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ETHICS AND SAFETY: ‘MORTAL ’QUESTIONS FOR SAFETY MANAGEMENT

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ABSTRACT

The paper discusses values and principles applied in safety decision-making and actions. However, there is no straightforward answer to what is safe enough. Therefore, the purpose of this section is to present some alternative and supplementing lines for reasoning around some fundamental questions of life and death of relevance for safety management in industry, and for individuals and society. The main focus is on high-hazard industries.

Purpose and scope

The challenge for safety management is being rational within accepted rules of facts and logic on one hand, and considering values and opinions of the public on the other hand. Døderlein (1987) describes the role distribution in safety decisions as cycles between political value decisions and scientific endeavour. Leiss and Krewski (1989) make a similar distinction between the domain of technical risks (the expert sphere) and the domain of perceived risk (the public sphere). The increased concern about the ethical aspect of safety is revealed at different levels and domains by:

- the activities of popular movements as a driving force for a safety agenda,
- mass media publicity, and an issue in political debates,
- legislation and standardisation, control and certifying activities at both national and international arenas based on moral obligations and/or on market needs.

In the popular literature on ethics in industry, we will find a variety of definitions, e.g. “ethics is practical wisdom, and its aim is quality of life”, “ethics is organised hindsight, since experience creates care and respect for the vulnerable and irreplaceable”, “ethics is the struggle against destruction”. None of these phrases are right or wrong, but they reflect a different focus dependent on the context and contents of the actual ethical discussion. A fundamental aspect of safety management is to take care of basic human values, e.g. protection of individuals’ life and health, property, human dignity, personal freedom and needs

adjusted to requirements for a sustainable development, etc. In dealing with risk issues, moral¹ questions are inevitable.

The moral guides and regulates behaviour. The resulting shared beliefs and their expressions within groups are a core element in the collective concept of “*culture*”. The function of laws, regulations and rules is to express and impose moral based norms and standards. Ideally, the relation between the legal (the law) and the legitimate (the moral) should be consistent in society, as well as the goals and objectives of a company should reflect the corporate culture and safety related cultural aspects. Discrepancies are a crucial problem to be aware of and cope with in safety management. In controversial risk and technology assessments and decisions we can sometimes hear “whistle-blowing” from employees based on the ethics of a profession, e.g. the Challenger accident, and illegal actions by pressure groups, e.g. environmentalists as Greenpeace, can be frequently noticed in the news. Industry spokespersons sometimes attribute whistle blowing and actions to ignorance of facts and paranoia. However, it is often a signal of blocking in risk communication due to lack of awareness and recognition of different lines of ethical arguments.

From a tamed and regulated industrial society to a wild post-modern “risk society”²

The first part of the industrial era was driven by a laissez fair profit making without any ethical considerations of human life and suffering except for the voice of some philanthropic organisations. The last hundred years have been a fight for increased societal safety, health and environmental regulations and control of industrial capitalism lead by the labour movement regarding occupational safety and health and the growth of environmentalist organisations since the publishing of “The Silent Spring” by Rachel Carson in 1962. Gradually the high-risk industries in Western countries became “tamed” by rather effective safety control regimes. The last 10-15 years have brought us back to the features of laissez faire regimes and the “law of the jungle” regarding safety management. Both the industries and the risks have become internationalised combined with a deregulation and privatisation of regulations and control regimes.

- Social scientists, e.g. Beck (1986; 1997), Perrow (1984) and Sagan (1993), look at risk issues and uncertainties regarding the current development of technologies and societies as a transaction period to a new modernity, a post-industrial era named “the risk society” by U. Beck. According to Beck (op.cit) the successes of industrial capitalism supported by the fast progress in science and technology undermine its own preconditions. However, I have no evidence for claiming that the risks have increased lately. The life in the industrial society could be dangerous, but we had some understanding of the risks’ sources and causes, magnitude and local effects. The new technological risks, nuclear, chemical, ecological, genetic, etc. are difficult to separate and survey in time and space, to explain by rules of causality, to define in terms of guilt and punishment, to compensate or to insure, i.e. “produced uncertainties” in the terminology of U. Beck. The new patterns in managing these “produced uncertainties” in terms of buzz words like “Business Process Reengineering” (BPE), “Just in time” (JIT), downsizing, outsourcing, etc. driven by cost cutting and short-term profit-making, generate systems lacking liability for the ethics of decisions and activities. These transitions have generated an increased debate about the social responsibility of business and ethics of business.
- The last century, and in particular the last decades, have brought about accelerating, dramatic changes in the living conditions. We are far safer than our ancestors in most areas. Still, in many ways we are living in “the age of uncertainty” (Galbraith 1977) and approaching the “risk society” (Beck, 1992). The uncertainty is tied to the rate of change. Our value systems, social institutions like the core family, political institutions like parliaments and political parties, public administration, education systems based on subjects and professions etc. were formed a century ago, based on the needs of that period. This is an important part of the “interlocking crisis” discussed in “Our common future” by the Brundtland Commission (1987). The wish for social and

