The ethics of risk

What is risk? Strictly, two categories have been identified: 'risk' (based upon known probabilities) and 'uncertainty' (epistemic – based upon what cannot be clearly identified). While life typically contains a measure of uncertainty, certain probabilities can be quantified, much like the tossing of a coin or the roll of a dice[1]. For each individual, even though they live with quantifiable 'risk', life is always risky, and generally, people have difficulty resolving risk-benefit conflicts. "People's perceptions frequently fail to match up with the actual dangers risks pose. Few people have a 'feel' for what a chance of dying, say a chance of one in a million, really means… We tend to emphasize low probabilities and underestimate those that are high"[2]. The use of statistics is one way to overcome this uncertainty; however, denial and overconfidence are more common ways to deal with it[3].

The main concern for regulatory bodies is to determine what risks are acceptable, both ethically and politically (what is ethically acceptable, and what will the public accept?). While realistically, risk management must be undertaken by regulatory bodies (a certain amount of paternalism seems unavoidable), lack of trust is a critical factor underlying controversy over technological hazards[4]. The playing field is tilted towards distrust, and 'the system destroys trust'[5]. Even being honest is more difficult than it appears, and scientists and policy makers who point out the gamble often taken in assessing risk are frequently resented for the anxiety their frankness provokes[6].

One of the philosophical theories proposed to address risk assessment is utilitarianism. Notwithstanding the fact that utilitarianism has been subject to devastating philosophical critique[7], it is still strongly favoured by many bioethicists. But where the literature on risk is concerned it seems to be generally agreed that utilitarianism (applied as cost-benefit analysis) is not an appropriate way to address this problem. Five main reasons have been identified:

- it is not democratic[8]
- it ignores unequal distribution of possible outcomes[9]

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[1] Hansson S E, "What is Philosophy of Risk?" *Theoria* 62 (1996) pp 169-86

[2] Teuber A. "Justifying Risk" *Daedalus* 119 (1990) 235-253

[3] Slovic P, Fischhoff B and Lichtenstein S. "Cognitive Processes and Societal Risk Taking", in Slovic P (ed.) *The Perception of Risk*, Earthscan London 2000, pp 32-50

[4] Slovic P "Perceived Risk, Trust and Democracy", in Slovic P (ed.) *The Perception of Risk*, Earthscan London 2000, pp 316-326

[5] *ibid*

[6] Slovic, Fischhoff, Lichtenstein (2000) *op cit*

[7] Cf Smart, J. J. C. & Williams, B. *Utilitarianism For & Against*, Cambridge, Cambridge University Press, 1990; Williams, B. *Ethics and the Limits of Philosophy*, Fontana Press, London, 1985

[8] Fischhoff B. "Acceptable Risk: A Conceptual Proposal", *Risk: Health, Safety and the Environment* Vol 5 (1): 1994.

- it is value-blind[10]
- it attempts to measure what human life is worth[11]
- it tries to reach a definite conclusion from insufficient information[12]

As an alternative to utilitarianism, contract theories have also been applied to risk assessment and have been criticised on other grounds, whether consent is actual or hypothetically derived. Criticism has been made because:

- obtaining a genuine consent is unrealistic and seeking it could create a stalemate[13]
- there can be too much faith in contracts, leading to the undesirable consequence that "only consent can turn a potential violation of a right into a permissible act"[14].

Even if an ethic of 'natural rights' is used as a basis for risk regulation, the fact is that harms vary qualitatively and their probabilities vary quantitatively. Some writers view this as insurmountable and therefore sufficient grounds on which to dismiss a natural rights theory of risk. This problem is sometimes call *causal dilution*[15]: "Given that a certain moral theory prohibits a certain action because it has the property P, under what conditions should a generalized version of the same theory prohibit an action because it possibly, but not certainly, has the property P?"

Altham[16] rejects utilitarian, contractual, and natural rights theories, citing fatal problems with each. His solution is to have no principle on which to base risk management; but to simply find the level of risk at which people do not feel anxious (based upon their own assessment of their quality of life) regardless of the facts, and their desire to reach agreement will cause them to accept the risk. For him risk is therefore entirely subjective.

