Late lessons from early warnings: the precautionary principle 1896–2000

Some summary points

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A great deal of information on the European Union is available on the Internet.
It can be accessed through the Europa server (http://europa.eu.int).

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1. Introduction: History as an approach to learning

The growing innovative powers of science seem to be outstripping its ability to predict the consequences of its applications, whilst the scale of human interventions in nature increases the chances that any hazardous impacts may be serious and global. It is therefore important to take stock of past experiences, and learn how we can adapt to these changing circumstances, particularly in relation to the provision of information and the identification of early warnings.

Late lessons from early warnings is about the gathering of information on the hazards of human economic activities and its use in taking action to protect both the environment and the health of the species and ecosystems that are dependent on it, and then living with the consequences.

The report is based on case studies. The authors of the case studies, all experts in their particular field of environmental, occupational and consumer hazards, were asked to identify the dates of early warnings, to analyse how this information was used, or not used, in reducing hazards, and to describe the resulting costs, benefits and lessons for the future.

In trying to reduce current and future risks the lessons of history have rarely been used. In *Late lessons*, fourteen case studies (arranged chronologically according to the first date of early warning) have been chosen from a range of well-known hazards to workers, the public and the environment, where sufficient is now known about their impacts to enable conclusions to be drawn about how well they were dealt with by governments and civil society. Such conclusions are based on 'the spirit of the times' and not on the luxury of hindsight

2. Some costs of acting too late

That we have all acted too late in many areas is now well known. Over the next 50 years we will see some thousands of extra skin cancers as today's children grow up exposed to the higher levels of ultraviolet radiation penetrating the normally protective ozone layer through the 'hole' created by chlorofluorocarbons (CFCs) and other synthetic chemicals. Over the same period many thousands of Europeans will die from one of the most painful and terminal of cancers, mesothelioma, caused by the inhalation of asbestos dust. In both cases we were taken by surprise: the hazards of these beneficial technologies were not 'known about' until it was too late to stop irreversible impacts. Both phenomena had such long latent periods between first exposures and late effects that 'pipelines' of unstoppable consequences, decades long, were set in place before actions could have been taken to stop further exposures.

3. …on some very early warnings…

The first reports of injuries from radiation were made as early as 1896 (hence the title of the report). The first clear and credible early warning about asbestos came two years later in 1898. A similar signal for action on CFCs came in 1974, though some may argue that important clues were missed earlier. Eleven other well-known hazards are dealt with in this report. We invite the reader to judge whether, as in the cases of asbestos and CFCs, the early warnings could have led to earlier actions to reduce hazards, at a lower overall cost to society.

4. …because of misplaced certainty and ignorance…

A key question arising from the case studies is how to acknowledge and respond not only to scientific uncertainty but also to ignorance, a state of not knowing, which leads to both scientific discoveries and unpleasant 'surprises', such as ozone holes and rare cancers. Socrates had a response to this when he acknowledged ignorance as a source of wisdom. The report shows that this is a lesson from history that many people have forgotten. Misplaced 'certainty' about the absence of harm played a key role in delaying preventive actions in most of the case studies. However, there is clearly nothing scientific about the pretence of knowledge. Such ‘certainty’ does little to reduce ignorance, which requires more scientific research and long-term monitoring in order to identify the unintended impacts of human activities.

5. ...on hazards that can take decades to appear

Knowing enough, and acting wisely enough, across the full range of environmental and related health issues seems daunting. The interconnections between issues, the pace of technological change, our limited understanding and the decades it can take the ecological and biological systems to be damaged by our technologies together present an unforgiving context. Some people fear or imagine that a more precautionary approach to forestalling potentially irreversible hazards will stifle innovation or compromise science. However, there are immense challenges and opportunities in understanding complex and emergent systems while meeting human needs with lower health and ecological costs. Many of the case studies suggest that wider use of the precautionary principle can help stimulate both innovation and science, replacing the 19th century technologies and simple science of the first industrial revolution with the ‘eco-efficient’ technologies and systems science of the third.