¹ For a discussion of ethical dilemmas related to decisions and actions in risk handling at all levels, some basic concepts should be used in a distinct way. The main concepts can be summarised as follows (Andersen & Sørensen, 1992): *Ethics* means moral philosophy or the theory of moral. *Moral* is the set of norms and values that guides our behaviour. *Norms* are standards based on fundamental values of society and individuals.

² The concept of “risk society” is based on the book with the same title by Ulrich Beck (1992).

economic development can conflict with the need for social stability and predictable risks which we know how to handle or are used to deal with.

- In many cases the introduction of new technology has created more efficient and reliable, but also more vulnerable socio-technical systems. This may be described as what Perrow (1984) calls 'system accidents'. System accidents imply an unforeseen interaction of multiple faults in a complex high hazard system. If the consequence potential is fatal, and the system properties are such that one is left with a remaining risk of the kind "little strokes fell great oaks", then it may be better to stick to Murphy's law instead of probability assessments: "Everything that may go wrong, does go wrong - at the worst possible point of time".

Main ethical lines of reasoning

In discussions on risk issues it is also important to be aware of the two main approaches for defending moral actions: 1) ethics of the mind - focusing on the purpose, meaning or intention of the action. 2) ethics of the consequence - focusing on the good or bad results of an action.

The moral guides and regulates behaviour. Laws, regulations and rules have the same function. Hale (1993) describes a shift in safety regulations and control from "end results/ compensation oriented" to "decision-rule/prevention oriented". In a way this can be considered as a shift in approach from ethics of the consequences to ethics of the mind, e.g. punish not trying instead of bad results.

To simplify the main approaches to ethics in the rich literature of philosophy, we may give attention to four groups of approaches or traditions in moral thinking:

- **UTILITY:** rational choice, risk-cost-effectiveness, human self-interest, maximises utility.
- **DUTY:** obligations, responsibility, guilt and punishment, human integrity, the good will.
- **JUSTICE:** risk distribution, politics: benefits and burdens, "maximise the minimum".
- **DISCOURSE:** participative, free informed consent, convince, democratic, socio-cultural reasoning.

Utility/rational choice: Utility ethics or utilitarianism starts with what is good and focuses on how to maximise what is good, and minimise what is bad (usually ascribed to Jeremy Bentham and John Stuart Mill). It gave the reasons for today's rational choice models and cost-benefit analysis in decision-making, "management by objectives", etc. Utility ethics has been the most common way of making technological risks legitimate in society. In safety management this tradition fits well with the positivistic and quantitatively oriented approaches for risk analysis, models for estimating the value of life, etc. based on preconditions of the enlightened self interest of individuals.

Duty: This tradition goes back to the formulation of the Ten Commandments in the Bible. The morally good behaviour is not a consequence of virtue and wisdom but of duty (deontological ethics). Immanuel Kant represented the ethics claim that we by reasoning ("Vernunft") can reach an ethical responsibility free from coincidences and emotions. The duties to moral imperatives are the guidelines for action, i.e. mainly the ethics of the mind, the "good will". Kant's categorical imperative is formulated in many ways. A simple version is "You shall act in such a way that the principle for your action can represent a general law". Many arguments for regulations and safety control systems, for protecting people from harm, for safety remedial actions considering individuals' integrity, for the "right to know" principle, etc. are rooted in the ethics of Kant. Duty is also related to responsibility and obligations, and by that it is an implicit ethical assumption in laws and regulations, and in the premises of court trials on guilt and punishment for safety offences (Bjordal, 1996).

