The Precautionary Principle, responsible innovation and post-normal science

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Principles in Environmental Policy

- *curative* model
  Polluter Pays Principle
- 'prevention is better than cure' model
  Prevention Principle
- 'better safe than sorry' model
  Precautionary Principle

paradigmatic shift from ***a posteriori*** control (civil liability as a curative tool) to the level of ***a priori*** control (anticipatory measures) of risks

De Sadeleer, 2005 Environmental Principles https://tradevenvironment.eu/index.php/book/environmental-principles-from-political-slogans-to-legal-rules/

Working definition Precautionary Principle (UNESCO COMEST 2005)

When human activities may lead to ***morally unacceptable*** harm that is ***scientifically plausible*** but ***uncertain***, ***actions*** shall be taken to avoid or diminish that harm.

Morally unacceptable harm refers to harm to humans or the environment that is

- threatening to human life or health, or
- serious and effectively irreversible, or
- inequitable to present or future generations, or
- imposed without adequate consideration of the human rights of those affected.

The judgment of *plausibility* should be grounded in scientific analysis. Analysis should be ongoing so that chosen actions are subject to review.

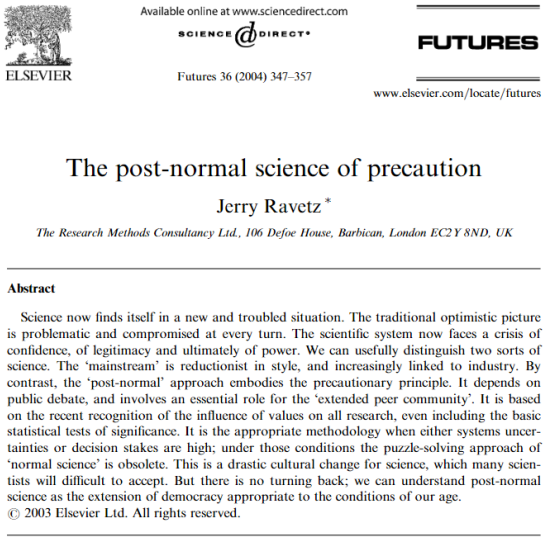
Uncertainty may apply to, but need not be limited to, causality or the bounds of the possible harm.

Actions are interventions that are undertaken before harm occurs that seek to avoid or diminish the harm. Actions should be chosen that are proportional to the seriousness of the potential harm, with consideration of their positive and negative consequences, and with an assessment of the moral implications of both action and inaction. The choice of action should be the result of a participatory process.

https://unesdoc.unesco.org/ark:/48223/pf0000139578

From the beginning, PNS has been the science of precaution

"Industrial science of hubris & corporate greed" vs "Post-normal science of precaution"



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The post-normal science of precaution

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Abstract

Science now finds itself in a new and troubled situation. The traditional optimistic picture is problematic and compromised at every turn. The scientific system now faces a crisis of confidence, of legitimacy and ultimately of power. We can usefully distinguish two sorts of science. The 'mainstream' is reductionist in style, and increasingly linked to industry. By contrast, the 'post-normal' approach embodies the precautionary principle. It depends on public debate, and involves an essential role for the 'extended peer community'. It is based on the recent recognition of the influence of values on all research, even including the basic statistical tests of significance. It is the appropriate methodology when either systems uncertainties or decision stakes are high; under those conditions the puzzle-solving approach of 'normal science' is obsolete. This is a drastic cultural change for science, which many scientists will difficult to accept. But there is no turning back; we can understand post-normal science as the extension of democracy appropriate to the conditions of our age.

- "… **new industrialised science, combining scientists' hubris in discovery with corporate greed in commercialisation, presents novel hazards to civilisation**."

