

Better Integration of **Radiation Protection** **in Modern Society**

Workshop Proceedings
Villigen, Switzerland
23-25 January 2001



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Radiation Protection

Better Integration of Radiation Protection in Modern Society

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NUCLEAR ENERGY AGENCY
ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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- to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

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FOREWORD

Since the recognition, in the early 20th century, of health risks from exposure to ionising radiation, an internationally accepted system of radiation protection has been progressively developed. As new scientific information and radiological challenges have been identified and addressed, the system has increasingly broadened its scope and has evolved independently from other systems aimed at the protection of public health and the environment. The framework of the system of radiation protection has been extended, and new portions have been added to handle each new situation. The goal has been to have a unified system of protection being able to cover all situations. The system has now reached a stage of development, however, where some voices argue that it is too complex and at times incoherent. It has become increasingly apparent and even inevitable that the system of radiation protection must reflect societal concerns and objectives to flourish in the future. These tendencies reflect much broader changes in democratic systems, particularly in decision making, that directly influence public health and safety or environmental protection.

Of relevance to the system of radiation protection in the present social context is the increasing social desire/need to understand decisions made by governments, regulatory bodies and industry, and to participate more actively in decision-making processes involving environmental and public health issues (this includes the willingness of stakeholders to accept responsibilities). Technical rationale that once sufficed to explain radiation protection theory and practice is no longer sufficient within today's social context. Indeed, the Collective Opinion *Radiation Protection Today and Tomorrow* (OECD/NEA, 1994) issued by the Committee on Radiation Protection and Public Health (CRPPH) noted that "decision making in several areas of radiation protection can less and less be made in isolation from its social dimensions". This presents a growing challenge to the radiation protection community, policy makers and governmental organisations providing expert advice for regulating and making decisions concerning radiation protection. To address these issues, industry, governments and regulatory bodies are becoming more transparent in terms of their operations.

The need to communicate theory, practice and the decision-making process to a wider audience, and to clearly define the role of experts, has led the radiation protection community to revisit the framework of the system of radiation protection. The very fundamentals of the system of radiation protection continue to be questioned, in a healthy fashion, and many issues have been identified which could better serve and address stakeholders' concerns given some additional thought and dialogue in the light of modern societal needs.

The area in which stakeholder involvement tends to be the most important is the clean-up of contaminated sites, often where the contamination has been "discovered" and is due to an accident, or to some past industrial or research activities. In these situations, the affected public usually wishes to play a role in the decision-making process with regard to site clean-up and final site use. Examples of such situations include the Marshall Islands, the area around Chernobyl, the Wismut uranium mining area in Germany and the Rocky Flats plutonium processing plant in the United States.

In order to investigate whether lessons from such specific situations could be synthesised into more general input at the policy level, the CRPPH organised a workshop in 1998 on the Societal Aspects of Decision Making in Complex Radiological Situations.¹ This workshop was hosted by the Swiss Nuclear Safety Inspectorate, the HSK, at its headquarters in Villigen, Switzerland. From the case studies presented and the general discussions at this workshop, it was concluded that pre-established, rigid numerical criteria for radiological clean-up were not universally useful in practice. Furthermore, the process of arriving at acceptable radiological protection options must be transparent and should involve the affected public from an early stage.

The influence of these conclusions was felt at many levels, nationally and internationally, and contributed significantly to generalising the discussion of stakeholder issues within the radiation protection community. In particular, the International Commission on Radiological Protection used some of this work as a basis for developing its Publication 82 which contains public protection recommendations for situations of prolonged exposure.

In April 1999 the CRPPH agreed to hold a second workshop, also in Villigen, to investigate the better integration of radiation protection in modern society. The HSK again graciously agreed to be the host.

This workshop was designed to contribute to the analysis and understanding of the socio-political-economic framework of modern decision making in pluralistic, educated and democratic societies, including an understanding of stakeholder responsibilities. Given our current world, in which developments are driven by forces described by key words like deregulation, globalisation, “information society” and “learning society”, this workshop was intended to improve understanding of the role of technical input, and in particular nuclear experience and knowledge, within societal decision-making processes. It was developed with the following specific objectives:

- share recent experience and lessons learned in stakeholder engagement in decision making;
- explore new mechanisms for arriving at decisions and policies appropriately acceptable to a diversity of stakeholders;
- identify how important cultural, socio-political and economic differences are considered and weighed in decision making;
- encourage the identification and acceptance by stakeholders of responsibilities within the decision-making process; and
- develop a better understanding of the differences between the role of the expert and that of the decision maker.