Justice: Based on moral intuition and reasoning John Rawls (1971) stated that justice means that I would prefer this society even if I am completely uncertain about my own position in it. This approach will often recommend actions different from the utilitarian principles, and the controversy is revealed in political conflicts on safety issues between capital and labour, between popular environmental pressure groups and industry, etc. The ethics of justice are of special relevance in decisions on risk distribution and risk equity, and will often be in conflict with criteria for action based on risk efficiency (rational economic/utilitarian criteria) as it will give priority to the least advantaged, i.e. a "maximise minimum" precaution principle.

Discourse: An alternative to the moral intuition approaches is the discourse ethics formulated by Jürgen Habermas. It is based on assumptions of man living in a society and not acting as isolated individuals. A valid ethics is related to structures of power and knowledge. Habermas' answer to risk issues is consensus through open, informed and democratic debate. These ideals are often difficult to make true due to the role of mass media, the power of wealth and of experts or other inequalities in power and resources for groups of participants. Schrader-Frechette (1991) states that risk evaluation is both scientific and democratic, and argues for procedural decision-making guidelines in line with the discourse stand. It illustrates the dualism of safety management and safety decision making. The basis for so-called "participatory co-operation" or industrial democracy and the Scandinavian model for "three-party collaboration" on health and safety are close to the ethics of Habermas (1990)³.

Ethical dilemmas

Most safety decisions by individuals, organisations or society are not purely within one of the outlined ethical stands. A single decision can be based on a fragmentation and mixture of values and factual inputs driven by rules and regulations, bargaining and discourse (on both ends and means). Decisions may be difficult for a number of reasons. The pros and cons can be evenly balanced but compatible, facts can be uncertain, the outcomes of different courses of action unknown, etc. This is what Nagel (1979) calls a "practical conflict". And he describes the strongest cases of conflicts as i.e. where there is decisive support for two or more *incompatible* courses of action or inaction. In that case a decision will still be necessary, but the choice will seem arbitrary in such a way that we will act against some reasons without being able to claim that they are outweighed.

- Such dilemmas can occur within each of the ethical stands, but most likely and most difficult when we try to combine two or more of them. A general example is the dilemma of capitalism to balance between economic liberalism grounded in utility theory and the "Protestant ethics"⁴, i.e. "duty" and individuals' social obligations as a basis for the development of capitalism. The ambiguity of combining liberalism and conservatism in political right wing parties is an expression of this ethical dilemma.
- Economic liberalism and the defence for the market mechanism is based on utility theory and the concept of the egoistic "economic man" (Friedman, 1962). But the founders of the theory of the market, e.g. Adam Smith in his book "Wealth of Nations" (1776) had a broader scope, i.e. the development of society, not just the economic sector isolated. As a professor in moral philosophy he emphasised the altruism of man, the sympathy and caring for other people⁵. The result was an ambiguity between an egoistic explanation of consumer behaviour and a fear of too egoistic behaviour by industry and powerful institutions. This ethical dilemma has been dominant in the discussions of industrial capitalism ever since (Sejersted, 1992), e.g. by Weber (1904) in his reflections on hard work and moderation in life style as conditions for capital formation - which may look strange for the actors in the international financial markets of today.
- These ethical dilemmas will be illustrated and discussed in relation to a sample of major accidents and the challenges for safety management by the current development in technology, the restructuring of business and industrial activities, and changes in the regulatory regimes of safety.

Revealed current safety problems in high-hazard industries and transportation

The list below exemplifies the impact of hostile competition, cost cutting and short-term profit making on changes in the organising and control of industrial activities and transportation. These dynamics of the market economy produce new root causes and preconditions for major accidents and vulnerable socio-technical systems:

³ See also the participative approach of "proceduaralism" suggested by Schrader-Frechette (1991)

⁴ See Max Weber (1904) on his analysis of the purist simple lifestyle of Protestant communities as a basis for funding the investments in industrial development.

⁵ Adam Smith in his book "The Theory of Moral Sentiment" (1759).