McKerlie[17] argues that moral views based on rights cannot deal with risk. Not only is a hostile intention not necessary for a rights violation, but "an action that turns out to

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[9] *ibid* (for example, benefits for many but disastrous consequences for a few)

[10] Baron D S "The Abuses of Risk Assessment", in Waterstone M (ed.) *Risk and Society: The interaction of science, technology and public policy*, Kluwer Academic Publishers 1992, pp 173-1778

[11] Teuber (1990) *op cit*; the problem of saving lives immediately at risk.

[12] Hansson SE, "Philosophical perspective on risk" *Ambio* Vol 28 (6) Sept 1999, pp 539-542, also Hansson S O "The False Promises of Risk Assessment", *Ratio* 6 (1) June 1993, 16-26

[13] Fischhoff (1994) *op. cit*; Hansson S O "What is philosophy of risk?", *Theoria* 62 (1996) 169-186

[14] Teuber (1990) *op cit*

[15] Hansson (1999) *op cit*

[16] Altham J E J "Ethics of Risk", *Proceedings of the Aristotelian Society* 1984, pp 15-29

[17] McKerlie D "Rights and Risk", *Canadian Journal of Philosophy* 16 (2) June 1986, pp 239-252

be harmless may nevertheless have been prohibited, while an action that causes harm may nevertheless have been permissible", e.g. driving down one's street versus Russian roulette . He also rejects the view that rights correspond with autonomy.

McKerlie also argues that "In many examples the rights view chooses an action that will not lead to the best outcome. For example, it will tell us not to kill an innocent person even if that would somehow save the lives of many others."[18] In saying this, of course, McKerlie does not identify a problem with natural law reasoning *per se*. He just assumes we have the right to do whatever is necessary to achieve what, on other grounds, he wants the outcome to be.

It also appears that 'scientific' risk assessment cannot be separated from either the values or management issues. Analysis cannot replace process, only inform it[19]. And science cannot pretend to be 'objective'[20]. What is studied, how the research is designed, how it is interpreted and reported are all value-laden [21]. This leads to three corollaries:

- Disagreement about risk will not disappear in the face of 'scientific evidence'[22].
- 'Public education' is not the sole answer[23].
- We don't need improved risk assessment techniques; we need greater participation in decision-making[24].

Most writers therefore suggest that ethical guidelines, or values, should be established first. The process of risk regulation should be, at least to some extent, democratic, because the procedure of decision-making is as important as the outcome[25]. Therefore much research into the public's 'perceptions of risk' has been and is being conducted.

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[18] *ibid*

[19] Fischhoff (1994) *op cit*

[20] Thompson P B "Risk Objectivism and Risk Subjectivism: When are Risks Real?" *Risk: Health, Safety and the Environment* 1: 3 (1989) Also find at www.fplc.edu/risk/vol1/winter/thompson.htm

[21] For example see Cranor C. "Scientific Conventions, Ethics and Legal Institutions", *Risk: Health, Safety and the Environment* 1 (1989):155. Presentation given at Symposium on Public Participation in Risk Management. www.fplc.edu/risk/vol1/spring/cranor.htm; the ethics of confidence and type I and II errors.

[22] Slovic, Fischhoff and Lichtenstein (2000) *op cit*

[23] Freudenberg W R and Rursch J A, "The risks of 'putting the numbers in context': a cautionary tale", in Löfstedt R and Frewer L, *The Earthscan Reader in Risk and Modern Society*, Earthscan London 1998, pp 77-90

[24] Teuber (1990) *op cit*

[25] Renn O. "Concepts of risk: a classification" in Krimsky S and Golding D (ed.) *Social Theories of Risk*; Praeger, London: 1992, ch3 pp 53-79, Fischhoff (1994) *op cit*

For example, a comparison of rival theories of risk perception considers the following[26]:

1. *knowledge:* people perceive things to be dangerous because they know them to be dangerous.
2. *personality theory:* some love risk-taking, others are averse.
3. *economic theory:* (a) the rich are more willing to take risks because they benefit more and are shielded from the consequences, while the poor feel the opposite; (b) "post-materialist" – living standards have improved so the rich are more interested in social relations and better health.
4. *political theory:* struggles over interests, i.e. explanatory power in social and demographic characteristics.
5. *cultural theory:* individuals choose what to fear (and how much to fear it) in order to support their way of life. (Renn categorises people as hierarchists, individualists or egalitarians).