The workshop was held on 23-25 January 2001. Annex 1 provides a list of workshop attendees. The members of the workshop Programme Committee responsible for its development were:

- Dr. Serge Prêtre, Switzerland (Co-Chair),
- Mr. Jacques Lochard, CEPN, France (Co-Chair),
- Ms. Francis Fry, NRPB, United Kingdom,
- Mr. C. Rick Jones, Department of Energy, United States,
- Prof. Wolfdeiter Kraus, BFS, Germany,

1. *The Societal Aspects of Decision Making in Complex Radiological Situations*, Workshop Proceedings, Villigen, Switzerland, January 1998, OECD, 1998.

- Dr. Ted Lazo, OECD/NEA,
- Prof. Henri Métivier, IPSN, France,
- Dr. Hans Riotte, OECD/NEA,
- Dr. Jan Olof Snihs, SSI, Sweden.

This CRPPH activity can be placed within the broader context of civil society's interaction with nuclear power, aspects of which are being addressed by several of the OECD Nuclear Energy Agency standing technical committees. For example, the Radioactive Waste Management Committee (RWMC) established the Forum on Stakeholder Confidence (FSC), recognising that public involvement is a key aspect to be considered during the development of management options for long-lived nuclear waste.² The Committee on Nuclear Regulatory Activities (CNRA) is investigating the interactions between the public and national regulatory authorities.³ The Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle (NDC) is studying national experiences with public communication on the risks of nuclear power.

Although these activities were developed as individual projects within relevant standing technical committees, the NEA will work to derive common objectives among them. One significant goal is to help Member countries to achieve harmonious and productive interaction between nuclear energy decision making circles and civil society.

2. *Stakeholder Confidence and Radioactive Waste Disposal*, Workshop Proceedings, Paris, France, August 2000, OECD/NEA, 2000.

3. *Investing in Trust: Nuclear Regulators and the Public*, Workshop Proceedings, Paris, France, November 2000, OECD, 2001.

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OPENING ADDRESSES

OPENING ADDRESS

W. Jeschki

Director, Swiss Federal Nuclear Safety Inspectorate

Dear Mr. Director-General, dear Serge Prêtre, dear speakers and participants and guests.

It is a pleasure for me to welcome you all to the Second Villigen Workshop. It is a honour for me and the Swiss Nuclear Safety Inspectorate to host this workshop on the “Better Integration of Radiation Protection in Modern Society”.

Before I will wish you an interesting and successful workshop – and there is no doubt for me that you will have successful three days seeing the names of the chairpersons and speakers – before I wish you success, I like to ask some questions on radiation protection in modern society.

First: What does mean “in modern society”? Is it not true, that in countries without nuclear power stations, undoubtles also modern societies like in Austria and Italy, radiation protection is very well integrated in the society? The use of ionising radiation and radiochemicals in medicine and industry is there widely accepted. At least very seldom one can hear a storm roaring in the newspapers because of low doses or some carelessness in handling radioactive materials.

So should the title of the workshop be “Better Integration of Radiation Protection in Societies using nuclear power”?

Second question: We have elaborated and adopted a highly sophisticated system of radiation protection, even based on some scientific backgrounds. We adopted the expression of effective dose, using weighting factors for tissues and for the quality of the ionising radiation.

Have we not forgotten a third weighting factor? A factor, which has the value one in modern societies without nuclear energy, which is one, using ionising radiation in medicine and industry and which is 1 000 or even a billion in modern societies using nuclear energy. A factor which is 1 000 or even a billion when using ionising radiation in context with nuclear energy?

This factor, which is a real one, which exists, is not one with a physical, a scientific background. I would call it a “nuclear aversion factor”.

In my opinion the journalists know very well that low doses, accumulated in medicine, industry or the nuclear field have the same health effects. But there know also very well that with low doses accumulated in the nuclear field on can sell the article very well, that with low doses coming from the nuclear field, one can make politics.

