-off into sewers: it may cause an explosion, kill wildlife or affect water supplies.

### CONTROL MEASURES FOR THE TRANSPORT OF CHEMICALS

Transport is necessary for products to reach consumers. The transport and storage of dangerous chemicals and goods has increased, as commerce has expanded, due to technical and production advances. The export of used toys, motor vehicles and electronics equipment can be a route through which hazardous chemicals are transported from developed to developing countries. These products may contain highly hazardous chemicals such as lead, cadmium and phthalates.

The hazardous properties of products or chemicals should be clearly stated so that people **at all stages of the transport chain** are aware of them. This information should always track the goods so that people can recognize the risks, avoid accidental mishandling, and have the right kind of the personal protection at their disposal in case of leakage.



Dangerous goods can be transported without causing unnecessary hazards if handled properly and with care.

Empty containers and packages of dangerous goods can present the same hazards as the chemical substance or product that they contained. It is therefore important to also treat them as dangerous goods.

Major accidents cause extensive damage, but so can smaller ones. It is forgotten easily that small amounts of oil, gasoline, battery acids and refrigerator fluids are released into the environment daily. Even small but frequent wastes from ships, households, cars or agriculture increase the contamination of the environment.

Recommendations and instructions for the handling, storage and transport of dangerous goods must be clear and unambiguous to avoid harmful or dangerous circumstances.

Under normal conditions, transport of dangerous goods does not pose a greater danger than the transport of any other goods, provided the transport chain respects the existing recommendations and laws, and are aware of the type of hazards that the cargo bears.

There is always a risk of spillage during the transport of hazardous goods. When incompatible substances mix with each other there is a possibility of a chemical reaction, which can produce enough heat to cause fire or explosion and can release dangerous gases. For example, toxic nitrous oxides are formed when ammonium nitrate (in fertilizers) decomposes in a fire. Another example involves the toxic gases that fume off when a spillage of concentrated sulphuric acid is absorbed in sawdust.

Spillages are possible in the following situations:

- Goods not properly packaged;
- Handling without reference to the contents: loading, unloading, etc. in the event of missing or incomplete labelling;
- Fire, either when the load or the vehicle is burning;
- Collision or capsizing; and
- Defects in tightness or incomplete closing of valves and connections.

The United Nations published a book collecting the work of the Committee of Experts: **UN Recommendations on the Transport of Dangerous Goods**.<sup>49</sup> This has been largely incorporated into the Globally Harmonised System of classification and labelling which covers the processes of production, storage and transport.

### WHAT TO DO?

To plan action taking into account the aforementioned, you can use a guide as a chart like **annex 2 card 5** which will help you to structure the following information and data to:

- Identify clearly the risk situation and establish the priority to act on it;
- Order priorities from higher to lower level risk;
- Establish objectives, such as to eliminate risk, to inform workers, or to establish control measures;
- Get information about the measures and procedures of action that are more adequate. Consult technical officers and workers;
- Analyse information and select the actions; and
- Submit the flowchart of actions to the working centre with an estimated budget for their consideration.

<sup>49</sup> [http://www.unece.org/trans/danger/publi/unrec/mr\\_nature\\_e.html](http://www.unece.org/trans/danger/publi/unrec/mr_nature_e.html) (last accessed 15 April 2008)



## UNIT 5: SAFE CHEMICALS – SAFE PRODUCTS GUIDELINES TO ENFORCE THE “SUBSTITUTION PRINCIPLE”

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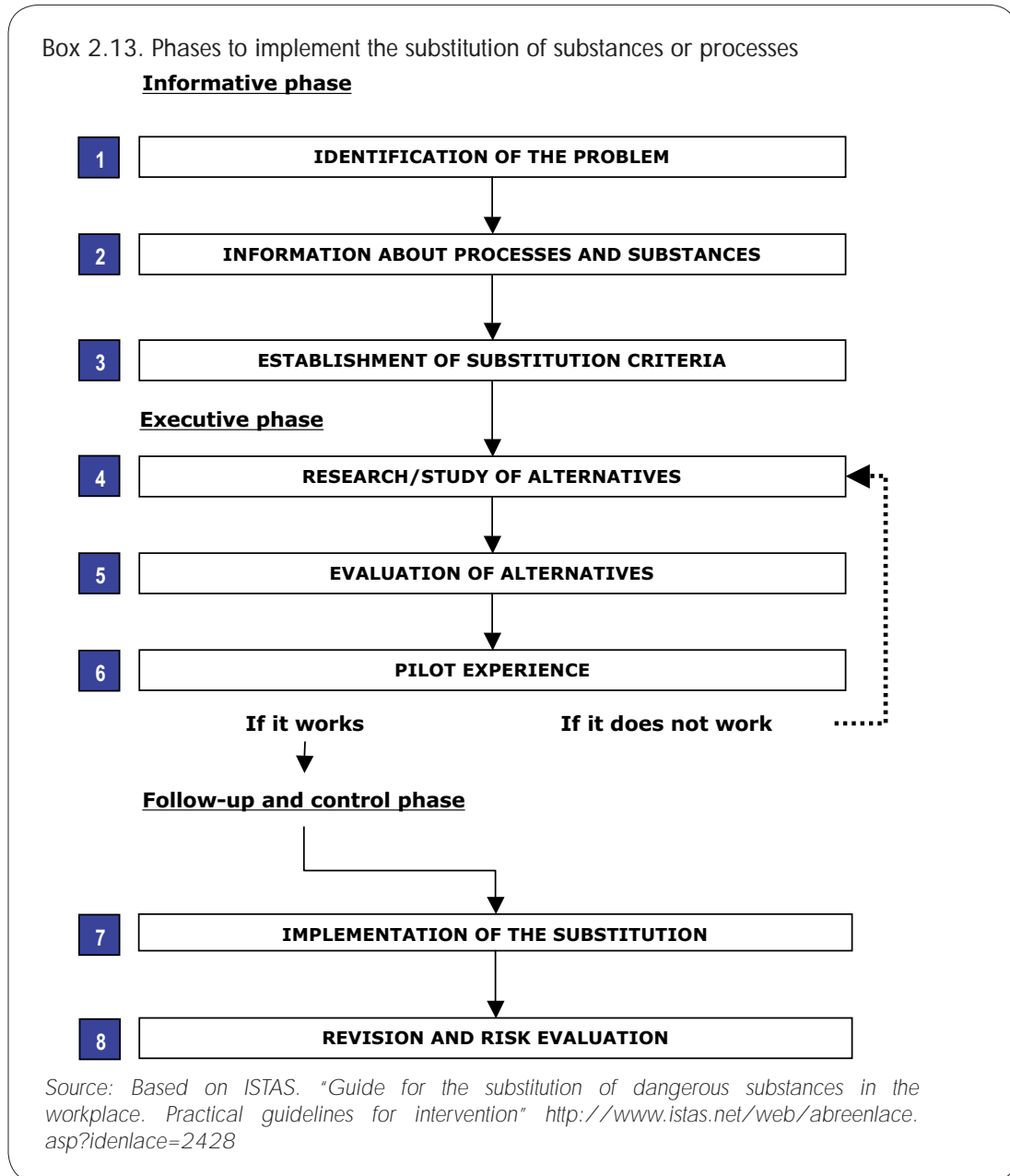
### THIS UNIT WILL MAINLY ADDRESS THE FOLLOWING QUESTIONS:

