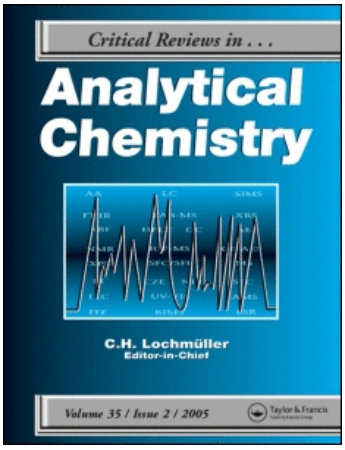


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# REDUCTION OF ENVIRONMENTAL RISK BY CHEMICALS

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Development, economic growth, technological expansion increase in developed countries and countries under transition. By 1980 the handling and disposal of hazardous wastes was recognised as national and global issue. Through the 1970s and 80s the growth of chemical manufacturing in developing countries exceeded that of the developed world. Samples showed that developing-world populations ranked high in exposure to toxic chemicals, bloods lead levels, and DDT contamination of human milk. In 1970 most air pollution legislation treated air pollution as a local phenomenon. By 1980 it had become global. Given suitable atmospheric conditions, sulphur dioxides and nitrous oxides can be tranported long distances and transformed into acids. So we have acid rains.

In 1974 there was a prediction that chlorofluorocarbons ($CFC_s$) used in refrigeration and as a propellant for aerosols could damage the stratospheric ozone layer. Eleven years later, in 1985 came confirmation. The ozone shield over the Antartctic was thinning and a "hole" had developed.

The concerns about increasing $CO_2$ levels expressed by a few scientists in 1960s were confirmed in 1980s by a large proportion of scientific community. Data showed increasing concentration not only $CO_2$, but also nitrous oxide ($NO_2$), methane ($CH_4$) and specific chlorofluorocarbons. Their addition to the atmospheric permits it to adsorb more of the infrared radiation emitted from the earth. Global warming becomes a possibility both $SO_2$ and $NO_x$ contribute to acidification while $NO_x$ cause nutrient enrichment. The $PAH_s$ (polycyclic aromatic hydrocarbons), dioxins and all heavy metals are potential contributor to ecotoxicity and human toxicity.

**Hazard** is the general term for anything which has the ability to cause injury or for the potential to cause injury. The hazard associated with a potentially toxic substance is a function of its toxicity and the potential exposure to the substance. The probability of exposure to the substance is a risk factor.

Hazardous substances and hazardous preparations are understood to mean substances or preparations which are deemed to be: - exposure, - oxidising, - extremely flammable, highly flammable, - flammable, - very toxic, - toxic, - harmful, - corrosive, - irritant, - sensitising, - carcinogenic, - mutagenic; - teratogenic, - exhibit any other chronically harmful proper ties, or - present a hazard to the environment.

In order to initiate a risk reduction program it is first necessary classify the general hazardous categories of chemicals:

- Physical hazard (compressed gas, flammable, explosive, oxidising, reactive, corrosive);
- Health hazard (toxic, irritant, corrosive, sensitizer, carcinogen, reproductive effects, mutagen);
- Special hazard (environment, radioactive, infections, miscellaneous)

Selecting a hazard evaluation for a particular purpose can be difficult. The different hazard evaluation procedures are different from each other. We can examine examples of hazard that may be present in a chemical process plant. A hazard is defined as a characteristic of the system that represent a potential for an accident with an undesirable consequence. It is hazard that involve loss of containment of flammable, combustible, highly reactive or highly toxic materials in amounts sufficient to seriously endanger the health and safety of the chemical plant employers, neighbouring public and environment.

The two basic approaches to hazard evaluation and control may be discussed:

- adherence to good practice and
- predictive hazard evaluation.

Adherence to good practice is a minimum requirement for any activity in the chemical process industry and elsewhere. This consists of observing the rules and regulations, meeting the requirements of the accepted standards and following the practices that have been proven best from years of experience with same processes.

Predictive hazard evaluation is an additional step that is needed when new and different processes, equipment, or procedures are being considered. When experience is lacking, it is necessary to examine the system for new hazard, new potential accident, and new ways in which system may respond to accidents.

The experience with the production, use, and handling of various chemical materials have documented in the form of standards (ISO, CEN or national). These standards summarize today's accepted good practice.

The term "Risk" must not be confused with the term "hazard". It is most correctly applied to predicted or actual frequency of occurence of an adverse effect of a chemical or other hazard.

People and the environment are subjected to various hazards which are caused by natural sources and /or people's activities. Hazards may be of biological, psychological or sociological nature and may have site location specific characters. A fundamental requirements of risk characterisation is that the identification of hazard should be carried out by using all kinds of chemical, biological and physical data, epidemiological bioassay data, together with exposure and dose response assessment.

