

## ENVIRONMENTAL RISK ASSESSMENT (ERA)

A. Introduction - In order to understand what is meant by environmental risk assessment it is important to be familiar with the concepts of hazard and risk. These terms have different meanings and are not interchangeable. The following definitions are used here.

\* Hazard is the inherent potential for something to cause harm. Hazards can include substances, machines, energy forms, or the way work is carried out.

\* Risk is the likelihood that harm will actually be done by the realisation of the hazard during the work being carried out or by the way something is used.

Risk = Hazard × Exposure.

In general, the term environmental covers the physical surroundings that are common to everybody including air, water, land, plants and wildlife. Thus environmental risk assessment covers the risk to all ecosystems, including humans, exposed via, or impacted via, these media. The term environmental risk assessment does not normally cover the risks to individuals or the general public at large from consumer products or from exposure in the work place, where other specific legislation applies.

In other words, environmental risk assessment (ERA) involves the examination of risks resulting from natural events (flooding, extreme weather events, etc.), technology, practices, processes, products, agents (chemical, biological, radiological, etc.) and industrial activities that may pose threats to ecosystems, animals and people. Environmental health risk assessment addresses human health concerns and ecological risk assessment addresses environmental media and organisms.

ERA is predominantly a scientific activity and involves a critical review of available data for the purpose of identifying and possibly quantifying the risks associated with a potential threat.

B. Rationality of ERA – Identification of an emerging issue or priority for further action can result in a demand for ERA to determine whether an initial indication of a problem is valid or not. ERA provides the basis for most legislative and regulatory programs as well as for international agreements to address

identified threats. While approaches vary significantly from one situation to another, and from one jurisdiction to another, international organizations are making efforts to bring some commonality to the approaches used.

If a threat to human health or the environment is identified through ERA, risk management is performed to consider the need to impose measures to control or manage the risk. While science remains an important factor at this third stage, other key factors must also be considered such as: socio-economic considerations; the availability of alternative technology, products, practices, processes, etc.; international comparisons and impacts; and communication and consultation with the public and stakeholders that will be affected by proposed changes.

In fact, the concept of risk management recognised the importance of an “effects-oriented approach” (e.g., environmental quality standards and effects standards) in addition to a “source-orientated approach” (e.g., emission standards based on the best available techniques not entailing excessive cost). The risk management policy sets out criteria for judging risks of technological hazards based on the following concepts:

- \* That a maximum acceptable level of risk can be identified which should not be exceeded irrespective of the economic or social benefit that could result from the activity under consideration.

- \* That a negligible risk level can be identified at which it not sensible to try to reduce the risk further.

- \* That between these two levels the risk should be reduced to as low as is reasonably practicable.

The risk criteria deriving from such a policy are laid out explicitly in ‘Premises for Risk Management’ which is part of any ‘National Environmental Plan’ of a nation.

C. Stages in carrying out an environmental risk assessment – Environmental risk assessment can be thought of as containing the following key stages.

1. Hazard identification. This would typically include identification of the property or situation that could lead to harm. This step is sometimes also known as problem formulation.

2. Identification of consequences if the hazard was to occur. This step is sometimes also known as hazard identification.

3. Estimation of the magnitude of the consequences. This can include consideration of the spatial and temporal scale of the consequences and the time to onset of the consequences. When considering chemicals, this step can sometimes be termed release assessment.

4. Estimation of the probability of the consequences. There are three components to this, the presence of the hazard, the probability of the receptors being exposed to the hazard and the probability of harm resulting from exposure to the hazard. This step can sometimes be called exposure assessment or consequence assessment.

5. Evaluating the significance of a risk (often termed risk characterisation or risk estimation) is the product of the likelihood of the hazard being realised and the severity of the consequences.

A concept frequently used in environmental risk assessment is that of the source – pathway – receptor. In this model the pathway between a hazard source (for example a source of contamination) and a receptor (for example a particular ecosystem) is investigated. The pathway is the linkage by which the receptor could come into contact with the source (a number of pathways often need to be considered). If no pathway exists then no risk exists. If a pathway exists linking the source to the receptor then the consequences of this is determined.

D. Uses of environmental risk assessment – There are a wide range of uses of environmental risk assessment and, although the specific methodology and the responsibility for carrying out the assessment may vary, the core principles and the key stages of the process are fundamentally the same in each case. ERA can be used in a number of ways:

\* Prioritization of Risks — When an organization is faced with a number of potential environmental risks, ERA can be used to establish their relative importance, and thus provides a basis for prioritizing which risks should be dealt with first.

\* Site-specific Risk Evaluation — ERA can be used to determine the risk associated with locating facilities in specific locations or to determine the risks that affect a particular site (e.g., environmental site assessment).

\* Comparative Risk Assessment — ERA is used to compare the relative risks of more than one course of action (e.g., what are the risks posed by untreated water versus the risks posed by chemicals used to treat water).

\* Quantification of Risks — ERA may be taken to a level where the risks are quantified in order to establish controls on the risks (e.g., maximum acceptable concentrations for chemicals in ambient or drinking waters).

E. Guidelines for conducting ERA - There are many approaches to conducting ERA. An overall framework developed by the Canadian Standards Association for conducting ERA is shown below. This framework highlights the importance of risk communication, in which stakeholders are involved throughout the process, from identification and priority setting, to ERA, to risk management, to monitoring and evaluation of the implemented measures.

risk\_management\_frameworkF. ERA is Used by followings –

\* Industry — Industry employs ERA to satisfy regulatory requirements, to make decisions on the use of substances and processes, and to locate facilities and operations based on the risks to human health and the environment. The resource extraction sector (mining, oil and gas) and the chemical manufacturing sector are regular users of ERA tools as these provide mechanisms for assessing the risk of environmental damage and implementing risk management or avoidance strategies.

\* Government — Government bodies use ERA to implement, or determine the need for, legislation, regulations or other controls to protect human health and/or the environment.

\* Finance — Financial organizations such as banks, investment firms and insurance firms, use ERA to define the financial risk associated with the environmental risks of potential investments. This information is included in the decision making process for the approval or rejection of loan and investment applications, and for setting premiums, interest rates and projected returns. Environmental site assessment is a common tool employed by the financial sector for assessing the environmental management responsibilities and potential costs associated with ownership of a given property.

\* Academia and NGOs — Universities and NGOs conduct research on industrial and other human activities using ERA.

G. Conclusion – ERA is an important tool for a number of reasons. For governments, it provides a method for determining risks to the public and the environment, and the process is communicated to the public to ensure transparency and understanding. The concept is already incorporated into some legislation and is also applied through policy and in developing new legislation.

ERA is also used in industry beyond what is implemented through legislation, and it is used to make decisions on materials, processes and facility siting. The process has several advantages:

- \* identification of trade-offs when examining comparative risks;
  
- \* avoidance of liability; and,
  
- \* disclosing the financial costs associated with risks.

ERA is often made difficult by the large degree of uncertainty that frequently accompanies the data. However, the environmental risk assessment and management process offers a course of action for making the best decision possible with the data that is available.

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