1. How can the “substitution principle” successfully be implemented?
  2. How to identify safer substitutes for chemicals?
  3. How to evaluate the economic, environmental and social viability of potential substitutes?
- 

One of the most efficient and effective way to reduce chemical hazards is the application of the “**substitution principle**”. This can be achieved either by substituting:

- The substance, for an another without affecting the productive process;
- Equipment and procedures without affecting the productive process; or by
- An auxiliary substance or primary resource that modifies the productive process.

For any of the three cases of substitution of substances or processes, necessary steps are as follows:



## IDENTIFICATION OF THE PROBLEM

The first steps involve identifying the problem. It is important to remember, though, that identification of the problem is not the only action required in dealing with the risk to eliminate. It is also crucial to know the circumstances and factors that help assess how necessary it is to implement substitution. For that process, it is necessary to determine how substitution would be achieved, and why it is needed.

Box 2.14. Identification of the substance to substitute

Substance	Cas No, Ipsc No.	Who Or Other Classification*	Harmful Effects
Toluene	108-88-3		<ul style="list-style-type: none"> <li>• Possible carcinogen (IARC3).</li> <li>• Sensitizer.</li> <li>• Neurotoxics.</li> <li>• Possible carcinogen (IARC3).</li> <li>• Sensitizer.</li> <li>• Neurotoxics.</li> <li>• Affects reproduction. Persistent Bioaccumulative and Toxic (PBT)</li> </ul>

\* Based on national legislation

Source: Based on ISTAS. “Guide for the substitution of dangerous substances in the workplace. Practical guidelines for intervention” <http://www.istas.net/web/abreenlace.asp?idenlace=2428>

## INFORMATION ABOUT PROCESSES AND SUBSTANCES

As part of these first steps, in compiling information it will be needed to put together a “basic card” of the workplace and the activity, to know what hazards and risks exist in the workplace, and which ones are being targeted for elimination.

It is suggested to compile basic information with regard to the identification of the substance or product (see box 2.14.), based on a number of questions on the tasks normally developed in the workplace (see box 2.15.).

Workers also need as well to know the functions of the chemicals, so that they can answer questions such as “why is it used” and “how is it used in the process”. Sometimes, chemicals are used but workers might not know why.

In the course of the exercise, workers might find that there is a lot of information needed that is not available. The labels and the **safety data sheet (SDS)** should provide basic information to identify adequately the substances and products used. Where SDSs are not directly available, in principle the employer has to provide them to the workers. Alternatively, a search can be conducted for guides and leaflets on the equipment and products used at work. In pursuing the information, workers may find that the equipment and products are often not used properly.

**Questions to raise, among others:**

- “What tasks do I perform?
- Why do I carry them out in such a way?
- Which risks do they entail?
- Could I do it differently?
- Why do I use this product?
- Which effects it has?
- Could I use another product?
- Could I use different tools?”



In accordance with the objectives and principles of the Occupational Safety and Health Convention, 1981 (n. 155), and Recommendation, 1981 (n.164), employers should make available to workers and their representatives chemical safety data sheets or similar relevant information of the chemicals used at work.

**ESTABLISHMENT OF SUBSTITUTION CRITERIA**

Substitution criteria are established in two different ways, by identifying:

- Those chemical substances that are priorities for substitution among all the chemicals that are being used; and
- The alternative substance which would be most appropriate.

It is important to bear in mind a **key principle in approaching substitution**:



When searching for an alternative, do not think of the process of substitution as if it were completely free of danger. Instead, it should be viewed as fulfilling an objective focused on eliminating a risk previously established. Be careful: make sure that the alternative presented does not just shift an equivalent or higher risk to another part of the process. This would only perpetuate the problem, and perhaps even make it more difficult to remedy.

Taking into account this definition, establishing objective criteria to search for alternatives is critical. The following table presents actions and strategies that should be followed as part of the substitution process.

**Box 2.15. Criteria for the election of alternative products**

Information available	The first criteria to decide for one or another product or substance should be the information accessible: composition, intrinsic hazard, use and applications, safety card, etc. Essential information on a potential alternative substance must be at least as complete, in terms of type and amount, as information on the substance to be substituted.
Avoidance of halogenated substances	All components that incorporate bromine, fluorine or chlorine have characteristics involving high persistence in the environment, and a high degree of toxicity in human beings.
Preference of mechanic, physic or biological options instead of chemical substances	The alternatives based on mechanical, physical or biological options normally present much lower levels of risk than those related to chemical substances.
Avoidance of most hazardous substances and products	All chemical substances present intrinsic hazards. When selecting substitutes, those substances that cause major harm for human health and the environment have to be always avoided. The absence of information on potential harmful effects does not mean the substance is safe.
Preference for easy and compatible products	The action of any chemical substance or product is based on an “active principle” which determines its properties: cleans, disinfects, protects, etc. Normally this “active principle” characterizes the substance, or, in limited situations it characterizes a combination of different substances. In all cases, it helps get information that is relevant to individual, specific substances or products.