- SHIPPING: Ferries - in Northern Europe: “Herald of Free Enterprise”, “Scandinavian Star”, “Estonia”, - numerous ferry accident in the Philippines; environmental shipping disasters - “Exxon Valdez”, “Sea Empress”, etc.
- AIR TRANSPORT: “Low price/high risk” concepts, especially the charter traffic has produced a long list of aircraft crashes.
- PETROLEUM DEVELOPMENT AND PRODUCTION (North Sea examples): Piper Alpha, and similar near accidents in recent years, the Sleipner platform collapse, increased exposure to high-risk helicopter transportation, etc.
- CONSTRUCTION: The fire in the Euro-tunnel, recent scandals in railroad tunnel constructions in Norway and Sweden.
- CHEMICAL PROCESS INDUSTRY: The Seveso and the Bhopal accidents, increase of near misses with catastrophe potential throughout Europe.
- NUCLEAR POWER: The economics of Russian nuclear power plants regarding operation, maintenance and safety priorities.
- SPACE: The Challenger accident, see the excellent analysis of an organisationally induced disaster by D. Vaughan (1996).
- FINANCE: The trade of derivatives (Baring Bank); and a stock market to be explained by mathematical chaos theory.
- FOOD INDUSTRY: The cow madness - “to beef, or not to beef”, the free flow of salmonella.
- INFORMATION TECHNOLOGY SYSTEMS: An overconfidence and dependency on IT systems for communication, co-ordination and distributed decision-making - who has not experienced the helplessness of no access to the server for the network?
- PRODUCTION INDUSTRY: Strikes by key sub-contractors, problems in transportation, etc. shutting down JIT and Kanban based production systems, e.g. the car industry.
- MAN-MADE NATURAL CATASTROPHES: Greedy human intervention in nature both creates and increases the consequences of flooding, fires, etc., e.g. the forest fires in Borneo.

The current trends in the literature of business administration and strategic management define a difference in functional emphasis between (Puschaver & Eccles, 1996):

- Risk as opportunity to be dealt with by strategic initiatives by top management
- Risk as operating uncertainty to be dealt with by line management
- Risks as hazards and losses to be dealt with in a framework of compliance and prevention by internal safety auditors and the operators of the primary processes.

This functional fragmentation of risk management is “risky” in many ways. It means a *reactive* approach to safety management, i.e. a lag or imbalance between the safety systems and the strategically defined aspect management systems of an organisation. By piecemeal decisions separating the possibilities from the hazards, the confrontation between the different ethical stands or perspectives is avoided, i.e. the strategic core can concentrate on the utility aspects whereas justice and duty are delegated to lower levels and layers in the company, or even outsourced to safety consultants. In my view, it is a must that safety issues are dealt with in an equal and balanced way as part of both strategic initiatives and operating performance. It is the only way to get the requisite variety of ethical reflections in industry and society.

- Studies of major accidents in complex, high-hazard industries have revealed a great number of explanatory factors, e.g. shortcomings in traditional single-loop deviation control systems, problems in co-ordination and communication, loss of competence, loyalty, and experience transfer, distributed decision-making and responsibilities, etc. (Rasmussen, 1994; Reason, 1990; Baram, 1996; Turner & Pidgeon, 1997). In particular, Sagan (1993) points to the many facets of organisational politics which corrupt the possibilities for learning. Senge (1991) describes the main barriers for creativity and deeper organisational learning as *fragmentation, competition, and reactivity*. These barriers also seem to be the main challenges for the development of effective safety management systems.

- Dahle⁶ (1997) states that the main obstacle for safety and a sustainable development is the utility based economic models applied by industry and government. The logic of calculating costs and benefits distributed over time by net present value or the internal rate of return, will inevitably result in a short term decision perspective, i.e. low probability major hazards and uncertainties related to environmental consequences are ignored due to the principles of economic modelling. Efforts are done to implement a *precaution* principle in environmental laws based on arguments related to the ethics of justice, i.e. if we are uncertain and have a reasonable doubt about possible negative consequences the risk should be considered unacceptable. The industry, and not the regulatory institutions, should give the evidence for being safe enough or clean enough.
- Focuses on uncertainty and vulnerability problems link well with a justice line of ethical arguments, whereas striving for reliable, cost-effective systems are in line with utility arguments. The discourse stand may offer some ways out of making “reliability versus robustness” a genuine dilemma. These dilemmas are not just about the size and patterns of risk types and their causes, but also about how we approach and choose between preventive strategies and means.

Equality: risk distribution versus risk effectiveness, parties and politics.