6. The importance of trusted information…

This report notes the importance of trusted and shared information for effective policy-making and stakeholder participation in decision-making, especially in the context of complexity, ignorance, high stakes and the need for ‘collective learning’. Public acceptability of risks requires public participation in the decisions that create and manage such risks, including the consideration of values, attitudes and overall benefits. Sound public policy-making on issues involving science therefore requires more than good science: ethical as well as economic choices are at stake.

Public trust in the politicians and scientists who are trying to protect people and the planet from hazards is very low, especially in Europe, where BSE in the United Kingdom and elsewhere, dioxins in Belgium, and the HIV-contaminated blood transfusion affair in France have contributed to a general sense of malaise. Governments are aware of this and are developing responses, such as the EU White Paper on European Governance (July 2001). This includes recommendations for improving public participation in managing the inter-reactions between science, technologies and society. This report aims to contribute to the debate on the emerging issue of democratisasing scientific expertise.

7. ...and of transatlantic understanding

The case studies and authors have been chosen with a transatlantic audience in mind. Three chapters are focused either on a North American issue (pollution of the Great Lakes) or primarily on the North American handling of issues that are also directly relevant to Europe (benzene, and DES administered in pregnancy) and authored by scientists from North America (Gilbertson, Infante, and co-author Swann, respectively). Three chapters cover issues of some conflict between North America and Europe (hormones as growth promoters, asbestos, and MTBE in petrol); and all other chapters are as relevant to North Americans, their public health and their environments as they are to Europeans.

It is sometimes said that the United States does not use the precautionary principle, but it is worth noting (see Table 1) that the United States has helped to promote what could be called ‘precautionary prevention’, without necessarily calling it ‘the precautionary principle’.

Some examples of 'precautionary prevention' in the United States Table 1.

Issue	'Precautionary prevention'
Food safety (carcinogenic additives)	The Delaney Clause in the Food, Drug and Cosmetics Act, 1957–96, which banned animal carcinogens from the human food chain
Food safety (BSE)	A ban on the use of scrapie-infected sheep and goat meat in the animal and human food chain in the early 1970s which may have helped the United States to avoid BSE
Environmental safety (CFCs)	A ban on the use of chlorofluorocarbons (CFCs) in aerosols in 1977, several years before similar action in most of Europe
Public health (DES)	A ban on the use of DES as a growth promoter in beef, 1972–79, nearly 10 years before the EU ban in 1987

Source: EEA

8. What about cases of 'crying wolf', or 'false positives'?

The case studies are all about 'false negatives' in the sense that they are agents or activities that were regarded at one time as harmless by governments and others, at prevailing levels of exposure and 'control', until evidence about their harmful effects emerged. But are there no 'false positives', where action was taken on the basis of a precautionary approach that turned out to be unnecessary? It was felt necessary to include such examples, but despite inviting some industry representatives to submit them, and discussing these in some detail, no suitable examples emerged. Attention was drawn to a US publication, *Facts versus fears* (Lieberman and Kwon, 1998), which attempted to provide some 25 examples of 'false positives'. However, on closer examination these turned out not to be robust enough for those who recommended them to accept our invitation to use the strongest half dozen in this report. The challenge of demonstrating 'false positives' remains: possible candidates that have been mentioned include the ban on dumping sewage sludge in the North Sea, and the 'Y2K millennium bug'.

9. So what exactly is the Precautionary Principle?

Forestalling disasters usually requires acting before there is strong proof of harm, particularly if the harm may be delayed and irreversible, an approach to scientific evidence and policy-making which is part of what is now called the precautionary principle.

Precautionary prevention has often been used in medicine and public health, where the benefit of doubt about a diagnosis is usually given to the patient ('better safe than sorry'). However the precautionary principle and its application to environmental hazards and their uncertainties only began to emerge as an explicit and coherent concept within environmental science in the 1970s, when German scientists and policy-makers were trying to deal with 'forest death' (*Waldsterben*) and its possible causes, including air pollution.

