3 ANNEXES

In Annexes 3.1-3.6 you will find information to support your work on hazard analysis

In Annex 3.1 you will find information on natural forces that must be considered by industry and the community in preventive and rescue work.

Annex 3.2 will give you some guidance on fire hazards.

In Annex 3.3 you will find some explanations on explosions as a result of physical processes and as a result of chemical reactions.

How dangerous are chemicals? In Annex 3.4 you will find some explanation of where and how chemicals can be dangerous.

Many deaths are caused by a combination of events Annex 3.5 will give you a brief outline of these problems, together with some examples.

In Annex 3.6 are some selected examples of accidents in various countries. It is very important to collect information from your own community on near-misses and accidents

In Annex 3.7 you will find examples of risk analysis methods used in industry and elsewhere.

References and some other useful information are to be found in Annex 3.8

3.1 Natural disasters

In global terms the most frequent kinds of natural disasters are flooding, earthquakes, cyclones and drought. Volcanic eruptions, tornados and landslides are less frequent.

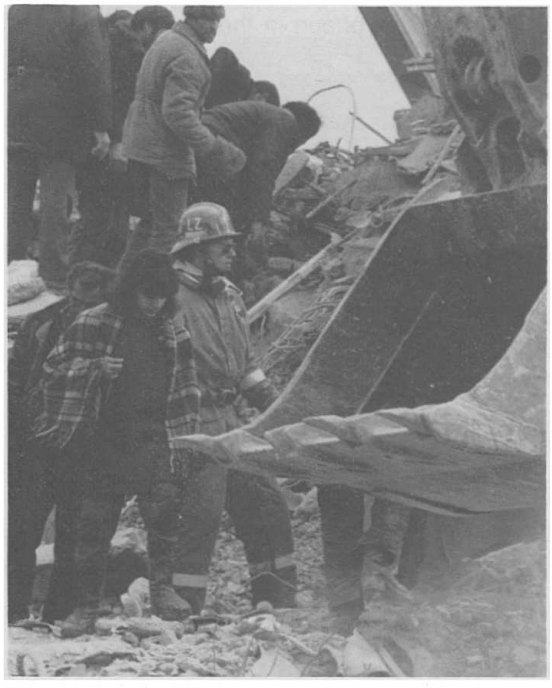
It is estimated that, on average, natural disasters claim 25,000 lives and cause damage valued in excess of $3000 million per year. There are great geographical variations in the risk that an individual is exposed to. About 95% of all natural disasters occur in developing countries. Natural disasters rarely cause many deaths in industrialised countries.

Factors affecting the risk are:

- population density
- building structures
- how long the event lasts
- how sudden and unexpected the event is
- how often such events occur and the number of incidents which preceded it.

Examples of hazards in connection with natural disasters are dams, seismically active areas, river banks and mountainous areas.

The extent to which people can minimise the effects of a natural disaster depends on how well informed they are about the likelihood of a disaster and the damage that could be caused. People's perception of risk plays an important role in this. For example, certain areas beside rivers in Sweden are liable to landslides. Some residential areas are thought to be unstable and houses could end up in the river if a landslide took place. However the desire to remain where you live, perhaps where you have lived for all your life, is stronger than the perceived risk. People living in built-up areas are more worried about daily threats, such as traffic, crime and pollution, than about the relatively slight risk of a land-slide. This means that politicians and those responsible in local authorities must show awareness of environmental risk at a very early stage in the planning process. A landslide at, for example, a chemical plant could have disastrous consequences.



"Rescuers search for survivors after the earthquake in Leninakan, Armenia, 1988".
Photo : Stig Dahler, Swedish National Rescue Services Board.

Every year there are about one million registerable seismic or microseismic tremors around the world. About 100,000 of these are felt by people, and 10 or 20 cause damage.

Examples of Earthquakes

Year	Place	Deaths
1906	San Fransisco, USA	452
1927	Nanshan, China	200.000
1963	Skopje, Yugoslavia	1.000
1976	Tangshan, China	243.000
1989	San Francisco, USA	63

One reason that so many people have died in earthquakes is that multi-storey buildings and houses were constructed of brick without reinforcement. Building collapse is the principle cause of deaths and injuries in earthquakes. In 1989 an earthquake in San Fransisco caused wide-spread fires and the collapse of some multi-storey road sections. An earthquake in an area with chemical industries, LPG plants etc. could have catastrophic consequences for people, property and the environment.

Earth tremors can trigger **landslides.** Landslides in areas with hazardous industries, depots etc. could also be disastrous.

Sometimes giant **tidal waves** can accompany an earthquake. These are called "Tsu-namis" and can reach a height of 50 metres, travelling at a speed of up to 700 km/hr in deep water. The Tsu-namis after the eruption of Krakatoa in 1883 reached a height of 40 metres and drowned 36,000 people.

Typhoons and hurricanes have rarely killed more than a few hundred people in the USA in recent times A hurricane in 1982 caused 155 deaths and damage to property worth about $23,000 million. The same hurricane killed nearly 10,000 in the Caribbean. In 1970 a hurricane in the Indian Ocean resulted in a catastrophe in Bangladesh, with a death toll of 300,000 and material damage too widespread to estimate. A hurricane in 1988 killed about 100 people and made 10% of Nicaragua's population homeless. At nearly the same time a typhoon in the Philippines killed 3-4,000 and made more than 110,000 homeless

Flooding is not unusual, both in industrialised and in developing countries However such events often have more serious consequences in developing countries. A flood in China in 1938 washed away a whole city and one million people died.

Depending on local conditions, the following natural forces must be considered by industry and others in their land-use planning their installation design, their processes, management, emergency plans etc:
- earthquake
- landslide
- flooding
- wind (typhoons, hurricanes)
- waves (tsu-namis)
- extreme frost, extreme drought, extreme sun.

The effects of a natural disasater can be reduced by having early warning systems, safer building methods, reliable transport systems and contingency plans.