Wildavsky and Dale conclude that cultural theory provides the best prediction of how people will perceive risk in a variety of situations. This corresponds with Teuber's conclusion that "we are not only end-oriented; we are also ideal-oriented. We do not care just about where we end up; we care about the kind of people we have to become in order to end up in one place or another"[27].

An evaluation of risk can't just measure against the benefits. Other characteristics are also important: control, familiarity, knowledge, and immediacy of benefits[28]. For example, voluntariness and control are important: people will accept more risk if they perceive to have more control (e.g. the "irrational" preference for driving over flying)[29]. But should the fact that people have double standards for different types of risk (feelings of dread, unfamiliarity, involuntarily accepted, control) be imposed upon industry?[30]

So how do we determine acceptable levels of risk? Considerations of policy regarding risks are highly complex:

> The acceptability of risk is a relative concept and involves consideration of different factors. Considerations in these judgments may include: The certainty and severity of the risk; the reversibility of the health effect; the knowledge or familiarity of the risk; whether the risk is voluntarily accepted or involuntarily imposed; whether individuals are compensated for their exposure to the risk; the advantages of the activity; and the risks and advantages for any alternatives.[31]

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[26] Wildavsky A and Dake K, "Theories of risk perception: who fears what and why?" *Daedalus* 119 (1990) pp 41-60

[27] Teuber (1990) *op cit*

[28] Slovic (2000) *op cit*

[29] Renn (1992) *op cit*, Slovic (2000) *op cit*

[30] Fischhoff (1994) *op cit*

[31] 53 Fed. Reg., at 28,513. cited in Fischhoff (1994) *op cit*

Some authors have compared a variety of ways to answer the question "which risks are acceptable?"[32]:

a) cost-benefit analysis
b) revealed preferences based on behaviour(assumes people have information and can use it optimally)
c) expressed preferences by directly asking people what they prefer(considered more democratic)
d) natural standards ('biological wisdom', that is, assuming that the optimal level of exposure is that under which the species evolved is acceptable)
e) multiple hazards (considering many hazards at once, and therefore needing to prioritise)
f) facing political realities (can't please everyone at once)
g) muddling through intelligently (no approach is clearly superior, so careful consideration should be given to all aspects, and good analysis should be insightful but not necessarily conclusive)
h) a combined approach (using the various approaches well enough in combination so that they complement one another's strengths rather than compound each other's weaknesses) – this is the one recommended by these authors.

Some consider that muddling through may be the only ethical way to make choices about public risk[33]. Fischhoff presents a detailed description of 'orderly muddling' risk regulation[34]. He and others suggest that the *reasonable person standard* could be used to determine generally acceptable tradeoffs, and that acceptable tradeoffs must be ones that citizens endorse in principle (rather than actual or hypothetical consent)[35].

IMPLICATIONS FOR GMOS

There has been a tendency for a 'Mexican stand-off' between companies involved in experiments with GMOs and large sections of the community that seem to distrust the safety and necessity for these developments.

Coming from the scientific and industry side, the developmental stages in risk management identified by Fischhoff seem to have been applied so far:

- All we have to do is get the numbers right
- All we have to do is tell the public the numbers
- All we have to do is explain what we mean by the numbers
- All we have to do is show the public that they have accepted similar risks in the past
- All we have to do is show the public that it's a good deal for them
- All we have to do is treat the public nicely

[32] Slovic, Fischhoff, Lichtenstein (2000) *op cit*

[33] Teuber (1990) *op cit*

[34] Fischhoff (1994) *op cit*

[35] Fischhoff (1994) *op cit*, Thompson (1989) *op cit*

- All we have to do is make partners of the public
- All of the above[36]

Yet many sections of the community remain *sceptical* about the numbers because of their anxiety about a number of things. They are concerned that scientists cannot identify in advance all of the variables and then control for them, and that there may be catastrophic unforeseen consequences. Some argue that given there is no real necessity for these developments when the world already produces sufficient food for its populations (although we are nowhere near achieving equitable distribution), are these risks worth taking? Is it possible that the ones who are really running the agenda on risk assessment are those who stand to gain most financially and/or professionally from these developments? And if that is the case, is it possible that risks are, inadvertently or otherwise, being minimised? Moreover, many sections of the public simply do not trust "experts" where environmental issues are concerned.