**Risk** may be defined as the combination of the probability of occurrence on an event and the possible extent of that event's adverse effects and consequences, in term of economic loss or human injury. Mathematically, risk can be expressed as:

**the probability of some events X the seriousness of its consequences.**

The policy based upon the risk assessment should include risk characterisation schemes, acceptable levels of risk, safety goals, safety standards and regulations. The risk limits for different activities of the company are set using a three-land index, consisting of:

- the maximum acceptable risk limit which should never been exceeded;
- the negligible risk limit, indicated the level below which it is not economically or environmentally sensible to try to reduce the risk, and;
- the grey area between the above risk, within which a trade-off must be made between cost effectiveness of risk reduction and the goal of achievening an acceptable level of risk. Figure 1 shows risk criteria for an organisation

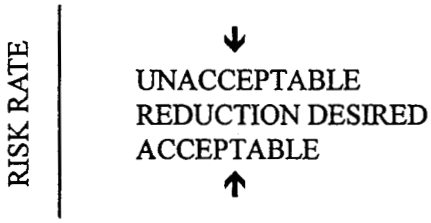


Figure 1. Risk criteria

**Risk reduction** is thus the process of the selecting the practical means to achieve the lowest level of risk as indicated by outcome of risk assessment and risk management procedures.

Protecting the environment and making efficient of natural resources are two of the most pressing demands in the present life. Risk can arise at four main stages in the life cycle of chemical: - manufacture, - distribution, - risk (by industry, commercial users or the general public) and - disposal. Risk from normal production, use and disposal, and minor releases and reasonably foreseeable misuse are assessed, but those from major release by catastrophic

accidents or deliberate misuse are not. There are many ways of reducing risks, including technical measures and also improvements in management, training and information. There is a wide range of risk reduction recommendation, depending on the nature of risk: - better information or better communication, - control on emissions or exposure, - control on packaging, transport, transfer and storage; - control use and - control on disposal.

**Environmental risk management** is a fairly recent phenomenon. Generally risk has been associated with insurance and the recovery of financial losses in the extent of unexpected disasters. Depending of the timing of the damage, risk can be immediate or delayed. The risk can also be voluntary, for example smoking, driving, or involuntary, e.g. living close a potentially dangerous industrial plant.

Organisations are built and managed on the whole concept of risk. No matter how big or small a business decision may be, it is based on the degree of risk for success or failure. Risk in organisations can find expression in may different ways for example risk of fire, industrial injuries, product responsibility and environmental disasters.

Environmental risk can also be associated with unexpected events, like industrial accidents, or with routine events such as permitted emissions to air and water. Some of these more generalised environmental risk are:

- injurious effects suffered by persons as a result of exposure due to activities of a company;
- non-compliance with regulations;
- loss of reputation, business and market shares.

A general procedures for risk management can be subdivided in three main phases, namely: 1. risk analysis, 2. risk assessment and 3. risk involving. Figure 2 shows these phases.