The equality principle that all people should be treated the same with respect to safety and environment, can be expressed in three different lines of argument that must be confronted and balanced against each other in decision-making on priorities of risk reduction means:

- *Equality of results* - i.e. risk democracy: that the goal is to achieve optimal equality of risk levels for all members of society, which means that the efforts are concentrated on small, extremely risk-exposed groups, i.e. ethics of justice. The principle of evenly distributed risk carried out to its extreme lead to ineffective allocation of available risk reduction resources.
- *Equality of treatment* - risk-cost effectiveness: efforts are made to ensure optimal risk reduction per invested unit of money, i.e. ethics of utility. Carried to its extreme this principle is probably politically unacceptable, especially when the question of cost-effective for *whom* is stressed. The analysis will give different results dependent on the stakeholder.
- *Risk-benefit equity* - risk compensation: for example economic compensation for particularly dangerous work or other unacceptable risk exposure, by insurance etc., e.g. the risk and benefit distribution for an activity or in general should be made as equal as possible over the population. It is mainly based on utility (market economy) reasoning, but can also include aspects of justice and discourse.

Safety is an unequally distributed benefit in society, e.g. employees in construction and in traditional industry are more exposed to accidents than the total work force. Only small amounts of money are used to prevent the enormous amount of accidents among the increasing number of old people. A little money extra to this work would have maximum impact on the fatal accident statistics. But is the modest effort based on implicit economic considerations of the value of human lives? In industry people at high risk are usually low-income workers, in other words; they have negative risk compensation. They have also very often higher risk exposure in traffic, at home and local community, i.e. a risk concentration which support the doctrines of the sociology of stratification.

- The problems and conflicts related to the distribution of wealth in a society of scarcity, overlap with the problems and conflicts that arises from the distribution of risk (Beck, 1992)⁷. Beck makes as a main point that it is an ongoing globalisation of risks, especially environmental risks, product risks etc. compared to traditional industrial production of local risks over the last centuries. This affects the political and social dynamics in a way that cannot be analysed within a framework of social groups, classes and stratification. Pollution travels on the wind and in the water, also affecting the rich people. Beck compares the new risk picture with the status of fate in medieval society related to the plagues, i.e. a risk fate in developed civilisation, related to something we cannot escape.

⁶ Ø. Dahle is a former managing director, ESSO Norge, and now president of Worldwatch Institute, Stockholm

⁷ Beck's chapter “On the logic of wealth distribution and risk distribution” (pp 19-50) is recommended reading.

- This worldwide equalisation of risk exposure is also followed by new international inequalities by outsourcing of high hazards industries to the “proletariat” of poor countries, e.g. the toxic accident in Bhopal, India. Controversies on risk distribution related to *utility versus justice* are found in and between groups and classes, local and global, countries and multinational companies⁸.
- By adding the ethical stands *of duty* and *of discourse*, the issue of risk distribution becomes even more difficult, i.e. principles of absolute moral norms and of democratic processes. “We” in the sense of the sum of all individual preferences with respect to safety (utility) does not serve as a basis for making a collective welfare function or a representation of the desired safety level in a society. In a democracy the solution to diverging individual wishes is a question of power distribution, political and economic interests. But does democratic decision-making render us impotent with respect to the threats we are facing? Do we manage to prioritise between incompatible values: shortsighted, narrow benefit considerations opposed to more long-term, solidarity-based loss prevention which is difficult to measure and discount?
- Combining the distance in time, space and culture of a risk issue in some sort of discounting represent a difficult ethical dilemma. Most people will give priority to current problems and to those directly affecting the person and his/her dearest and nearest. This self-interest stand is the basis for utility arguments, but can be opposed by arguments on justice or on duty.
- An example of a conflict between a utility and duty stand is the discussion of “green” accounting and discounting related to international agreements on reductions in CO₂ emissions between nations. An argument in Norway for increasing gas production and converting it into electricity, and by that violating the national obligations for CO₂ reductions, is that that it will substitute coal based electricity in the European market and by that contribute to an overall reduction in pollution. This stand is opposed on uncertainty about facts, i.e. will the gas substitute the coal, or will it just contribute to a total increase in the supply of energy and pollution? The other argument is ethical and based on *duty and obligations* on respecting treaties and solve *own* safety and environmental problems first as a basis for moral acting on risk transfer in the international arena.