Source: Based on ISTAS. “Guide for the substitution of dangerous substances in the workplace. Practical guidelines for intervention” <http://www.istas.net/web/abreenlace.asp?idenlace=2428>

**RESEARCH/STUDIES AND THE EVALUATION OF ALTERNATIVES**

At this stage, an initial, informed and objective evaluation needs to be developed, which will eventually help take sound decisions in a quick and independent manner. The elements to take into account in the evaluation are the following:

- Impacts on human and environmental health;
- Technical viability;
- Economic and costs viability;
- Social impacts.

In pursuing that objective, summarizing in a matrix all the information collected on the alternative substance and the substance to replace can be useful for comparison purposes. The following table provides a good structure for carrying out this comparative analysis.

It is also important to underline some working methodologies such as "Alternatives Assessment Framework" that is designed to evaluate and identify environmentally and socially preferable alternatives. "Alternatives" encompass production processes, chemicals, materials, products, economic systems (such as transportation systems), and functions, as well as eliminating the need for a current activity or the function of a product.<sup>50</sup>

### WHERE TO GET MORE INFORMATION?

Sources of information to identify alternatives:

- Toxic Use Reduction Institute – Massachusetts - <http://www.p2gems.org/>
- Pesticide Action Network Database - <http://www.pesticideinfo.org>
- ISTAS alternatives database: Includes over 300 documents in Spanish language on alternatives to reduce or eliminate chemical risk, classified by substances, uses, processes and sectors - <http://www.istas.net/ecoinformas/web/index.asp?idpagina=576>
- Campaña de tóxicos de Greenpeace España - [http://www.greenpeace.es/toxicos/toxi\\_0.htm](http://www.greenpeace.es/toxicos/toxi_0.htm)
- Solvent Alternatives Guide - <http://clean.rti.org/>
- Alternatives Assessment Framework of the Lowell Centre for Sustainable Production <http://www.chemicalspolicy.org/downloads/FinalAltsAssess06.pdf>

50 Based on Lowell Centre for Sustainable Production (2006). "Alternative Assessment Framework" <http://www.chemicalspolicy.org/downloads/FinalAltsAssess06.pdf> (last accessed 14 April 2008)

Box 2.16. Informative matrix on the effects of selected chemicals

Substance CAS N.	Exposure routes			Acute effects			Chronic effects	Environment
	Contact (skin)	Ingestion (digestive tract)	Inhalation (respiratory tract)	Irritant				
				Skin	Eyes	Respiratory system		
							To be specified	To be specified
* Perchloroethylene (PER) 127-18-4	✓	✓	✓	✓	✓	✓	<ul style="list-style-type: none"> <li>• Carcinogenic</li> <li>• Reproductive system</li> <li>• Nervous system</li> <li>• Liver/kidneys</li> <li>• Respiratory system</li> <li>• Endocrine disrupter</li> </ul>	<ul style="list-style-type: none"> <li>• Persistent</li> <li>• Bioaccumulative</li> <li>• Toxicity</li> <li>• Water polluter</li> <li>• Air polluter</li> <li>• Soil polluter</li> <li>• Damages ozone layer</li> <li>• Volatile components</li> <li>• Toxic waste</li> </ul>
** Terephtine essence (turpentine) 8006-64-2	✓	✓	✓	✓	✓	✓	<ul style="list-style-type: none"> <li>• Possible carcinogenic</li> <li>• Affects nervous system and kidneys</li> </ul>	<ul style="list-style-type: none"> <li>• Eco-toxic,</li> <li>• water pollutant,</li> <li>• volatile compound</li> </ul>
** D-limoneno 5989-27-5	✓	✓	✓	✓	✓	✓		<ul style="list-style-type: none"> <li>• Water pollutant,</li> <li>• volatile compound</li> </ul>

\* Substance to be substituted

\*\* Possible alternatives

Source: Based on ISTAS. "Guide for the substitution of dangerous substances in the workplace. Practical guidelines for intervention" <http://www.istas.net/web/abreience.asp?idenlace=2428>

### PILOT EXPERIENCE

Before introducing an alternative, it is highly advisable to develop a pilot project that uses this specific substance at some point in the production process for the purpose of testing it.

At this stage, how the alternative is presented will be extremely important. The attitude and perception of directly affected workers and other people are key to obtain as much information and feedback as possible from the pilot experience, and to ensure that the experience works properly and successfully.

The results of the pilot experience must be properly evaluated and taken into account in order to assess the viability of the proposed alternative on an industrial scale.

### IMPLEMENTATION OF THE SUBSTITUTION

Once the previous steps have been successfully covered, the alternative of substitution considered is more likely to be viable.

### REVISION AND RISK EVALUATION

The introduction of a safer substance in replacement of another one does not guarantee the total elimination of risk. For this reason, it is necessary to carry out regular evaluations that consider the new existing risks, as well as to set-up any necessary preventive measures to initiate effectively a process of substitution. Workers have an important role in the promotion of substitutes.

## UNIT 6: KEEP AN EYE ON WHAT IS HAPPENING! HEALTH AND ENVIRONMENTAL SURVEILLANCE AND FOLLOW-UP

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THIS UNIT WILL ADDRESS THE ISSUE OF SURVEILLANCE AND FOLLOW-UP.

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### SURVEILLANCE AND FOLLOW-UP: EVALUATION, EFFICIENCY AND REVISION

There must be a follow-up of the measures of prevention and control of chemical risk, included in the national legal framework, to make sure that there is effective and efficient implementation.

Once chemicals risks have been evaluated and the prevention plan has been elaborated, a variety of potential exposure parameters must be selected for further monitoring purposes. This is necessary to determine whether the risk has been completely eliminated, or because of peculiarities and specificities of the workers exposed (e.g. pregnant women, the need to use personal protective equipment (PPE), etc.).