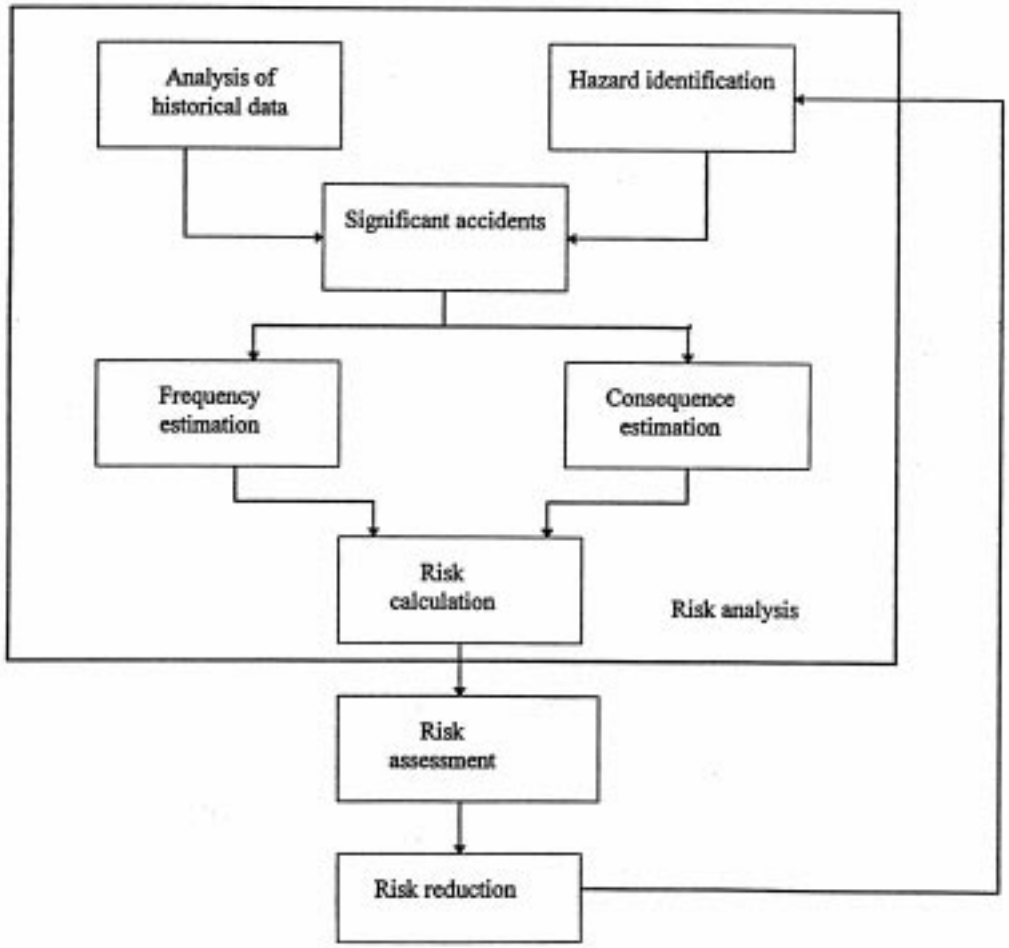

Figure 2. A general phases for risk management

**Chemical safety** is practical certainty that injury will not result from exposure to hazard under defined conditions: in other words, the high probability that injury will no result. Chemical risk assessment, chemical safety communication, chemical emergencies and chemical risk management are the main areas of the activity for the promotion of chemical safety as an important component of sustainable development in rural, urbant and global settings.

The importance of chemical safety in increasing with the use of chemicals, pesticides, pharmaceuticals, adhesives, colorants, etc.

As a part of the measures to provide internationally evaluated scientific and technical basis for effective environmental management of toxic chemicals, the principles of a harmonised classification of chemical hazards will be elaborated and necessary research promoted. Harmonized labelling and classification of toxic chemicals will contribute to the information base needed to promote community action. Human resources development and institutional and sectoral capacities will be enhanced by the use in countries of safety date in such forms as the International Chemical Safety Cards with harmonised chemical classification and labelling systems.

**Pollution prevention and cleaner production approach.** In the technological area there is now a heavy emphasis on "clean" technology and still accelerating effort to promote the shift to clean technology through research, development and policy. It embraces the efficient use of energy and of resources, the reduction of waste, the elimination of chemical and toxic substances, the life of products and the reuse of components. Many countries are in the process of establishing National Cleaner Production Centres. For countries in transition, Cleaner Productions offers an important opportunity for "leap-froging "the end of pipe" phase of technological development that many developed countries have been through.

**Sustainable development**.The main task of all environmental management tools - to meet the needs of the present without compromising the ability of future generation to meet their own needs. It mean sustainable development. Sustainability is extremely important in all development activities. The basic parameters of sustainable development and risk reduction can be indicated as follows:

- available sources, - supportive capacity and risk reduced environment, - sustainable development activities, - risk reduction of waste residuals (gaseous emissions, liquid discharges, solid wastes parameters and physicochemical mechanism, dilution, sedimentation, intermediate products, etc.), - biomechanisms, - resultant risk reduced environmental quality.

**Regulatory Control**. The health and environmental hazards of chemical substances and preparations have to be communicated to the users, to enable the materials be used and stored safety. This achieved by standardization, classification and labelling of chemicals and providing safety data sheets. The information used to classify a chemical substances as a dangerous, either to health or the environment, can be used for hazard assessment, which can be combined with chemical exposure data to product a risk assessment.

Chemical control in the European Union is based on a Network of legistation for hazard communication and safety assessment. All dangerous substances have been classified, packaged and labelled according to the requirements of Concil Directive 67/548/EEC. The EU scheme for classification packaging and labelling of dangerous preparations is specified in Council Directive 88/379/EEC. Industrial users of dangerous chemical substances or preparations must be supplied with a safety data sheet, according to Commission Directive 93/112/EEC. New chemical substances must be notified according to Council Directive 92/32/EEC before placed on the EU market. Existing chemical substances, which are defined as those listed in the European Inventory of Existing Commercial Chemical Substances (EINESC). The EC Council Regulation Nr. 743/93 is on evaluation and control of the risk

EINESC - listed substances. Risk assessment is conducted on notified new substances according to the Commission Directive 93/67/EEC. Risk assessment for existing chemicals - according Commissions Regulations Nr. 1488/94.

Regulation 1836/93/EEC allowing voluntary participation by companies in industrial sector in EU eco-management and audit scheme (EMAS) aims at promoting the use of environmental management systems and auditing as a tool for systematic and periodic evaluation of the environmental performance of certain activities, and the International Organisation for Standardization ISO 14000 - series of standards on environmental management (ISO 14001 and 14004) and on environmental auditing (ISO 14010, 140011 and 14012).

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