That is, the attitudes one brings to a particular issue where risk assessment is concerned may well condition what one makes not only of the evidence that is available but who is interpreting the evidence.

Assuming the efficacy of objective risk assessment, Philip Regal puts it this way:

> "Philosophers of science could do a great deal to improve the quality of risk assessment by helping regulators and the public to further identify and understand the differences between judgments based on credible scientific information and theory, and judgments based on world-views that include theory reductionism, essentialism, idealism, Greek cosmology, and utilitarianism masking as objective science … [S]ome environmentalists … also mistake Platonic or Aristotelian models of the balance and perfection of nature for hard science. They may strongly oppose any modifications of nature and may make the false claim that the science of ecology warns that any disturbance of nature is unsafe."[37]

There needs to be better communication and trust between agribusiness and science on the one hand, and the community on the other if a process is to be developed which will provide an agreed basis for risk assessment. At the moment public disquiet on the risks involved with GMOs is unlikely to be met by bland assurances of safety from business, government, and scientific authorities. That is, "just trust us" doesn't quite cut it.

The Hastings Center (US) recently launched an international project, *Public Perceptions of Agricultural Biotechnology*, which is funded by the Rockefeller Foundation. At its first meeting in May 2000, participants from Europe and the US

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[36] Fischhoff, B (1998), *op. cit.*, 134

[37] Regal P J "Metaphysics in Genetic Engineering: Cryptic Philosophy and Ideology in the 'Science' of Risk Assessment", appears in Ad Van Dommelen (ed.) *Coping with Deliberate Release: The Limits of Risk Assessment*, International Center for Human and Public Affairs, Tilburg/Beunos Aires 1996: 15-32. Find also at www.psrast.org/pjrbiosafety.htm

"generally agreed that perceptions of risk and benefit are multilayered and cannot be properly understood by scientific interpretations alone."[38]

John I Fleming, PhD, Director, Southern Cross Bioethics Institute
Gregory K Pike, PhD, Deputy Director, Southern Cross Bioethics Institute
Selena Ewing, B.H.Sc., Research Officer, Southern Cross Bioethics Institute

[38] *Hastings Center report*, July-August 2000, 47

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Bibliography

Adam, Barbara, "Industrial Food for Thought: Timescapes of Risk", *Environmental Values*. 1999; 8(2), 219-238.

Altham, J E J "Ethics of Risk", *Proceedings of the Aristotelian Society* (1984), 15-29.

Anderson, Elizabeth "Values, Risk, and Market Norms", *Philosophy & Public Affairs* 17 (1988), 54-65.

Andre, Judith "Nagel, Williams and Moral Luck", *Analysis* 43 (1983), 202-7.

Baron D S "The Abuses of Risk Assessment", in Waterstone M (ed.) *Risk and Society: The interaction of science, technology and public policy*, Kluwer Academic Publishers 1992, pp 173-1778

Brady, James B "Conscious Negligence", *American Philosophical Quarterly* 33 (1996), 325-35.

Braybrooke, David "Limits to Risk", *Transaction Social Science and Modern Society* 28 (1991), 23-7.

Brunk, Conrad et al "Is a Scientific Assessment of Risk Possible? Value Assumptions in the Canadian Alachlor Controversey", *Dialogue* 30 (1991), 235-47.

Byrd III, D & Lave L "Significant Risk Is Not the Antonym of De Minimis Risk", in While (ed.) *De Minimis Risk*.

Claycamp, H Gregg "Negligible Risk & Cellular Transmitters", *Risk: Health, Safety & Environment* 9 (1998), 101-8.

Cohen, Maurie J, "Science and Society in Historical Perspective: Implications for Social Theories of Risk", *Environmental Values*. 1999; 8(2), 153-176.

Cranor C. "Scientific Conventions, Ethics and Legal Institutions", *Risk: Health, Safety and the Environment* 1 (1989):155. Presentation given at Symposium on Public Participation in Risk Management. www.fplc.edu/risk/vol1/spring/cranor.htm

Cranor Carl F "The Normative Nature of Risk Assessment: Features and Possibilities", *Risk: Health, Safety & Environment* 8 (1997), 123-36.