Undertaking health surveillance of various areas of risks which, in principle, have been controlled and eliminated, is necessary to make sure that the objective of risk elimination has been achieved. In addition, periodic evaluation of potential health and environmental impacts must be undertaken, and become necessary as a result of:

- Modifications of the production mass, materials or process;
- Record of new cases of occupational diseases or impacts on the environment;
- Accidents or incidents;
- Figures on occupational or environmental health which illustrate risk;
- Changes in the knowledge of risk;
- Legislative changes; or
- New methods or technologies to control risk;
- Staff turnover or new management staff; and
- Change in microclimate or buildings.

### WHAT TO DO?

- Identify the situations of risk and where risk is located;
- Specify measures to adopt actions proposed and agreed with the working centre;
- Indicate starting and closing dates for specific actions;
- Undertake a follow-up process; and
- Where results are not satisfactory, study measures and actions to improve it. (see as an example annex 2 card 4)

## UNIT 7: WATCH OUT! RISK NEVER SLEEPS: EMERGENCY AND FIRST-AID PROCEDURES

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Good safety organization, ventilation and engineering controls, adequate provision of information on the health hazards of chemicals, and training of workers can help reduce and control chemical exposure in the workplace.

Nevertheless, as poisonings may still occur, workers must be trained and properly equipped so that emergency situations can be handled satisfactorily.

Chemicals that are stored together may accidentally mix during an emergency, forming a new substance with thoroughly different characteristics. The plant chemist or industrial hygienist should be able to provide workers and trade unions representatives with advice about the appropriate storage of chemicals, in order to keep non-compatible chemical substances away from each other.

### THE EMERGENCY PLAN

It is essential to have an emergency plan in every workplace. The plan should lay down the following procedures and information:

- The evacuation of workers, including a system of accounting for them workers once outside the building;
- Methods of notifying outside assistance such as medical, rescue, fire or environmental protection specialists, as necessary;
- The role of various plant officials during an emergency;
- The role of selected workers; and
- The location and procedures for the use and maintenance of all emergency equipment in the plant.

Everyone in the plant should be kept informed of the emergency plan and be able to understand it in detail. The plan should describe clear and unobstructed **emergency exits**, a functioning and frequently tested alarm system, and **training in evacuation** for all workers. It should also detail procedures for the immediate evacuation of disabled workers who may need assistance in reaching emergency exits.

There should be **emergency assembly points** outside the plant so that each worker can be accounted for after evacuation. These predetermined meeting areas should be safe in case of escalation of the situation.

The emergency plan should outline the structure of the first-aid organization within the plant, as well as procedures to obtain more specialized medical care when and as necessary. The role of all plant personnel (including workers, supervisors and managers) during an emergency situation should be described. The location of all emergency and first-aid equipment, including emergency showers, eye-wash stations, first-aid kits and stretchers, should also be mapped out.

The plan should address the organization of the internal capability **to fight small fires** within the plant. As with first aid, the role of all plant personnel in a fire emergency must be described, even if it only details the procedures for rapid evacuation. The location of all fire-fighting equipment such as sand buckets, hoses and extinguishers, as well as automatic fire-fighting systems, should be described with specific guidance as to who should fight a chemical fire, when and how.

A chemical leak or spill can have disastrous consequences when the situation is not tackled rapidly. The emergency plan should specify the staff who will be involved in **controlling the leak or managing the spill**. Again, any specific material or equipment must be described.

Emergency plans should be developed in conjunction with local medical, fire, law enforcement and civil defence authorities, as well as neighbouring plants, to ensure better coordination among these actors and a more effective implementation.



1. Every workplace should have an emergency plan.
2. The plan should cover emergency exits and an alarm system for evacuation.
3. The plan should outline the duties and responsibilities for first aid and fire fighting within the organization.

## MODULE 2 REFERENCES

### Official websites:

- UNECE. "Globally Harmonized System of Classification and Labelling of Chemicals (GHS)" [http://www.unece.org/trans/danger/publi/ghs/ghs\\_welcome\\_e.html](http://www.unece.org/trans/danger/publi/ghs/ghs_welcome_e.html)
- International Labour Organization. "Safe work" <http://www.ilo.org/public/english/protection/safework/intro/>

### Documents:

- ILO. International Labour Office "Programme on Safety and Health and Work and Environment. International Chemical Control Toolkit" [http://www.ilo.org/public/english/protection/safework/ctrl\\_banding/toolkit/main\\_guide.pdf](http://www.ilo.org/public/english/protection/safework/ctrl_banding/toolkit/main_guide.pdf)
- ILO. International Occupational Safety and Health Centre of Information. "Basics of chemical safety" <http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/toc.htm>
- ILO. International Occupational Safety and Health Centre of Information. "Chemical safety training modules" <http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/index.htm>
- ILO. "Chemicals in the workplace. Your health and safety at work." <http://www.itcilo.it/actrav/actrav-english/telearn/osh/kemi/chemicaa.htm>
- IPCS (International programme on chemical safety). "Users' manual for the IPCS health and safety guides" <http://www.inchem.org/documents/hsg/hsg/hsgguide.htm>
- IPCS (International Programme on Chemical Safety). "Safety and Health in the Use of Agrochemicals" <http://www.itcilo.it/actrav/actrav-english/telearn/osh/kemi/pest/pesti2.htm>
- ISTAS (2004). "La prevención del riesgo químico en el lugar de trabajo. Guía de intervención" <http://www.istas.net/ecoinformas/web/abreenlace.asp?idenlace=1367>
- ISTAS (2005). "Guía para la sustitución de sustancias peligrosas en la empresa. Manual práctica para la intervención" <http://www.istas.net/ecoinformas/ficheros/ECOSustanciasDefinitiva.pdf>
- Lowell Centre for Sustainable Production: Alternatives Assessment Framework, 2006, <http://www.chemicalspolicy.org/downloads/FinalAltsAssess06.pdf>
- Lowell Centre for Sustainable Production (October 2003). "Integrated Chemicals Policy, Seeking New Direction in Chemicals Management" <http://chemicalspolicy.org/downloads/ChemPolicyBrochure.pdf>
- WHO/UNEP (2006). "Sound Management of Pesticides and diagnosis treatment of pesticide poisoning"

NOTES:

