

# REVIEW

## Review of “The Precautionary Approach to Risk Appraisal,” by Andrew Stirling

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November, 2003

### 1. Novelty and Originality

The paper addresses a key issue in the interpretation of the precautionary principle. Is the application of the principle a substitute for rigorous scientific analysis or does it require such an analysis beforehand? The author’s response to this question leads him first to a detailed discussion of uncertainty and its treatment in risk assessment. He distinguishes four types of uncertainty (he uses the term *incertitude*): *risk* (probabilities and extent of damage is known to science), *ambiguity* (probability distribution is known to science, but the extent of damage is not clear), “classic” *uncertainty* (damage potential is known but the probability distribution is uncertain), and *ignorance* (Both components are uncertain or unknown). The neglect of these differences of uncertainty categories has major implications for the validity and reliability of risk assessments. The classic probabilistic risk assessments methods provide valid and reliable results only for the category *risk* and partially for the category of *uncertainty*, yet it does not provide meaningful results in the cases of *ambiguity* and *ignorance*. These two categories are, however, of major importance for the application of the precautionary principle. The principle does not preclude scientific inquiries but demand a set of scientific methods that differ considerably from those demanded by probabilistic risk assessments.

On the basis of this focus on ambiguity and ignorance, the author recommends that scientific inquiries are necessary elements of the precautionary approach but they are far from being sufficient. He suggests more humbleness from the scientists’ side when it comes to

incorporating science into policy making. He then articulates a set of pragmatic recommendations for applying precaution without falling into the trap of arbitrariness, another major problem that many skeptics of the principle have raised. In cases of high uncertainty, the author recommends to scrutinize the burden of persuasion and make it mandatory for the proposer of uncertain but potentially hazardous activities to provide evidence for being able to manage even unexpected consequences. The emphasis should be on avoiding Type 2 errors (mistaken approvals) rather than Type 1 error (undue restrictions). This emphasis on looking for potential harm is enhanced by continuous monitoring and investigations with respect to the “real-life” impacts once a decision to approve has been taken. In addition, policy makers should investigate potential alternatives including different policy and production options in order to avoid situations with potentially high but uncertain harm.

By looking into the available policy options, the author suggests that a precautionary approach demands four strategies: first, to conduct an interdisciplinary appraisal including the social sciences in order to include all potentially harmful or beneficial impacts in all spheres of public life. Second, to involve the major stakeholders and interested parties in the appraisal activity in order to assess and include their preferences, concerns and tacit knowledge. Third, to assure independence of the appraisal team and the need to disclose assumptions and subjective judgments where they have been used. Fourth, to conduct all the appraisal activities in accordance with the criterion of resilience rather than on the basis of economic optimization processes that do little justice to uncertainty and vulnerability.

The last section of the paper raises 18 questions that could be used as a checklist for guiding a risk management process when dealing with radioactive waste. Special attention is given to a new assessment methods (deliberative mapping) that the author has developed in other contexts.

## 2. Quality of Paper

The paper addresses the two main problems of applying the precautionary principle. First: What is the role of science and what the role of discretion? Second: How do we avoid arbitrary and inconsistent judgments when we use precaution as a guide for risk management? The responses to both question in Andrew Stirling' paper are academically convincing and at the forefront of current research. With respect to the first question, the author argues that the issue is not science versus discretion but rather the type of science that is needed for risk versus ambiguity or ignorance situations. Classic probabilistic risk modeling may be the appropriate answer if the problem can be framed as a risk or, to a lesser degree, an uncertainty problem. If the problem is ambiguity or ignorance, the scientific inquiry should pursue a different direction. Then risk managers need to provide the best available data on potential irreversibilities, to look into vulnerabilities and identify factors for increasing resilience. This assignment is at least as scientifically challenging as doing classic risk assessments. So the answer is not more or less science but using different types of good and solid science.

The second question of arbitrariness is addressed in a more indirect way. The authors list qualitative recommendations that should guide risk managers in their quest to be systematic, consistent and predictable. These recommendations may not determine the outcome of the regulatory process but provide procedural certainty for the regulatory process itself and the steps that are included.

In addition to the abstract argumentation and the conceptual modeling, the author applies these insights to the subject of radioactive waste management. Whether he is always accurate in his own appraisal of the risks and uncertainties in nuclear waste management, is debatable but of little importance for the main arguments presented in the paper. The paper demonstrates that Stirling's terminology and concept can successfully be applied to this issue and that it promises an improved risk management strategy compared to the ones that have been used so far. This alone is a major step forward for overcoming the present stalemate in finding appropriate strategies for dealing with the risks of nuclear waste.

### **3. Overall Judgment**

The paper is interesting, novel and has practical value for risk managers. It provides new and challenging insights for an academic as well as a management oriented readership. The list of questions at the end could have been more specific and operational, yet they provide a good cut for a first checklist or evaluation protocol. The application of his suggestions to nuclear waste includes judgments that may not be shared by all risk analysts in this area. Yet the objective of this paper is not to perform the analysis but to provide criteria and procedures for structuring such an analysis independent of the outcome of this process. My overall impression is that this paper provides excellent advice for risk management according to an intellectually convincing and practically feasible interpretation of the precautionary principle.

#### **ABOUT THE AUTHOR**

Ortwin Renn is Chair of the Board of Directors at the Center of Technology Assessment in Stuttgart (Germany). Since 1994 he has been Chair of Environmental Sociology of the State University in Stuttgart within the Institute of Social Sciences, and since 2003 Executive Director of the non-profit Company DIALOGIC. From 1996 to 1997 he was President of the European Society of Risk Analysis (SRA-Europe). Awards and honors include: „Fellow“ of the American Association for the Advancement of Science (AAAS); Fellow of the Society for Risk Analysis (SRA); Official member of the European Academy of Science and Arts; Outstanding Publication Award from the Environment and Technology Section of the American Sociological Association for the book: „Risk, Uncertainty and Rational Action“ co-authored by C. Jaeger, G. Rosa und Th. Webler. He has chaired the German Federal Committee on the Harmonization of Risk Standards, the Scientific Advisory Board of the Foundation “Precautionary Risk Management”, and the State’s Scientific Committee for Environmental Research. He has participated on: Panel on public participation of the US- National Academy of Sciences’ State Commission for Sustainable Development, the State Board for Higher Education, the Environmental Committee of the National Catholic Church; the Regional Environmental Board of the Protestant Church; and several national and international scientific review committees. He is a past member of the German Federal Advisory Council for Global Environmental Change (1996-2000) and the Prime Minister's Future Commission in the State of Baden-Württemberg (1998-2000). Publications include more than 30 book publications and 250 articles in journals and edited volumes.