Curlo, Eleonora, "Marketing Strategy, Product Safety, and Ethical Factors in Consumer Choice", *Journal of Business Ethics*. 1999; 21(1), 37-48.

Davis, Michael, "Telling the Truth about Risk Assessments: Commentary on 'The Ethics of Truth Telling and the Problem of Risk' (Paul Thompson)", *Science and Engineering Ethics*. 1999; 5(4), 511-13.

de Melo-Martin, Immaculada "Ethics and Uncertainty: In Vitro Fertilization and Risks to Women's Health", *Risk: Health, Safety & Environment* 9 (1998), 201-27.

Dworkin, Gerald "Taking Risks, Assessing Responsibility", *The Hastings Center Report* October 1981, 26-31.

Fiksel, Joseph "De Minimis Risk: From Concept to Practice", in While (ed.) *De Minimis Risk*.

Fischhoff B and Fischhoff I, "Will they hate us? Anticipating unacceptable risks", *Risk Management* (in press) July 2001.

Fischhoff B, Slovic P and Lichtenstein S. "Weighing the Risks: Which Risks are Acceptable?", in Slovik P. (ed.) *The Perception of Risk*, Earthscan London 2000, pp 121-136

Fischhoff B, Slovic P, Lichtenstein S, Read S and Combs B. "How safe is safe enough? A psychometric study of attitudes toward technological risks and benefits", in Slovic P. (ed.) *The Perception of Risk*, Earthscan London 2000, pp 80-103

Fischhoff B. "Risk Perception and Communication Unplugged: Twenty Years of Process", in Löfstedt R and Frewer L, *The Earthscan Reader in Risk and Modern Society*, Earthscan London 1998; ch 6 pp 133-145

Fischhoff, Baruch "Acceptable Risk: A Conceptual Proposal", *Risk: Health, Safety & Environment* 5 (1994) Also find at www.fplc.edu/risk/vol5/winter/Fischhof.htm

Freudenberg W R and Rursch J A, "The risks of 'putting the numbers in context': a cautionary tale", in Löfstedt R and Frewer L, *The Earthscan Reader in Risk and Modern Society*, Earthscan London 1998, pp 77-90

Fritzsche, Andrew F "The Moral Dilemma in the Social Management of Risks", *Risk: Health, Safety & Environment* 7 (1996), 291-5.

Glover, Jonathan, *Causing Death and Saving Lives*, London 1977.

Halfmann, Jost, "Community and Life Chances: Risk Movements in the United States and Germany", *Environmental Values*. 1999; 8(2), 177-197.

Hansson, Sven Ove "Can we reverse the burden of proof?", *Toxicology Letters* 90 (1997), 223-8.

Hansson, Sven Ove "Decisions Making Under Great Uncertainty", *Philosophy of the Social Sciences* 26 (1996), 369-86.

Hansson, Sven Ove "The False Promises of Risk Analysis", *Ratio* 6 (1993), 16-26.

Hansson, Sven Ove "The Limits of Precaution", *Foundations of Science* 2(1997), 293-306.

Hansson, Sven Ove "What is philosophy of risk?", *Theoria* 62 (1996), 169-86.

Hansson, Sven Ove, "A Philosophical Perspective on Risk", *Ambio*, 28:539–542, 1999.

Hansson, Sven Ove, "Adjusting Scientific Practices to the Precautionary Principle" *Human and Ecological Risk Assessment*, 5:909-921, 1999.

Hansson, Sven Ove, "The Moral Significance of Indetectable Effects", *Risk* 10:101-108, 1999.

Hansson, Sven Ove, review of Erik Nord, Cost Value Analysis in Health Care. Making Sense out of QALYs, *Philosophical Quarterly*, in press.

Hardin, Russel "Ethics and Stochastic Processes", *Social Philosophy & Policy*, 7 (19??), 69-79.

Hughes J "GM Crops, the Precautionary Principle and the Case for a Moratorium", Presentation given to the Annual Society for Applied Philosophy in Manchester, May 2000. http://homepages.tesco.net/~jonathon.hughes/gmcrops.htm

Jackson, Frank "A probabilistic approach to moral responsibility", in R Barcan Marcus et al (eds) *Proceedings of the 7th International Congress of Logic, Methodology and Philosophy of Science* (1983).