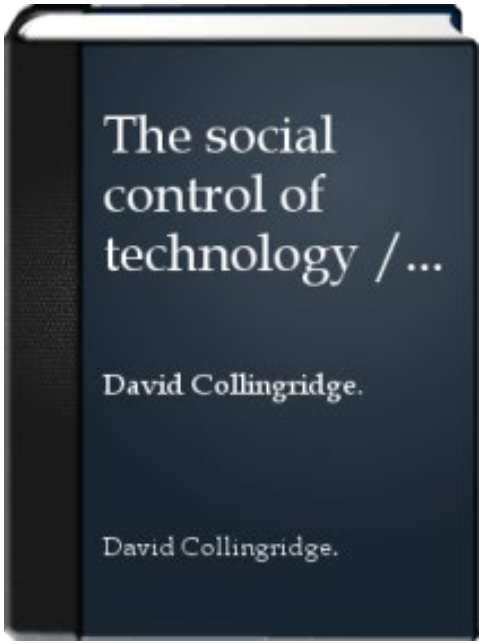
- "We are living with the effects of the myriad **pollutants** that have been (and are still being) **dumped into the environment at such a rate that prior testing would be a significant extra expense and retrospective testing is impossible**."

- **"**Up to now our industrial society has developed on **the principle that innovations are safe until proved dangerous. Turning it round to** the adoption and implementation of a **'precautionary principle' is an enormous task**, which many vested interests will resist and are already resisting."

- "The **contrasting approach to science […] could be called 'precautionary'**, since it is usually concerned with reacting to the unintended harmful effects of progress. **Its style is 'post-normal'**; it lies at the contested interfaces of science and policy. It addresses issues where, typically, facts are uncertain, values in dispute, stakes high and decisions urgent."

Ravetz, 2004 https://reader.elsevier.com/reader/sd/pii/S0016328703001605

Collingridge Dilemma



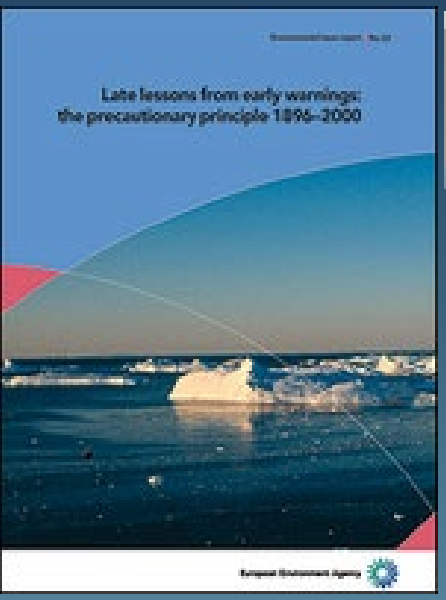
1980

“The social consequences of a technology cannot be predicted early in the life of the technology.

By the time undesirable consequences are discovered, however, the technology is so much part of the whole economics and social fabric that its control is extremely difficult.

This is the *dilemma of control.*”

Late lessons from early warnings EEA 2001/2013 reports



34 case studies: *20 in vol 2-2013*

'Environmental chemicals'

- ***Beryllium***
- **PCBs**
- **CFCs**
- **TBT antifoulants**
- ***Mercury***
- ***Tobacco-environmental***
- ***Perchlorethylene***
- ***Booster biocides***
- ***DBCP***
- ***DDT***
- ***Vinyl chloride***
- ***Bisphenol A***

Ecosystems

- ***Ecosystems resilience***
- **Great Lakes pollution**
- **Fish stock collapse**
- **Acid rain**
- ***Bee decline, France***
- ***Invasive alien species***
- ***Floods***
- ***Climate change***

Transport fuel additives

- **Benzene**
- **MBTE**
- ***Leaded petrol***

'Micro technologies'

- ***Nano***
- ***GMOs***

Animal feed additives

- **BSE, 'mad cow disease'**
- **Beef hormones**
- ***Antibiotic growth promotors***

- **Asbestos**

Pharmaceuticals

- ***Contraceptive pill pollution***
- **DES**

Radiations

- **X-rays**
- ***Mobile phones-head cancers***
- ***Nuclear accidents***

https://www.eea.europa.eu/publications/environmental_issue_report_2001_22
https://www.eea.europa.eu/publications/late-lessons-2

European Environment Agency

Late Lessons II report 2013

- Key decisions on innovation pathways made by few on behalf of many
- Lack of (institutional) mechanisms to respond to early warning signals
- Misleading market prices fail to reflect all costs and risks to society and nature

✓ Broaden application of the principles of precaution, prevention and polluter-pays

✓ Make government and business accountable

✓ Broaden evidence considered (lay/local knowledge) and public engagement

✓ Build resilience in governance systems and institutions

https://www.eea.europa.eu/publications/late-lessons-2

The RECIPES-Project

The objective

The RECIPES project aims to reconcile innovation and precaution by developing tools and guidelines to ensure the precautionary principle is applied while still encouraging innovation.