The main element of the precautionary principle they developed was a general rule of public policy action to be used in situations of potentially serious or irreversible threats to health or the environment, where there is a need to act to reduce potential hazards *before* there is strong proof of harm, taking into account the likely costs and benefits of action and inaction. A precautionary approach, however, requires much more than establishing the level of proof needed to justify action to reduce hazards (the 'trigger' for action). The *Vorsorgeprinzip* ('foresight' or 'precautionary' principle), in the German Clean Air Act of 1974, as elaborated in the 1985 report on the Clean Air Act (Boehmer-Christiansen, 1994) also included elements such as:

- research and monitoring for the early detection of hazards;
- a general reduction of environmental burdens;
- the promotion of 'clean production' and innovation;
- the proportionality principle, where the costs of actions to prevent hazards should not be disproportionate to the likely benefits;
- a cooperative approach between stakeholders to solving common problems via integrated policy measures that aim to improve the environment, competitiveness and employment;

- action to reduce risks before full ‘proof’ of harm is available if impacts could be serious or irreversible.

Since the 1970s, the precautionary principle has risen rapidly up the political agenda, and has been incorporated into many international agreements, particularly in the marine environment, where an abundance of ecological data on pollution yielded little understanding but much concern: ‘huge amounts of data are available, but despite these data … we have reached a sort of plateau in our understanding of what that information is for..... This is what led to the precautionary principle’ (*Marine Pollution Bulletin*, 1997). More generally, Principle 15 of the UN Rio Declaration on Environment and Development 1992 (see Table 1) extended the idea to the whole environment.

The use of different terms in these treaties and agreements, such as ‘precautionary principle’, ‘precautionary approach’ and ‘precautionary measures’, can cause difficulties for communication and dialogue on how best to deal with scientific uncertainties and potential hazards. Table 2 attempts a clarification of some key terms used in the discussions of the Precautionary Principle.

Table 2. **Uncertainty and precaution — towards a clarification of terms**

Source: EEA

Situation	State and dates of knowledge	Examples of action
Risk	‘Known’ impacts; ‘known’ probabilities e.g. asbestos causing respiratory disease, lung and mesothelioma cancer, 1965–present	**Prevention**: action taken to reduce known hazards e.g. eliminate exposure to asbestos dust
Uncertainty	‘Known’ impacts; ‘unknown’ probabilities e.g. antibiotics in animal feed and associated human resistance to those antibiotics, 1969–present	**Precautionary prevention**: action taken to reduce potential risks e.g. reduce/eliminate human exposure to antibiotics in animal feed

Ignorance	'Unknown' impacts and therefore 'unknown' probabilities e.g. the 'surprises' of chlorofluorocarbons (CFCs) and ozone layer damage prior to 1974; asbestos mesothelioma cancer prior to 1959	**Precaution**: action taken to anticipate, identify and reduce the impact of 'surprises' e.g. use of properties of chemicals such as persistence or bioaccumulation as 'predictors' of potential harm; use of the broadest possible sources of information, including long term monitoring; promotion of robust, diverse and adaptable technologies and social arrangements to meet needs, with fewer technological 'monopolies' such as asbestos and CFCs

10. The Case studies: 14 costly hazards….

See the tables of dates of early warnings and actions, or inactions, at the end of each chapter for summaries of the case studies.

11. Information was not used, or ignored: or we were all taken by 'surprise'

In many of the case studies, adequate information about potential hazards was available well before decisive regulatory advice was taken, but the information was either not brought to the attention of the appropriate decision-makers early enough, or was discounted for one reason or another. It is also true that in some of the case studies, early warnings — and even 'loud and late' warnings — were effectively ignored by decision-makers because of short-term economic and political interactions (for example, see the case studies on asbestos, PCBs, the Great Lakes, and sulphur dioxide and acidification).