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## ANNEX 1: CLASSIFICATION AND LABELLING: GLOBAL HARMONISED SYSTEM (GHS), EU RISK- AND SAFETY-PHRASES

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### A. GHS LABELLING:







The pictograms that follow are from the first edition (2005) of the GHS.<sup>51</sup>



<sup>51</sup> <http://www.unece.org/trans/danger/publi/ghs/pictograms.html> (last accessed 24 April 2008)

UN RECOMMENDED SYMBOLS FOR THE TRANSPORT OF DANGEROUS GOODS



Symbol/compulsary Word	Symbol/compulsary Word	Case in which is used
		ALWAYS
		SKIN OR EYE IRRITATION
		SKIN SENSITIZER OR SKIN OR EYE IRRITATION
DANGER	ATTENTION	ALWAYS

**B. EU RISK-PHRASES:**

[Changes from the 28th Adaptation to the Technical Progress (ATP 28) of 6 August 2001 are indicated in blue]

R 1	Explosive when dry.
R 2	Risk of explosion by shock, friction, fire or other sources of ignition.
R 3	Extreme risk of explosion by shock, friction, fire or other sources of ignition.
R 4	Forms very sensitive explosive metallic compounds.
R 5	Heating may cause an explosion.
R 6	Explosive with or without contact with air.
R 7	May cause fire.
R 8	Contact with combustible material may cause fire.
R 9	Explosive when mixed with combustible material.
R 10	Flammable.
R 11	Highly flammable.
R 12	Extremely flammable.
R 13	Extremely flammable liquefied gas.
	The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 14	Reacts violently with water.
R 14/15	Reacts violently with water, liberating extremely flammable gases.
R 15	Contact with water liberates extremely flammable gases.
R 15/29	Contact with water liberates toxic, extremely flammable gas.
R 16	Explosive when mixed with oxidizing substances.
R 17	Spontaneously flammable in air.
R 18	In use, may form flammable/explosive vapour air-mixture.
R 19	May form explosive peroxides.
R 20	Harmful by inhalation.
R 20/21	Harmful by inhalation and in contact with skin.
R 20/21/22	Harmful by inhalation, in contact with skin and if swallowed.
R 20/22	Harmful by inhalation and if swallowed.
R 21	Harmful in contact with skin.
R 21/22	Harmful in contact with skin and if swallowed.
R 22	Harmful if swallowed.
R 23	Toxic by inhalation.
R 23/24	Toxic by inhalation and in contact with skin.
R 23/24/25	Toxic by inhalation, in contact with skin and if swallowed.
R 23/25	Toxic by inhalation and if swallowed.
R 24	Toxic in contact with skin.

R 24/25	Toxic in contact with skin and if swallowed.
R 25	Toxic if swallowed.
R 26	Very toxic by inhalation.
R 26/27	Very toxic by inhalation and in contact with skin.
R 26/27/28	Very toxic by inhalation, in contact with skin and if swallowed.
R 26/28	Very toxic by inhalation and if swallowed.
R 27	Very toxic in contact with skin.
R 27/28	Very toxic in contact with skin and if swallowed.
R 28	Very toxic if swallowed.
R 29	Contact with water liberates toxic gas.
R 30	Can become highly flammable in use.
R 31	Contact with acids liberates toxic gas.
R 32	Contact with acids liberates very toxic gas.
R 33	Danger of cumulative effects.
R 34	Causes burns.
R 35	Causes severe burns.
R 36	Irritating to eyes.
R 36/37	Irritating to eyes and respiratory system.
R 36/37/38	Irritating to eyes, respiratory system and skin.
R 36/38	Irritating to eyes and skin.
R 37	Irritating to respiratory system.
R 37/38	Irritating to respiratory system and skin.
R 38	Irritating to skin.
R 39	Danger of very serious irreversible effects.
R 39/23	Toxic: danger of very serious irreversible effects through inhalation.
R 39/23/24	Toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R 39/23/24/25	Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.
R 39/23/25	Toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R 39/24	Toxic: danger of very serious irreversible effects in contact with skin.
R 39/24/25	Toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R 39/25	Toxic: danger of very serious irreversible effects if swallowed.
R 39/26	Very toxic: danger of very serious irreversible effects through inhalation.
R 39/26/27	Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin.
R 39/26/27/28	Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed.

R 39/26/28	Very toxic: danger of very serious irreversible effects through inhalation and if swallowed.
R 39/27	Very toxic: danger of very serious irreversible effects in contact with skin.
R 39/27/28	Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed.
R 39/28	Very toxic: danger of very serious irreversible effects if swallowed.
R 40	Limited evidence of a carcinogenic effect. The phrase has been changed by ATP 28 (6 August 2001). The corresponding phrase used in earlier cards reads: Possible risk of irreversible effects.
R 40/20	Harmful: possible risk of irreversible effects through inhalation.
R 40/20/21	Harmful: possible risk of irreversible effects through inhalation and in contact with skin. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 40/20/21/22	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 40/20/22	Harmful: possible risk of irreversible effects through inhalation and if swallowed. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 40/21	Harmful: possible risk of irreversible effects in contact with skin. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 40/21/22	Harmful: possible risk of irreversible effects in contact with skin and if swallowed. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 40/22	Harmful: possible risk of irreversible effects if swallowed. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
R 41	Risk of serious damage to eyes.
R 42	May cause sensitization by inhalation.
R 42/43	May cause sensitization by inhalation and skin contact.
R 43	May cause sensitization by skin contact.
R 44	Risk of explosion if heated under confinement.
R 45	May cause cancer.
R 46	May cause heritable genetic damage.
R 47	May cause birth defects.  <i>The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.</i>
R 48	Danger of serious damage to health by prolonged exposure.

