

CHEMICAL HAZARDS & THEIR CONTROL IN SMALL & MEDIUM-SIZE ENTERPRISES (SMEs)

- an approach to hazard reduction -



**IT IS EVERYONE'S CONCERN
IF YOUR COMPANY USES,
PRODUCES, STORES, OR
TRANSPORTS HAZARDOUS
CHEMICALS**

HAZARDOUS CHEMICALS

The use of toxic chemicals is never to be taken lightly. Accidentally released, they are a potential – and frequently an actual – danger to human life and the environment.

Although, when an incident occurs our reaction may be to blame it on bad luck and say, "well, it could have happened at any time and in any case it was beyond our control", if appropriate measures have been taken in the first place, most industrial accidents can be prevented or their effects, at least, minimized.



LEARNING FROM EXPERIENCE



In May 1995, cyanide contaminated-water from the zinc plating unit of an electroplating factory poured into a river in St.Gallen, Switzerland.

The installation was equipped with a refrigeration system designed to maintain its sodium cyanide plating bath at a constant temperature. The bath itself contained a cooling coil.

Although a retention device had been installed to prevent any accidental run-off of liquid from the plating bath, the cooling coil, because it contained only a harmless chemical, was disregarded as a safety risk.

Therefore, despite regular safety checks, no one noticed that the cooling coil was corroding. The outcome of this lack of attention was that the coil became the means through which the cyanide solution leaked into the plant's refrigeration tank, causing it to overflow.

Because the factory had no overall liquid retention system, the cyanide-contaminated water flowed through its drains and pipes into the local water treatment plant. In order to protect this plant's biological treatment pond from contamination, the inflow coming from the factory had to be blocked off. As a result the cyanide-contaminated water poured directly into the near-by river.

THE CONSEQUENCE

The consequence was an ecological disaster that killed some 50,000-100,000 fish and extensively contaminated 20 km of the river's biotope.

LESSONS LEARNED

- The refrigeration system, an unrecognised potential outlet for the cyanide, should have been included within the safety management plan.

- A liquid-level alarm device could have alerted staff about the overflow.
- A spillage retention device could have contained the overflow. The waste-water treatment plant also needed a device to deal with this kind of an emergency.
- Immediately blocking the factory drains would have prevented the polluted run-off from flowing towards the waste-water plant.

Avoidable incidents are frequently caused by factors regarded as unrelated to the potential hazards within a system. In this case the error was to have considered a refrigeration coil to be free of risk when it was not...



From a routine task to a deadly incident!

In March 1997, in a meat-cutting factory in Montreal, Canada, a box in the storage area fell onto, and broke, an insulated refrigeration pipe. Ammonia from the refrigeration system poured out of the break into the factory basement.

THE CONSEQUENCE

A worker who was unable to escape through the barred windows was gassed and burned to death.

Being unaware of the presence of ammonia, the emergency services arrived with inadequate equipment. The rescue lasted for an hour and a half, leaving 19 workers and 5 firemen hospitalized with severe burns and ammonia poisoning.

LESSONS LEARNED

- Pipework should have been installed out of harm's way, or well protected, and regularly inspected.
- An emergency escape plan should have been prepared and implemented.
- The local emergency services should have been aware of the type of danger they may encounter in this place.

ANTICIPATING RISKS

Another approach to risk management is to visualize an accident and conceptually model its consequences. The lessons which can be drawn will help improve safety.

A major hazard lies in the accidental mixing of solutions, creating, as a result, toxic substances, which may lead to fire, explosion, or pollution. The outcome can lead to a major catastrophe, particularly if the installation is situated in a populated area or in a highly active industrial zone.

For example, in the electroplating process sulphuric acid is periodically added to the sulphate bath in order to maintain the strength of the solution. Let us suppose that instead of adding the acid to the sulphate bath a worker mistakenly adds it to the nearby sodium cyanide (NaCN) plating bath. If there is sufficient NaCN to react with the acid, an extremely toxic gas (HCN) will immediately be emitted into the atmosphere.

Modelling shows that this can lead to the formation of an instantly lethal cloud that can spread over a distance of more than 150 m.

IT CAN HAPPEN!

Chemical containers are often unclearly labelled or even unlabelled. Sometimes they are identical in colour, shape and size, despite their different contents. If drums containing acid are kept near those containing cyanide, a disaster is in-the-making. All that is needed to make it happen is when a worker, under pressure to meet a delivery deadline, being too confident in his work habits, or insufficiently aware of the risks involved, fails to pay due care and attention to what he is doing. The results can be fatal.



Could this type of accident happen in your plant? YES NO

REDUCING HAZARDS IN **YOUR** INSTALLATION

Experience can teach, if we are willing to learn. An accident points to causes and consequences and provides us with opportunities to prevent similar incidents from happening. Here are some essential hazard management concepts which should prove to be useful for reducing risks.

REDUCE THE HAZARD POTENTIAL!

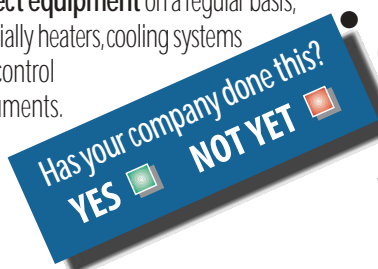
As much as possible, reduce the presence of hazardous substances in your factory, i.e., those that are toxic (for humans or wildlife), inflammable, explosive, or highly reactive. Therefore:

- **obtain information** about safer methods and products;
- **substitute hazardous substances** by less hazardous replacements;
- **minimize stocking and using** hazardous products and substances.

