

An interpretation and evaluation of the US Environmental Protection Agency ecological risk assessment guidelines

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Abstract

In order to facilitate a common understanding, on-going debate and increasing application of ecological risk assessment (ERA) in South Africa, the ERA process of the US Environmental Protection Agency (EPA) has been summarised and evaluated for South African conditions. Many of the individual steps in the process have been interpreted and reworded in order to improve communication of the concepts. The basic process is unchanged though a few minor changes are recommended as improvements. A comparison is also made with integrated environmental management (IEM). It is noted that ERA addresses many of the key principles underpinning IEM, including consultation with interested and affected parties which provides an opportunity for public and specialist input into the decision-making process. However, there are some differences though more in degree than in principle. Of importance is that the ERA framework provides explicitly for quantification of all aspects of an assessment in an IEM procedure.

Introduction

Many environmental statutes, implemented by the US Environmental Protection Agency (EPA) since the 1970s, regulated and reduced point-source releases to the environment. Risk assessment emerged as a regulatory paradigm in the early 1980s, at a time when regulatory and policy decisions were being influenced by ecological impact measures. The use of ecological information for decision-making expanded slowly through the 1980s. In the mid-to late-1980s, tools and methods for conducting ecological risk assessments began to be standardised (Calow, 1998). The EPA's Science Advisory Board recommended that ERA be the cornerstone for decision-making within environmental management. Their report "*Future Risk: Research Strategies for the 1990s*" (US EPA, 1988) emphasised the need for a fundamental shift in EPA's approach to environmental protection. The move was from conventional approaches to focussing on the resources at risk, their composition within a landscape, multiple stressors and multiple assessment end points. In 1992, the EPA published the "*Ecological Risk Assessment Framework*" as the first statement of principles for ecological risk assessment, and in 1998 published the "*Ecological Risk Assessment Guidelines*". These documents not only describe single-species, chemical-based risk assessments, but also techniques for assessing risks to ecosystems from multiple stressors and multiple end points. In the rest of the world the value of the process has only recently been considered.

In the UK the Department of the Environment (DOE) generally leads policy to control risk to the environment and published "*A Guide to Risk Assessment and Risk Management for Environmental Protection*" (UK DOE, 1995). This guidance has been followed in reports for instance on dioxin emissions. Legislation in most other EU countries placed a greater emphasis on technological standards to achieve improvement, and risk assessment is more difficult to fit within such a framework. This approach is akin to the precautionary principle, due to its focus on prevention and is not

ideally suited for applications where substances are persistent and may build up in the environment.

The draft Australian/New Zealand Standard on Risk Management of 1994 defines risk as follows: "*Risk arises out of uncertainty. It is the exposure to the possibility of such things as economic or financial loss or gain, physical damage, injury or delay, as a consequence of pursuing a particular course of action.*" The Management Advisory Board of the Australian Public Service identifies a five-step generic process for managing risk (Australian Academy of Science, 1995). These are: establish the context, identify the risks, analyse the risks, assess and prioritise risks and treat the risks.

Some reasons for risk management in general include the following (Skivington, 1992). The public typically has an unsympathetic attitude towards companies causing adverse environmental impacts. These attitudes have impacts on potential markets. There is also ever-tightening legislation affecting local and international trade. ERA is important for environmental decision-making because of the high cost of eliminating environmental risks associated with human activities and the necessity of making regulatory decisions in the face of uncertainty (US EPA, 1998).

There is a need to establish a common understanding of ERA in South Africa. There is also a need to examine published ERA processes and adapt them, where necessary, to South African conditions. The South African Department of Water Affairs and Forestry (DWAF) is currently collaborating with the CSIR to develop an ERA framework in South Africa. This paper presents a description and examination of the US EPA guidelines for ERA as it is the process used most widely. It is also hoped that the present summary will simplify familiarisation with the original lengthy document (US EPA, 1998).

An interpretation of the US EPA ERA process

The US EPA defines ERA as "*the process that evaluates the likelihood that adverse effects may occur or are occurring as a result of exposure to one or more stressors*" (US EPA, 1998). The process consists of a number of formal phases (Fig. 1).

The interpretation of the US EPA process in this paper distin-

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