Jasanoff, Sheila, "The Songlines of Risk", *Environmental Values*. 1999; 8(2), 135-152.

Kane, Robert "Responsibility, Luck, and Chance: Reflections on Free Will and Indeterminism", *Journal of Philosophy*, 96 (1999), 217-40.

Keating, Gregory C "Reasonableness and Rationality in Negligence Theory", *Stanford Law Review* 48 (1996), 311-84.

MacLean, D "Risk and consent: philosophical issues for centralised decisions", in MacLean: *Values at Risk*.

MacLean, D (ed.) *Values at Risk*, New Jersey 1985.

Marshall, Brent K Globalisation, Environmental Degradation and Ulrich Beck's *Risk Society Environmental Values*. 1999; 8(2), 253-275.

Marx, T.G.: "The Cost of Living" *Policy Review* 25 (1983), 53-8.

McCarthy, David "Liability and Risk" *Philosophy & Public Affairs* 25(1996), 238-62

McKerlie, Dennis "Rights and Risk", *Canadian Journal of Philosophy*, 16(1986), 239-52.

McLain, David L; Keenan, John P Risk, "Information, and the Decision about Response to Wrongdoing in an Organization", *Journal of Business Ethics*. 1999; 19(3), 255-271

Mehta, Michael D "Risk Assessment and Sustainable Development: Towards a Concept of Sustainable Risk", *Risk: Health, Safety & Environment* 8(1997), 137-54.

Meinhold, Charles B "The NCRP Considerations on Levels of Negligible Risk", in While (ed.) *De Minimis Risk.*

Menkes, J & Frey, S "De Minims Risk as a Regulatory Tool", in While (ed.*) De Minimis Risk.*

Meyers, Sheldon "A lications of De Minimis", in While (ed.) *De Minimis Risk*.

Mole R H "Accepting Risks for Other People", *Proc Roy Soc Med* 69 (1976), 107-13.

Perhac Jr, Ralph M. "Environmental Justice: The Issue of Disproportionality" *Environmental Ethics*. 1999; 21(1), 81-92.

Persson, Lars "Ethical Issues in Radiation Protection", *Radiation Prodection Dosimetry* 86 (1999), 83-5.

Regal P J "Metaphysics in Genetic Engineering: Cryptic Philosophy and Ideology in the 'Science' of Risk Assessment", appears in Ad Van Dommelen (ed.) *Coping with Deliberate Release: The Limits of Risk Assessment,* International Center for Human and Public Affairs, Tilburg/Beunos Aires 1996: 15-32. Find also at www.psrast.org/pjrbiosafety.htm

Rehman-Sutter, Christoph "Toward an Ethical Concept of Risk", *Risk: Health, Safety & Environment* 9 (1998), 109-18.

Renn O. "Concepts of risk: a classification" in Krimsky S and Golding D (ed.) *Social Theories of Risk*; Praeger, London: 1992, ch3 pp 53-79

Rescher, Nicholas Risk: *A Philosophical Introduction to the Theory of Risk Evaluation and Management,* New York 1983.

Rosebury, Brian "Moral Responsibility and 'Moral luck'", *The Philosophical Review*, 104 (1995), 499-524.

Rosenberg, Shapir "Luck and Responsibility", *Dialogue*, 41 (1999), 38-44.

Rowe W D. "Risk analysis: a tool for policy decisions", in Waterstone M. (ed.) *Risk and Society: The interaction of science, technology and public policy*, Kluwer Academic Publishers 1992, pp 17-31

Sandin, Per "Dimensions of the Precautionary Principle", *Human and Ecological Risk Assessment* 5 (5), pp. 889-907, 1999.

Sapolsky H M. "The politics of risk", *Daedalus* 119 (1990) pp 83-96

Schultz, William B "Why the FDA's De Minimis Interpretation of the Delaney Clause Is a Violation of Law", *Journal of the American College of Toxicology*, 7 (1988), 521-7

Schuyt, Kees, "The Sharing of Risks and the Risks of Sharing: Solidarity and Social Justice in the Welfare State", *Ethical Theory and Moral Practice*. 1998; 1(3), 297-311.

Sen, Amartya "Rationality and Uncertainty", Theory and Decision, 18 (1985), *Journal of the American College of Toxicology*, 109-27.