R 48/20	Harmful: danger of serious damage to health by prolonged exposure through inhalation.
R 48/20/21	Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/20/21/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R 48/20/22	Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/21	Harmful: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/21/22	Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R 48/23	Toxic: danger of serious damage to health by prolonged exposure through inhalation.
R 48/23/24	Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin.
R 48/23/24/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed.
R 48/23/25	Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed.
R 48/24	Toxic: danger of serious damage to health by prolonged exposure in contact with skin.
R 48/24/25	Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed.
R 48/25	Toxic: danger of serious damage to health by prolonged exposure if swallowed.
R 49	May cause cancer by inhalation.
R 50	Very toxic to aquatic organisms.
R 50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 51	Toxic to aquatic organisms.
R 51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 52	Harmful to aquatic organisms.
R 52/53	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 53	May cause long-term adverse effects in the aquatic environment.
R 54	Toxic to flora.
R 55	Toxic to fauna.
R 56	Toxic to soil organisms.
R 57	Toxic to bees.
R 58	May cause long-term adverse effects in the environment.

R 59	Dangerous for the ozone layer.
R 60	May impair fertility.
R 61	May cause harm to the unborn child.
R 62	Possible risk of impaired fertility.
R 63	Possible risk of harm to the unborn child.
R 64	May cause harm to breast-fed babies.
R 65	Harmful: may cause lung damage if swallowed.
R 66	Repeated exposure may cause skin dryness or cracking.
R 67	Vapours may cause drowsiness and dizziness.
R 68	Possible risks of irreversible effects.
R 68/20	Harmful: possible risk of irreversible effects through inhalation.
R 68/20/21	Harmful: possible risk of irreversible effects through inhalation and in contact with skin.
R 68/20/21/22	Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed.
R 68/20/22	Harmful: possible risk of irreversible effects through inhalation and if swallowed.
R 68/21	Harmful: possible risk of irreversible effects in contact with skin.
R 68/21/22	Harmful: possible risk of irreversible effects in contact with skin and if swallowed.
R 68/22	Harmful: possible risk of irreversible effects if swallowed.

**C. EU SAFETY-PHRASES:**

[Changes from the 28th Adaptation to the Technical Progress (ATP 28) of 6 August 2001 are indicated in blue]

S 1	Keep locked up.
S ½	Keep locked up and out of the reach of children.
S 2	Keep out of the reach of children.
S 3	Keep in a cool place.
S 3/7	Keep container tightly closed in a cool place.
S 3/7/9	Keep container tightly closed in a cool, well-ventilated place. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
S 3/9	Keep in a cool, well-ventilated place. The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
S 3/9/14	Keep in a cool, well-ventilated place away from (incompatible materials to be indicated by the manufacturer).
S 3/9/14/49	Keep only in the original container in a cool, well-ventilated place away from ... (incompatible materials to be indicated by the manufacturer).
S 3/9/49	Keep only in original container in a cool, well-ventilated place.
S 3/14	Keep in a cool place away from ... (incompatible materials to be specified by the manufacturer).
S 4	Keep away from living quarters.
S 5	Keep contents under ... (appropriate liquid to be specified by the manufacturer).
S 6	Keep under ... (inert gas to be specified by the manufacturer).
S 7	Keep container tightly closed.
S 7/8	Keep container tightly closed and dry.
S 7/9	Keep container tightly closed and in a well-ventilated place.
S 7/47	Keep container tightly closed and at a temperature not exceeding ... °C (to be specified by the manufacturer).
S 8	Keep container dry.
S 9	Keep container in a well-ventilated place.
S 10	---
S 11	---
S 12	Do not keep the container sealed.
S 13	Keep away from food, drink and animal feedstock.
S 14	Keep away from ... (incompatible materials to be indicated by the manufacturer).
S 15	Keep away from heat.
S 16	Keep away from sources of ignition -- No smoking.
S 17	Keep away from combustible material.
S 18	Handle and open container with care.

S 19	...
S 20	When using do not eat or drink.
S 20/21	When using do not eat, drink or smoke.
S 21	When using do not smoke.
S 22	Do not breathe dust.
S 23	Do not breathe gas/fumes/vapour/spray (appropriate wording to be specified by the manufacturer).
S 24	Avoid contact with the skin.
S 24/25	Avoid contact with skin and eyes.
S 25	Avoid contact with eyes.
S 26	In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
S 27	Take off immediately all contaminated clothing.
S 27/28	After contact with skin, take off immediately all contaminated clothing, and wash immediately with plenty of ... (to be specified by the manufacturer).
S 28	After contact with skin, wash immediately with plenty of ... (to be specified by the manufacturer).
S 29	Do not empty into drains.
S 29/35	Do not empty into drains; dispose of this material and its container in a safe way.
S 29/56	Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point.
S 30	Never add water to this product.
S 31	...
S 32	...
S 33	Take precautionary measures against static discharges.
S 34	Avoid shock and friction. <i>The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.</i>
S 35	This material and its container must be disposed of in a safe way.
S 36	Wear suitable protective clothing.
S 36/37	Wear suitable protective clothing and gloves.
S 36/37/39	Wear suitable protective clothing, gloves and eye/face protection.
S 36/39	Wear suitable protective clothing and eye/face protection.
S 37	Wear suitable gloves.
S 37/39	Wear suitable gloves and eye/face protection.
S 38	In case of insufficient ventilation, wear suitable respiratory equipment.
S 39	Wear eye/face protection.
S 40	To clean the floor and all objects contaminated by this material, use ... (to be specified by the manufacturer).
S 41	In case of fire and/or explosion do not breathe fumes.



S 42	During fumigation/spraying wear suitable respiratory equipment (appropriate wording to specified by the manufacturer).
S 43	In case of fire, use ... (indicate in the space the precise type of fire-fighting equipment. If water increases the risk, add "Never use water").
S 44	If you feel unwell, seek medical advice (show label where possible). The phrase has been deleted by ATP 28 (6 August 2001), but may still appear in cards not modified since then.
S 45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 46	If swallowed, seek medical advice immediately and show container or label.
S 47	Keep at temperature not exceeding ... °C (to be specified by the manufacturer).
S 47/49	Keep only in the original container at a temperature not exceeding ... °C (to be specified by the manufacturer).
S 48	Keep wet with ... (appropriate material to be specified by the manufacturer).
S 49	Keep only in the original container.
S 50	Do not mix with ... (to be specified by the manufacturer).
S 51	Use only in well-ventilated areas.
S 52	Not recommended for interior use on large surface areas.
S 53	Avoid exposure -- obtain special instructions before use.
S 54	---
S 55	---
S 56	Dispose of this material and its container to hazardous or special waste collection point.
S 57	Use appropriate container to avoid environmental contamination.
S 58	---
S 59	Refer to manufacturer/supplier for information on recovery/ recycling.
S 60	This material and its container must be disposed of as hazardous waste.
S 61	Avoid release to the environment. Refer to special instructions/safety data sheets.
S 62	If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.
S 63	In case of accident by inhalation: remove casualty to fresh air and keep at rest.
S 64	If swallowed, rinse mouth with water (only if the person is conscious).