The RECIPES project will work closely with different stakeholders through interviews, workshop and webinars.

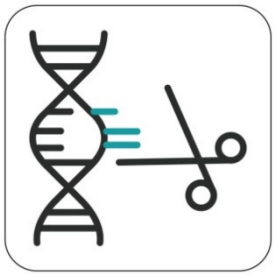
To this end, RECIPES will

1. Analyse legal and policy initiatives on the precautionary principle at the international, European and national level and describe the emergence of an 'innovation principle'
2. Examine the application of the precautionary principle in eight specific cases
3. Develop scenarios for the future of the precautionary principle taking into account innovation
4. Introduce mechanisms for public involvement in scientific and technological decision-making
5. Create tools and guidelines to the precautionary principle to help policymakers and other stakeholders to assess risks and take into account innovation.

"REconciling sCience, Innovation and Precaution through the Engagement of Stakeholders"

https://recipes-project.eu/

Case studies



CRISPR gene drives
Rathenau Institute

GMOs
ARC

Financial risks
HU Berlin

Neonicotinoid insecticides
University of Bergen

Nanotechnologies
(OEAW)

Glyphosate
Maastricht

Endocrine disruptors
Maastricht University

Artificial Inteligence
Rathenau Institute

Micro plastic
Maastricht University

RECIPES is funded by the Horizon 2020 Framework Programme of the European Union under Grant Agreement no. 824665. Views and opinions expressed in this course are purely those of the lecturer and may not in any circumstances be regarded as stating an official position of the European Commission.

How many EU legal acts make reference to the PP (2000-2019)?

Legal acts in total		Legal acts still in force (in July 2019)	
Regulations	47	Regulations	40
Directives	41	Directives	27
Decisions	47	Decisions	27
SUM	**135**		**94**

RECIPES Policy Brief (2020)
https://recipes-project.eu/sites/default/files/2020-03/Synthesis%20Stocktaking%20Report.pdf

Preliminary findings RECIPES

- PP is a **legal principle**, has a role in law and policy at all levels (international, EU, national)
- PP is an **ethical responsibility**
- Endorsed as a powerful framework for improving decision-making for the environment, human health and consumer safety
- Various **calls for reform**
  - Industry lobby calls for “Innovation Principle” (see tomorrows regulatory capture lecture by Saltelli e.a,)
  - Environmental and health-oriented NGOs ask for wider use and stronger enforcement of the PP
  - No evidence that PP hampers innovation; evidence that PP can stimulate sustainable innovation
  - **Coupling PP with RRI?**

Responsible Research and Innovation (RRI)

- *Responsible Research and Innovation is a **transparent, interactive process** by which **societal actors and innovators** become **mutually responsive** to each other with a view on the (ethical) **acceptability, sustainability and societal desirability** of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society).*

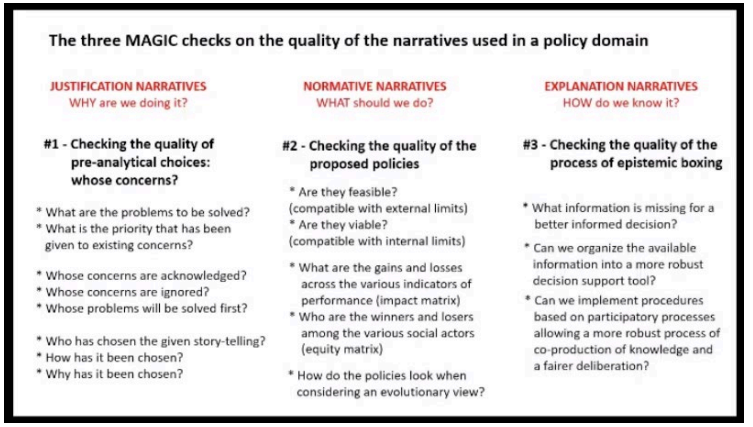
R. von Schomberg (ed.): *Towards Responsible Research and Innovation in the Information and Communication Technologies and Security Technologies Fields. A report from the European Commission Services*, 2012, p. 9.
https://publications.europa.eu/en/publication-detail/-/publication/60153e8a-0fe9-4911-a7f4-1b530967ef10/language-en