Shrader-Frechette, Kristin "Technological Risk and Small Probabilities", *Journal of Business Ethics* 4 (1985), 431-45.

Shrader-Frechette, Kristin Risk and Rationality. *Philosophical Foundations for Populist Reforms*, Berkely 1991.

Simons, Kenneth W,"Negligence", *Social Philosophy and Policy*. 1999; 16(2), 52-93.

Slovic P "Perceived Risk, Trust and Democracy", in Slovic P (ed.) *The Perception of Risk*, Earthscan London 2000, pp 316-326

Slovic P, Fischhoff B and Lichtenstein S. "Cognitive Processes and Societal Risk Taking", in Slovic P (ed.) *The Perception of Risk*, Earthscan London 2000, pp 32-50

Slovic P, Fischhoff B and Lichtenstein S. "Rating the risks", in Slovic P (ed.) *The Perception of Risk*, Earthscan London 2000, pp 104-120

Spangler, Miller B "A Summary Perspective on NRC's Implicit and Explicit Use of De Minimis Risk Concepts in Regulating for Radiological Protection in the Nuclear Fuel Cycle", in While (ed.) *De Minimis Risk*.

Statman, Daniel "Moral and Epistemic Luck", *Ratio* 4 (1991), 146-56.

Szerszynski, Bronislaw Risk and Trust: "The Performative Dimension", *Environmental Values*. 1999; 8(2), 239-252.

Taylor, Michael R "The De Minimis Interpretation of the Delaney Clause: Legal and policy Rationale", *Journal of the American College of Toxicology*, 7 (1988), 529-73

Teuber Andreas "Justifying Risk", *Daedalus* 119 (1990), 235-54.

Thompson P B "Risk Objectivism and Risk Subjectivism: When are Risks Real?" *Risk: Health, Safety and the Environment* 1: 3 (1989) Also find at www.fplc.edu/risk/vol1/winter/thompson.htm

Thompson, Paul B, "The Ethics of Truth Telling and the Problem of Risk", *Science and Engineering Ethics*. 1999; 5(4), 489-510

Thomson, Judith Jarvis "Imposing Risks", in *Rights, Restitution, and Risk* London 1986.

Thomson, Paul B "Risking or being willing: Hamlet and the DC-10", *Journal of Value Inquiry* 19 (1985), 301-10.

Thomson, Paul B "The Philosophical Foundations of Risk", *The Southern Journal of Philosophy* 24 (1986), 273-86.

Travis, C & Richter S "On Defining a De Minims Risk Level for Carcinogens", in While (ed.) *De Minimis Risk*.

VanDoren, Peter Chemicals, Cancer, and Choices: *Risk Reduction through Markets* CATO Institute : Washington D C, 1999.

Von Magnus, Eric "Preference, Rationality, and Risk Taking", *Ethics* 94(1984), 637-48.

von Winterfeldt D. "Expert Knowledge and Public Values in Risk Management: The Role of Decision Analysis", in Krimsky S and Golding D (ed.) *Social Theories of Risk* Praeger, London: 1992, ch 14 pp 321-342

Walker, Margaret "Moral Luck and the Virtues of Impure Agency", *Metaphilosophy* 22 (1991), 14-27.

Weale, Albert "Statistical lives and the principle of maximum benefit", *Journal of Medical Ethics* 5 (1979), 185-95.

Weinberg, Alvin M "Science and its Limits: The Regulator's Dilema", *Issues in Science and Technology* 1985, 59-72.

While, Chris "A lication of the De Minimis Concept in Risk Management", in While (ed.) *De Minimis Risk.*

While, Chris (ed.) *De Minimis Risk*, New York 1987.

Wicclair, Mark R, "The Continuing Debate Over Risk Related Standards of Competence", *Bioethics*. 1999; 13(2), 149-153.

Wildavsky A and Dake K. "Theories of Risk Perception: Who Fears What and Why?" *Daedalus* 119 (1990) 41-60

Williams, Bernad & Nagel, Thomas "Moral Luck", *Proceedings of the Aristotelian Society* : Su . 50 (1976), 115-35.

Zimmerman, Michael "Luck and Moral Responsibility" *Ethics* 97 (1987)

Zimmerman, Michael "Negligence and Moral Responsibility", *Nous* 20 (1986), 199-218.