## ANNEX 2: CARDS

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The following cards provide advice to prevent exposure to hazardous chemicals in the workplace.<sup>52</sup>

They are presented in an easy to follow, structured form that can help you better collect, analyse and summarize information, particularly for individuals who are not too familiar with risk prevention at the workplace. They seek to provide you with some basic guidance on how to structure and develop your work on chemical risk prevention in the workplace.

 	<p>Hearing from you!</p> <p>We welcome any suggestions, comments, and observations you may want to send in. To do this, complete the cards and attach additional information that can be shared with the rest of us.</p>
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Card 1a – Identification of risk situations: flowchart of the production process	
Flowchart of the production process	Map of the working place
Activity: Production process:	

<sup>52</sup> Based on ISTAS. "Chemical risk prevention in the workplace. Guide for intervention" <http://www.istas.net/web/abreenlace.asp?idenlace=1367> (in Spanish – last accessed 15 April 2008)

Card 1b - Identification of risk situations		
Section:	List of products used	Resulting products and wastes
Production process: Tasks:		
Production process: Tasks:		

Card 2 – Identification of hazardous substances				
Risk situation: .....				
Section:		Process:		Task
Simple product or mix product	Substance CAS / ICSC Number	Occupational health and safety risk	Environmental Risk	Comments

Card 3 – Risk identification	
Risk situation: .....	
Section:	Production process:
Task:	Risk factors:
	<ul style="list-style-type: none"> <li>• dfadg</li> <li>• gargr</li> </ul>

<b>Card 4 – Risk evaluation</b>					
On a scale that goes from “very low risk” to “very high risk” for human health and the environment.					
Risk situation: .....					
Section:			Productive process:		
Task	Substances used	Working conditions / potential risk	Existence of harm to human health and the environment	Workers’ perception	Evaluation of risk

<b>Card 5 – Plan of implementation</b>				
Risk situation: .....				
Section:			Productive process:	
Task	Priority (high, medium or low)	Objectives	Measures to adopt	Actions to put on place



Card 6 – Follow up					
Risk situation: .....					
Section:			Productive process:		
Task	Measures to adopt	Proposed and suggested actions	Actions agreed with the employers	Implementation dates and person responsible from the working centre	Result

## ANNEX 3: QUESTIONNAIRES

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### A. – QUESTIONNAIRE TO WORKERS

#### Identification of chemical risk

This questionnaire gives examples of questions that can be formulated (either orally or in written form) to workers to find out more about their working situation and conditions, their exposure to risk, and to ascertain the knowledge they have regarding these issues.

These questions are a general guide. When developing the questionnaire, consideration should be given to whether to shorten or enlarge the list, based on the extent of information already available, the amount of time the workers have to answer, and how predisposed they are to give answers.

Working area: \_\_\_\_\_

Position: \_\_\_\_\_

Gender:                      Woman                       Man

#### Special working conditions

- Pregnant or breastfeeding women
- Person sensible to certain products
- Others

1. Do you use or are you exposed to chemical materials or products in your work?	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. What are they used for and where do they come from?	_____ _____
3. Are the containers labelled?	Yes <input type="checkbox"/> No <input type="checkbox"/>
4. Do you know the chemical names of products besides the commercial names?	Yes <input type="checkbox"/> No <input type="checkbox"/>

5. If it is a compost product (mix). Do you know the name of each of the products (components)?	Yes <input type="checkbox"/> No <input type="checkbox"/>
6. Do you have information about the effects or harm the chemicals you use might cause to human health and the environment?	Yes <input type="checkbox"/> No <input type="checkbox"/>
7. How can these products penetrate your organism?	Respiratory system Ingestion <input type="checkbox"/>  Through skin <input type="checkbox"/>
8.a. Does the presence and manipulation of these products create a risk situation that might cause an accident (splashing, etc.)	Yes <input type="checkbox"/> No <input type="checkbox"/>
8.b. Why does a risk exist? What are the reasons?	_____ _____
9. Have you suffered or are you suffering from any health problem, nuisance or pain related with the chemical products in your work (eyes irritation, etc.)	Yes <input type="checkbox"/> No <input type="checkbox"/>
10. If you have suffered intoxication, which symptoms showed up?	Short after using the product (few minutes or hours): Acute <input type="checkbox"/>  Long time after using the product: Chronic <input type="checkbox"/>
11. Can materials and/or products used or present in your working centre be the cause of pollution in the surrounding and immediate/local external environment?	Yes <input type="checkbox"/> No <input type="checkbox"/>
12. Are hazardous and polluting substances spilled in waste pipes or drains?	Yes <input type="checkbox"/> No <input type="checkbox"/>
13. Are containers of chemical products separated from the rest of the waste and treated specially as hazardous waste?	Yes <input type="checkbox"/> No <input type="checkbox"/>
14. Are there hazardous wastes in drums or other open containers, broken or without labelling?	Yes <input type="checkbox"/> No <input type="checkbox"/>
15. Do you know at what level of concentration, or amount of chemical exposure harmful effects occur to human health or/and the environment?	Yes <input type="checkbox"/> No <input type="checkbox"/>
16. Are there any first aid kit in your working centre?	Yes <input type="checkbox"/> No <input type="checkbox"/>
17. What does it contain?	_____ _____