“Statistical lives” versus individuals in danger, and the value of life and death

The concept of saving “statistical lives” is a logical contradiction. Death is inevitable. But expectations of an increase in average length of life is a performance measure for investments and priorities of resources in a framework of utility and cost-effectiveness. Most people will apply a completely different ethics of reasoning when it comes to identified individuals at extreme danger both regarding priorities on rescue operations in accidents and on medical treatment of deadly diseases, i.e. an obligation to do whatever possible at whatever cost to save the person. When the acute death risk is perceived as high enough, most people will be willing to pay unlimited amounts of money for the tiniest straw representing a chance to survive.

- Judgements on priorities of proactive risk prevention versus injury treatment are a real genuine ethical dilemma. Over time accident prevention will reduce repair and treatment costs (social/health budget). It is, however, not merely a political matter to arrange for such transfers, nor is it merely a matter of economic models to prove the connections. In considerations of the future lives and health of “statistical” persons, versus the lives and health of identified individuals, the duties usually override the rational utility arguments.
- Nagel (1979) asks whether it is a bad thing to die, i.e. whether death in itself is an evil. As a state of non-existence it has no value, positive or negative. It is the *loss of life*, not the death that has a value for the person, i.e. what is good about life, not what is bad about death. The economic models for assessing the value of life are either based on some simple preconditions of productivity and/or consumption, insurance compensation, or some imaginary market price. In accident cost accounting death/fatalities are sometimes set equal to the cost of a fixed time of absenteeism. Fatality rates are used as a main safety performance criterion. All these approaches

⁸ Nagel (1979) suggests an alternative ethical way of reasoning based on *altruism* as a way out of the genuine dilemma between utility and justice.

to life and death decisions are difficult to defend without contradictions in ethical reasoning. How to defend that a 25 year old high educated male is much more worth than a non-productive old person or a child? What are the parameters to be included in a “loss of life” assessment? Is it independent of how you die, or the causes of the death? As part of a basis for an informed discourse of future priorities, it may make sense to do ex post assessments of this kind to reveal the factual, but implicit, risk distribution and priorities in society. But ex ante reasoning will inevitably cause impossible, genuine dilemmas - and should be avoided.

Ethical basis for risk acceptance criteria and decision-making

Do we want complete safety from hazards and injuries? Yes, most people say. But it is not that simple. Nature is capricious, and all human activity includes some kind of risk. In other words, the complete absence of risk is a utopia. And yet objectives like "full protection from harmful effects" or “as low as reasonably possible” (ALARP) will be both meaningful and useful concepts - not in their literal sense, but interpreted in accordance with the intentions of adaptation and perfection. Then the phrases represent a dynamic goal of continuous improvement in risk management and loss prevention.

- The application of phrases like “full safety” in laws and regulations can usually be traced back to an ethics of justice, whereas the ALARP principle is mainly utilitarian. The safety directives and standards developed by EU’s “new method” are also mainly utilitarian regarding their ethical basis. In the development of safety laws and regulations and safety objectives, different ethical stands are often combined and not always consistent:
 - the justice stand will be consequence and precaution oriented in formulating criteria
 - the duty stand will focus on obligation aspects
 - the utility stand will focus on a risk-benefit balance
 - the discourse stand will focus on the criteria for the process of reaching consensus on acceptance criteria

Risk acceptance is just partly connected with real risk. Primarily, it is a question of confidence in the ability to control dangerous situations and/or confidence in the "system", the safety management systems of trade and industry, or of society. This poses great demands on safety management at all levels with respect to competent efficiency, personal and professional integrity in difficult decision dilemmas etc. With an increasingly complex structure of society, trade and industry, communication, political and administrative systems, technical systems and technological change etc., it is getting more and more important to relate to different ethical and political arguments to keep an image of being in control and for being trusted.

- Safety decisions have to be made despite uncertainties and lack of knowledge, or ignorance. Since we cannot choose not to choose, a certain arrogance is required to choose in the knowledge of our ignorance about technical risks (Green, 1991). The choices will always include value judgements and trade-offs based on ethical assumptions. There is a need for developing a mechanism for a path between the positivistic and rational choice founding of risk analysis and the richness of perceptions and judgements of risk issues. Shrader-Frechette (1991) suggests a solution based on what she calls “scientific proceduralism”. This concept is built on three ideas:
 - Accepting the explanatory and predictive power of risk analysis for decision support, but also be aware the limitations of the approach.
 - Adding naturalistic and situation specific criteria, including ethical arguments as legitimate.
 - The best answers to risk issues are achieved by exposing risk evaluations and decisions to intelligent debate, criticism, and amendment by the scientific community and lay people likely to be affected by the risk.