Table 1
Lines of questioning on responsible innovation.

Product questions	Process questions	Purpose questions
How will the risks and benefits be distributed? What other impacts can we anticipate? How might these change in the future? What don't we know about? What might we never know about?	How should standards be drawn up and applied? How should risks and benefits be defined and measured? Who is in control? Who is taking part? Who will take responsibility if things go wrong? How do we know we are right?	Why are researchers doing it? Are these motivations transparent and in the public interest? Who will benefit? What are they going to gain? What are the alternatives?

Stilgoe, Owen & Macnaghten, 2013
http://dx.doi.org/10.1016/j.respol.2013.05.008

Compare to Mario Giampietro 22 Sept PNS5DJ presentation here:



RRI is

- A **process** (see definition before)
- A **practice**
  - of the highest **integrity** and **quality**
- A **reflective & critical research culture**
  - Get rid of perverse incentives
- Need for internal **reform** of science

(PNS4, 15-17 Nov 2018 Barcelona: http://symposium.uoc.edu/go/pns4)

Sustainable Innovation at the core of the PP since:*

1974 German Clean Air Act: “Vorzorge Prinzip”

- Elements of danger should be recognised early, research is therefore essential;
- When irreversible effects are expected, measures ought to be taken even if one lacks good scientific knowledge, in other words, **clear and unambiguous proof of possible damage is not necessary**;
- The proportionality principle: **costs of action should not be disproportionate to the likely benefits**;
- **Authorities must support and accelerate technical development that can reduce the spread of environmentally harmful substances;**
- Cooperative approach between stakeholders via integrated policy measures;
- The **authorities should contribute to the introduction of cleaner processes and technologies in private trade and industry.**

** footnote: Condorcet presented this same insight in 1794 …*

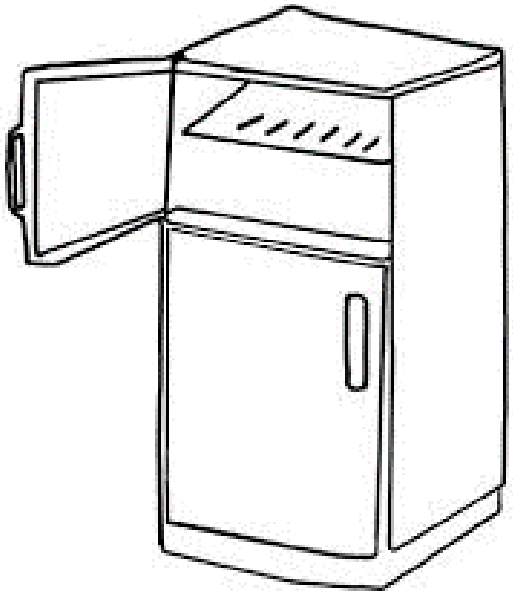
Implications of PP for Science

- Coping with uncertainty and value loading
- Be more realistic about the role and potential of science in assessment of complex risks
- Extended peer communities for precaution and sustainable development
- Transdisciplinarity https://www.oecd.org/science/addressing-societal-challenges-using-transdisciplinary-research-0ca0ca45-en.htm
- Increase protection of whistle blowers
- Enhance the role of monitoring and empirical research
- Enhance the role of vulnerability science: systematic search for surprises and ways to constrain them
- The need for critical self-reflection and discussion

Elements of post-normal science

- Appropriate management of uncertainty quality and value-ladenness
- Plurality of commitments and perspectives
- Internal extension of peer community *(involvement of other disciplines)*
- External extension of peer community *(involvement of stakeholders in environmental assessment & quality control)*