12. Technology appraisal is broadening…

In the United States, for instance, the seminal study by the National Research Council (NRC), 'Understanding risk' (NRC, 1996) and the subsequent report by the presidential commission (Omen *et al*., 1997) documented the limitations of conventional narrow risk assessment and highlighted the importance of interdisciplinary, lay knowledge and divergent stakeholder viewpoints in the characterisation of risk issues and of appropriate assessment approaches. The 1998 report of the UK Royal Commission on Environmental Pollution developed this theme (RCEP, 1998), underscoring the potential significance of uncertainty and different 'framing assumptions' in the shaping and interpretation of formal appraisal. In France (Kourilsky and Viney, 1999) recommendations on implementation of the precautionary principle stressed the need to organise systematically national expertise capacities, including both scientific and technical expertise, alongside economic and social expertise. In Germany, the importance of more broad-based discursive procedures is recognised in the major report of the German Advisory Council on Global Change — WBGU (WBGU, 2000). The development of the Swedish chemicals policy is based on recognition of many of the lessons noted here concerning the fundamental limitations of risk assessment, particularly the use of persistence and bioaccumulation as 'proxies' for unknown but possible impacts.

13. …and involving the public…

Some practical yet more broadly based institutional procedures such as consensus conferences and scenario workshops have been developed in Denmark and the Netherlands to try to articulate public questions and values with respect to scientific presumptions about the answers, and these have been exported widely over recent years (Renn *et al*., 1996). In the United Kingdom, the advent of new 'strategic commissions', on food, human genetics, and agricultural genetics and environment, is a recent innovation that opens up the risk policy process in the way suggested by some of these lessons. Detailed policy appraisals in areas such as BSE (Phillips *et al*., 2000) and mobile phones (IEGMP, 2000) have seen various of these lessons explored in some detail, with specific recommendations on how to handle issues such as institutional conflicts of interest and unrealistic expectations of the role of science as a touchstone, or arbiter, of ultimate truth.

The tools for participatory approaches are in various stages of development, and the challenges are far from trivial (Brookes, 2001). But this has to be set against traditional approaches, where the costs of failure can also be high, as illustrated by the public rejection of irradiated foods, the abandoned attempt to dump the North Sea Brent Spar oil installation and the response to GMOs.

14. Precaution, science and decision-making

The precautionary principle raises important issues for science and decision-making. Some are to do with what many might perceive as the mechanics of science, such as the levels of proof (or strength of evidence), needed for taking action.

Table 3 gives some examples of policy action taken at different levels of proof.

Different levels of proof for different purposes: some illustrations Table 3.

Verbal description	Examples
'Beyond all reasonable doubt'	Criminal law; Swedish chemical law, 1973 (for evidence of 'safety' from manufacturers)
'Balance of evidence'	Intergovernmental Panel on Climate Change, 1995 and 2001
'Reasonable grounds for concern'	European Commission communication on the precautionary principle
'Scientific suspicion of risk'	Swedish chemical law, 1973, for evidence required for regulators to take precautionary action on potential harm from substances

Source: EEA

15. Twelve late lessons

- Acknowledge and respond to ignorance, as well as uncertainty and risk, in technology appraisal and public policy-making.
- Provide adequate long-term environmental and health monitoring and research into early warnings.
- Identify and work to reduce blind spots and gaps in scientific knowledge.
- Identify and reduce interdisciplinary obstacles to learning.
- Ensure that real world conditions are adequately accounted for in regulatory appraisal.
- Systematically scrutinise the claimed justifications and benefits alongside the potential risks.
- Evaluate a range of alternative options for meeting needs alongside the option under appraisal, and promote more robust, diverse and adaptable technologies so as to minimise the costs of surprises and maximise the benefits of innovation.
- Ensure use of 'lay' and local knowledge, as well as relevant specialist expertise in the appraisal.
- Take full account of the assumptions and values of different social groups.
- Maintain the regulatory independence from interested parties while retaining an inclusive approach to information and opinion gathering.
- Identify and reduce institutional obstacles to learning and action.
- Avoid 'paralysis' by analysis' by acting to reduce potential harm when there are reasonable grounds for concern.