Conclusion:

- SOLUM CERTUM, NIHIL ESSE CERTI

REFERENCES

- Andersen, H.W. & Sørensen, K. (1992) *Frankensteins dilemma*. AdNotam, Oslo.
- Baram, M. (1996) *Safety Management and Organizational Change*. Paper at NeTWork, Bad Homburg.
- Beck, U. (1986) *Risikogesellschaft: Auf dem Weg in eine andere Moderne*. Suhrkam Verlag, Frankfurt am Main.
- Beck, U. (1992) *Risk Society: Towards a New Modernity*. Sage Publ., London.
- Beck, U. (1997) *Risiko og frihet*. [Risk and Freedom] Fagbokforlaget, Bergen.
- Bjoldal, E.N. (1996) *En undersøkelse av premisser i dommer etter personulykker og akutt forurensning i arbeidslivet*. [An investigation of terms in court sentences of industrial accidents and pollution] Centre for Technology and Culture. Univ. of Oslo.
- Dahle, Ø. (1997) *Bærekraftig produksjon, utvikling og endring*. [Sustainable production, development and change] Sikkerhetsdagene '97, NTNU, Trondheim.
- Døderlein, J. (1987) "Introduction to Risk and Decisions". In W.T. Singleton & J. Hovden (Eds.) *Risk and Decisions*. Wiley, Chichester.
- Friedman, M. (1962) *Capitalism and Freedom*. Univ. of Chicago Press, Chicago.
- Galbraith, J.K. (1977) *The Age of Uncertainty*. London.
- Green, C.H. (1991) *Ignorance, Arrogance and Morality: the Necessary Components of Decision Making*. Flood Hazard Research Centre. Middlesex University.
- Habermas, J. (1990) *Moral consciousness and communicative action*. MIT, Cambridge, Mass.
- Hale, A.R. (1993) *Quis custodet? Implications of certification and regulatory systems for expert manpower and training*. In Larsson, T.J. & Clayton, A. (Eds.), *Insurance and Prevention*. IPSO Factum 46, Stockholm.
- Leiss, W. (1989) *Prospects and Problems in Risk Communication*. Univ. of Waterloo Press, Waterloo.
- Nagel, T. (1979) *Mortal questions*. Cambridge University Press. Cambridge.
- Perrow, C. (1984) *Normal Accidents. Living with High-Risk Technologies*. Basic Books. N.Y.
- Puschaver, L. & Eccles, R.G. (1996) "In Pursuit of the Upside: The New Opportunity in Risk Management" *PW Review*, Dec. 1996.
- Rasmussen, J. (1995) *Review of Major Accidents. Implications for a Research Program*. RISKCENTRUM, Karlstad.
- Rawls, J. (1971) *Theory of Justice*. Harvard Univ. Press, Cambridge, Mass.
- Reason, J. (1990) "The contribution of latent human failures to the breakdown of complex systems". *Phil. Trans. R. Soc.Lond. B.* 327, 475-484.
- Sagan, S.D. (1993) *The Limits of Safety: Organizations, Accidents and Nuclear Weapons*. Princeton Univ. Press, Princeton.
- Shrader-Frechette, K.S. (1991) *Risk and Rationality. Philosophical Foundations for Populist Reforms*. Univ. of California Press. Berkeley.
- Sejersted, F. (1996) "Introduksjon". In K. Haukelied (Ed.) *Risiko og ansvar* [Risk and Responsibility] TMV no. 19, Univ. of Oslo.
- Senge (1991) *The Fifth Discipline*. Harper, New York.
- Turner, B.A. & Pidgeon, N.F. (1997) *Man-Made Disasters*. Butterworth-Heinemann, Oxford.
- Vaughan, D. (1996) *The Challenger Launch Decision: Risky Technology, Culture, and Deviance at NASA*. Chicago Univ. Press, Chicago.
- Weber, M. (1904/1976) *Den protestantiske etik og kapitalismens ånd*. [The Protestant Ethics and the Spirit of Capitalism] Fremad, Copenhagen.