18. Are you aware if there is any risk prevention plan at your working centre?	Yes <input type="checkbox"/> No <input type="checkbox"/>
19. If so, can you describe what you know about this?	_____ _____
20. Are you aware if there is an emergency plan in case of an accident? (emergency telephones, transport, etc.)	Yes <input type="checkbox"/> No <input type="checkbox"/>
21. Do you know the substances that cannot be mixed with the products you are using?	Yes <input type="checkbox"/> No <input type="checkbox"/>
22. Do you know what to do in case of spillage of a chemical product?	Yes <input type="checkbox"/> No <input type="checkbox"/>
23. Have you ever heard about possible alternatives to the hazardous substances you are using?	Yes <input type="checkbox"/> No <input type="checkbox"/>
24. If so, please describe briefly what you know about this	_____ _____
25. Do you know how chemical risk could be reduced, minimized and eliminated in work position?	Yes <input type="checkbox"/> No <input type="checkbox"/>
26. If so, please describe briefly what you know about this	_____ _____
27. Do you know the collective and individual measures the employer has to put in place to control pollution in the workplace?	Yes <input type="checkbox"/> No <input type="checkbox"/>
28. Is there any periodical revision of the equipment or the ventilation mechanisms at your workplace?	Yes <input type="checkbox"/> No <input type="checkbox"/>
29. Do know what personal protective equipment (gloves, respiratory masks, etc.) are used at your workplace?	Yes <input type="checkbox"/> No <input type="checkbox"/>
30. If so, please describe them briefly	_____ _____
31. Do you know what personal protective equipment should be adequately used when?	For the correct manipulation of products <input type="checkbox"/>  For the correct storage of products <input type="checkbox"/>  For the correct transport of products <input type="checkbox"/>

**B. – Inspection guide to identify chemical risk**

Working area: \_\_\_\_\_

Position: \_\_\_\_\_

Gender:                      Woman                       Man

**Special working conditions**

- Pregnant or breastfeeding women
- Person sensible to certain products
- Others

>> Training and information	
1. Do workers know the potential risk of stored substances, substances used or generated in the workplace?	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. Have they received information and training on the safe way to manipulate toxic substances?	Yes <input type="checkbox"/> No <input type="checkbox"/>
3. Are all containers labelled?	Yes <input type="checkbox"/> No <input type="checkbox"/>
4. Are those pipes through which chemical substances circulate clearly signed and marked?	Yes <input type="checkbox"/> No <input type="checkbox"/>
5. Have procedures been established in case of a spillage, emergencies, etc.?	Yes <input type="checkbox"/> No <input type="checkbox"/>
6. Do workers know when they have to use personal protective equipment?	Yes <input type="checkbox"/> No <input type="checkbox"/>
7. Are workers told of the hygienic habits to have during working time, e.g. before consuming food and drinks, as well as those habits away from the workplace?	Yes <input type="checkbox"/> No <input type="checkbox"/>
8. Have workers been informed about the risk and the danger to the environment and the way to treat and eliminate wastes, emissions and spillage?	Yes <input type="checkbox"/> No <input type="checkbox"/>

>> Control of contamination	
1. Are the toxic substances used necessary or can they be replaced with others which are less harmful to human health and the environment?	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. When toxic substances are not used are they placed in a closed/sealed space?	Yes <input type="checkbox"/> No <input type="checkbox"/>

3. Do you feel there are workers unnecessarily exposed to toxic and hazardous chemicals?	Yes <input type="checkbox"/> No <input type="checkbox"/>
4. If so, please describe in which situations?	_____ _____
5. Are there any systems of ventilation or respiration installed?	Yes <input type="checkbox"/> No <input type="checkbox"/>
6. Is the workplace cleaning done frequently and regularly to avoid any accumulation or dispersion of particles?	Yes <input type="checkbox"/> No <input type="checkbox"/>
7. Are there any systems of health and biological surveillance of these workers exposed to toxic risk in place?	Yes <input type="checkbox"/> No <input type="checkbox"/>
8. Are the toxic substances present at the workplace regularly measured?	Yes <input type="checkbox"/> No <input type="checkbox"/>
9. Are the workers informed about the results of the tests?	Yes <input type="checkbox"/> No <input type="checkbox"/>
10. Are there any measures in place to avoid air and water pollution and the release of waste?	Yes <input type="checkbox"/> No <input type="checkbox"/>
11. Are toxic products stored in closed/sealed containers?	Yes <input type="checkbox"/> No <input type="checkbox"/>
12. Are the toxic products collected by a responsible and competent authority?	Yes <input type="checkbox"/> No <input type="checkbox"/>
13. Are toxic substances poured into water through pipes, ending up in the sewers or elsewhere?	Yes <input type="checkbox"/> No <input type="checkbox"/>
14. Are the emissions of pollutants to the exterior through windows, systems of ventilation, or chimneys?	Yes <input type="checkbox"/> No <input type="checkbox"/>
15. Are there dangerous substances in the products produced by the company?	Yes <input type="checkbox"/> No <input type="checkbox"/>

<b>&gt;&gt; Workers protection</b>	
1. In those areas where irritant, corrosive and hazardous substances are used, are there any fountains, washbasins, or showers?	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. Does the working centre look after the laundry of working clothes?	Yes <input type="checkbox"/> No <input type="checkbox"/>
3. Do workers receive enough information and training to permit them to work in safe conditions?	Yes <input type="checkbox"/> No <input type="checkbox"/>

>> Organization and working rhythms	
1. Do working rhythms and demands to finalise tasks make it difficult to comply with security and prevention measures	Yes <input type="checkbox"/> No <input type="checkbox"/>
2. Is the salary based on bonuses from production?	Yes <input type="checkbox"/> No <input type="checkbox"/>
3. In the different working shifts, particularly at night, are the prevention measures the same?	Yes <input type="checkbox"/> No <input type="checkbox"/>
4. Do measures proposed to prevent and control chemical risk stop, prevent or adversely interfere with production and work?	Yes <input type="checkbox"/> No <input type="checkbox"/>

## ANNEX 4: EXAMPLE OF A BASIC CARD TO SUMMARIZE INFORMATION ABOUT THE WORKING CENTRE

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**Data card:**

Name of the company:

Activity:

Number of workers:

Address:

Postal code:

City and country:

Brief description of the company activity:

**Hazardous substances and products used:**

Product/substance	Use	Comments

<b>Hazardous wastes generated:</b>		
Waste	Process	Management

Comments:

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