Conservation of misery
("risk migration" / regrettable substitution)
classic example



- NH_3 -> acute health risk
- Propane -> explosion risk
- CFC -> ozone layer
  - *1987 Montreal Protocol*
- PFC -> greenhouse gas
  - *1997 Kyoto protocol*
- HFCs (HFO-1234yf)

Risk migration in the circular economy

Propelling plastics into the circular economy – weeding out the toxics first

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ABSTRACT

The Stockholm Convention bans toxic chemicals on its persistent organic pollutants (POPs) list in order to promote cleaner production and prevent POPs accumulation in the global environment. The original 'dirty dozen' set of POPs has been expanded to include some of the brominated diphenyl ether flame retardants (POP-BDEs). In addition to cleaner production, there is an urgent need for increased resource efficiency to address the finite amount of raw materials on Earth. Recycling plastic enhances resource efficiency and is part of the circular economy approach, but how clean are the materials we are recycling? With the help of a new screening method and detailed analyses, we set out to investigate where these largely obsolete BDEs were showing up in Dutch automotive and electronics waste streams, calculate mass flows and determine to what extent they are entering the new product chains. Our study revealed that banned BDEs and other toxic flame retardants are found at high concentrations in certain plastic materials destined for recycling markets. They were also found in a variety of new consumer products, including children's toys. A mass flow analysis showed that 22% of all the POP-BDE in waste electrical and electronic equipment (WEEE) is expected to end up in recycled plastics because these toxic, bioaccumulative and persistent substances are currently not effectively separated out of plastic waste streams. In the automotive sector, this is 14%, while an additional 19% is expected to end up in second-hand parts (reuse). These results raise the issue of delicate trade-offs between consumer safety/cleaner production and resource efficiency. As petroleum intensive materials, plastic products ought to be repaired, reused, remanufactured and recycled, making good use of the 'inner circles' of the circular economy. Keeping hazardous substances – whether they are well known POPs or emerging contaminants – out of products and plastic waste streams could make these cycles work better for businesses, people and nature.

Top 10 of circumstances / characteristics of risk migration

Rank	Circumstance / characteristic	# cases
1	Lack of systems analytic approach	37
2	Incomplete life cycle assessment	27
3	Lack of critical reflection on risks and promised benefits	25
4	No incentives to meet ALARA	25
5	Persistence and/or bioaccumulation	17
6	Ignoring ignorance	14
7	Novel material / special unfamiliar properties	11
8	Mismatch novel aspects and authorization tests / standards etc	10
9	Unreflective upscaling from small scale experiences	9
10	Non standard situations	4

Factors that hamper early detection of unintended negative side effects

- Bias in appraisal of risks and benefits
- Required level of proof
- “We don’t want to know” / “Don’t spoil the party”
- Early warners sidelined or silenced
- Manufactured doubt
- Inadequate risk assessment – blind spots
- lack of monitoring
- institutional factors
- vested interests / power