PREVENT ACCIDENTS!

Most accidents are linked to human errors such as using one product instead of another, or misinterpreting operational procedures. Unfortunately, when dealing with hazardous substances, only a very low level of error can be tolerated. Therefore:

- **clearly label hazardous products** with information on their properties such as toxicity, flammability, or reactivity clearly indicated;
- **inspect equipment** on a regular basis, especially heaters, cooling systems and control instruments.



LIMIT THE CONSEQUENCES!

The consequences of emergency incidents can be mitigated by undertaking measures at two levels: *technical* and *procedural*. Measures at the *technical* level involve adapting factory design to impede dangers such as the leakage of hazardous vapours or liquids from leaving the site. They also involve the use of emergency equipment. Therefore:

- **consider what accidents** are liable to happen in your factory;
- **make an inventory of all potential hazards** and emergency equipment, its locations, and exit routes;
- **develop a system to immediately contain** any spilled hazardous substances, including polluted extinction water in the case of fire.

Measures at the *procedural* level involve developing an emergency plan to reduce the effects of a possible incident. This includes visualising what could happen "if" ..., and determining what steps should be taken to lower risks, and to respond to emergencies. Therefore:

- **establish an emergency management team** to examine and regularly review your company's risk prevention and emergency response arrangements.
- **prepare rescue procedures** to include an emergency response unit, first aid, evacuation, coordination with public emergency services, and communication with all staff and local people who are potentially at risk should there be an incident in your factory.

TOWARDS SAFETY MANAGEMENT



We **MUST** develop a safety culture.

The attitudes of staff towards safety, their actions to prevent accidents, and the extent to which they comply with safety rules is determined by the company culture so that safety becomes an integral part of company activities.

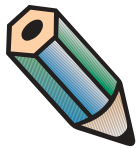
- A *safety culture* requires a change of "mind-set", so that safety receives as much emphasis as production, sales, and profits. Pressures to achieve output at the expense of safety, may also be at the expense of human lives and the environment.
- A *safety culture* requires good, and regular, communication between the board room and the factory floor: between management and staff, with management being particularly receptive to staff safety concerns.
- A *safety culture* implies a problem-solving, rather than a culprit-finding, approach to incident investigation and prevention.

THE KEYS TO A SAFETY POLICY

To assure that effective action is taken towards safety, *do not forget* to:

- establish an emergency management policy and programme covering safety rules, procedures, planning, and equipment;
- provide staff training on all aspects of your company's hazard potential, and safety requirements, so that they too, can identify danger areas and recommend solutions;
- make sure the rules are followed.





HELP?

In the first instance, safety improvement requires information, time, care, attention, *and competent advice*. Do you:

- Need help with hazard analysis?
- Want to have your installations checked?

Call us! We will provide you with free information and advice on setting up a safety management program.



Networking for Safety

Free or low-cost advice can also be obtained from public authorities, chemical suppliers and trade associations. Much information is within arm's reach on the Internet. So, why not take a look at the following chemical safety sites?

<http://siri.org/msds>

Site dedicated to industrial safety and environmental protection databases (MSDS=Material Safety Data Sheets). Also provides links to a number of specialised agencies.

<http://ull.chemistry.uakron.edu/erd/>

Site of hazardous chemicals database of the Department of Chemistry, University of Akron, Ohio, USA.

<http://hazard.com>

Site of Vermont [USA] Safety Information Resources Incorporated (SIRI), providing practical information, links to related sites and a discussion forum.

<http://www.ilo.org/public/english/protection/safework/cis/products/icsc/index.htm>

Site of the International Labour Organisation (ILO), with an excellent search engine for finding essential labour safety information. Searching in French possible.

<http://www.oecd.org/ehs/accident.htm>

Site covering the work of the Organisation for European Co-operation and Development (OECD), concerning chemical accident prevention.

<http://www.chemfinder.com>

Site comprising safety files covering all aspects of 60,000 dangerous products.

<http://www.fishersci.ca>

Site comprising 16,000 chemical safety files. Also in French. (Search by name of chemical in English).

<http://www.cdc.gov/niosh/npg/pgdstart.html>

Site of the NIOSH Pocket Guide to Chemical Hazards, of the US National Institute for Occupational Safety and Health (NIOSH). Provides for searching by substance, category and CAS number.

This brochure can be obtained at the following address:

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SAFETY IS ALSO GOOD BUSINESS

Although major chemical accidents are usually associated with large companies, small and medium-sized enterprises (SMEs) also face major hazards that can place them in critical situations.

How much money is it reasonable to spend on safety? The answer should be linked to the cost of failure. Serious accidents may cost lives, severely damage equipment and stocks as well as the environment, and put your firm out of business.



The cost of failure:

- *Material and product damage*
- *Equipment and building damage*
- *Clean-up costs*
- *Lawsuits and fines*
- *Wages paid during interrupted work*
- *Costly overtime for recovery*
- *Loss of business*
- *Environmental damage*
- *Possible injuries and loss of human life.*

The value of safety:

- *Uninterrupted operating time*
- *More efficient operations*
- *Higher profitability*
- *Good image*
- *Better worker and customer safety*
- *Safe workplace*
- *Safe neighbourhood*