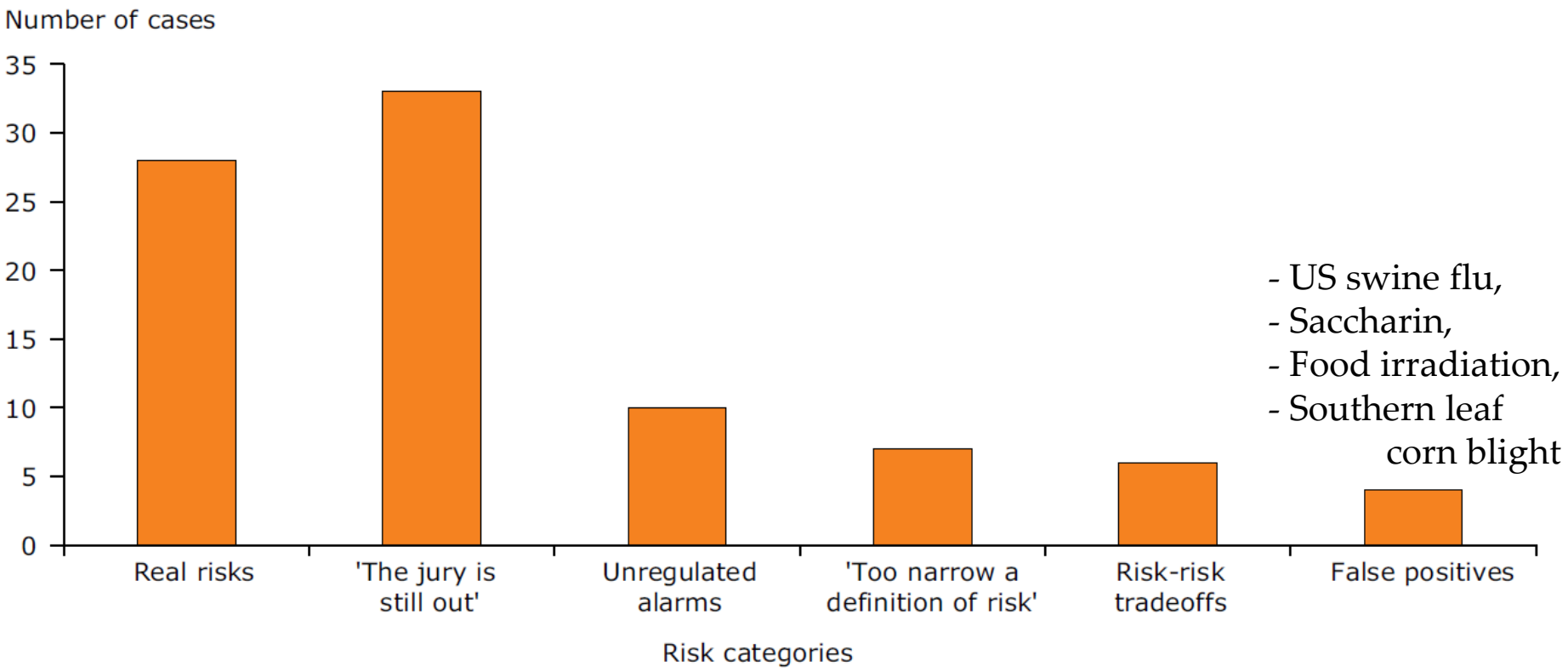
Critics on the PP

Critics have put forward the following arguments against the PP:

- PP is a brake on innovation, progress and change and deprives us of important benefits; False Positives
- The PP is unscientific, anti-science, subjective, political, intuitive, unpredictable, irrational
- Symmetry argument: precautionary actions can also be risky
- PP does not provide clear guidance / is not a good administrative principle

EEA Late Lessons II report:
Ch. 2: The precautionary principle and false alarms — lessons learned

Figure 2.1 Distribution of 88 proclaimed false positives



https://www.eea.europa.eu/publications/late-lessons-2/late-lessons-chapters/late-lessons-ii-chapter-2/view

Aligning the goals of precaution and innovation

- Precautionary principle is a stimulant and navigation system for innovation, not a break!
  - The 43 cases in the two Late Lessons reports and the 9 new RECIPES case studies show no evidence that precaution hampers innovation, but many examples where precaution promoted innovation.
- More attention needed for avoiding regrettable substitution
- Conflation of prevention and precaution

The Precautionary Principle is:

- ***NOT*** *the same as "****prevention****"* which is concerned with "known" risks". *"Precaution"* = Uncertain/unknown hazards/risks.
- ***NOT*** *based on "****zero risks****"* but aims to achieve lower/more acceptable risks/hazards
- ***NOT*** *proof against* ***mis-use*** or bad decision making
- ***NOT one sided*** – it applies to substitutes/alternatives too
- ***NOT based on anxiety/emotion***- but uses the best of the "systems sciences" of complex processes to make, hopefully,wiser decisions.
- ***NOT a guarantor of "consistency"*** between cases – each case is different/ has different facts. (as with legal cases)
- ***NOT*** a brake but a stimulant on innovation and can combat monopolies (CFCs, Asbestos, PCBs)