The question now is: how can this “nuclear aversion factor” be defined, so that it loses its effectiveness, so that it comes back from the value of 1 000 to the value of 1?

As the host for this workshop the Swiss nuclear safety inspectorate was eager to create for you the adequate environment. In the Swiss news media you will find a playground for the topics of the workshop. I mean the issue of depleted uranium (DU). Everybody knows that the DU used in weapons cannot harm the health of soldiers due to ionising radiation. But there is a psychological factor. A number of people had been against the war in Kosovo, a number of people are afraid from the power of a NATO. But to be a pacifist, a number of people don't like to confess. It's much easier to create a "war aversion factor" and to use it by calculating the harm DU can produce; and by doing so these persons are indirectly against war, against the NATO.

I think this actual and still ongoing happening is a good field to test your theses.

So, now. I can wish you very good three days, a lively discussion and a lot of good ideas coming out from the lectures and discussions.

OPENING ADDRESS

L.E. Echávarri

Director General, OECD Nuclear Energy Agency

Friends and colleagues,

On behalf of the OECD Nuclear Energy Agency, I would like to welcome you to the 2nd Villigen Workshop: Better Integration of Radiation Protection in Modern Society. The NEA is very appreciative of the efforts made by Director Jeschki and his staff at the HSK to welcome us here for these three days, and of the work of the two co-chairmen, Serge Prêtre and Jacques Lochard, in developing the programme. I must also thank all of you for the interest you have shown in this important meeting and for the efforts that all of you have made to attend. Reviewing the programme and the attendance list, I am sure that we will finish this meeting with useful and interesting results.

Unfortunately, one only has to turn on the News these days to see the relevance of radiological risk identification, assessment and management in today's society. The investigations that are currently ongoing to determine the role of depleted uranium in the so-called Gulf War Syndrome, and in what has already been called the Balkan Syndrome, is a very real example of the type of emerging radiation protection problems that can easily become front page news. Other recent examples of radiological situations that caught the eye of political leaders, the public and the press include:

- the OSPAR Sintra agreement, through which governments will attempt to reduce towards zero the concentrations of various radionuclides in the marine environment; and
- the recent European discussions regarding surface contamination on fuel transport casks.

These situations might seem, in terms of risk, to be much ado about nothing. However the political and public reactions to these situations illustrate quite clearly that, even though we do not feel something is a problem, our political and public masters may.

This situation raises several fairly difficult questions:

- How do regulators and governments share the responsibility of making social judgements with regard to what is an acceptable risk?
- How can the regulator, who is often charged with making these judgements on behalf of the government, develop a process that leads to decisions that are sufficiently open and transparent, while at the same time maintaining independence?
- How do regulators judge and balance the needs of often competing interests, such as industry, local public groups, national and international environmental NGOs, and even government officials/politicians from other ministries?

Although it is clear that these questions have no single answer, I hope that during the course of this workshop you will be able to make progress towards a better understanding of the processes that have been shown to achieve acceptable results, and towards a clearer understanding of the roles and responsibilities of the various stakeholders in these processes.

As you know, discussions on various stakeholder issues are also being pursued at the NEA in areas other than radiation protection. This 2nd Villigen Workshop is the third NEA workshop on stakeholder issues since August 2000. You will hear later on from Mr. Yves Le Bars, who chaired the Radioactive Waste Management Committee's Forum for Stakeholder Confidence in August 2000. You will also hear from Prof. Jukka Laaksonen, who chaired the Committee on Nuclear Regulatory Activities' November 2000 meeting titled, "Investment in Trust: Nuclear Regulators and the Public". These three workshops and their conclusions form the basis for the NEA's work in the area of Nuclear Power in Civil Society. Based on the results of these workshops, the NEA is also trying to establish a global approach for the organisation on our relations with the Civil Society. This approach will be discussed at some forthcoming meeting of the NEA Steering Committee and is very much in line with the strategy of the OECD, which considers the interaction with the Civil Society in all its activities to be of primary importance. Additionally, the OECD is currently investigating various approaches to developing an over-arching programme to co-ordinate all OECD work in the area of risk, in which the NEA's experience will play an important role. As you know, the problem related to how the public perceives risk is not at all unique to nuclear energy as we can see with the use of bio-technologies or with food safety.

As you can see, the issues that you will be discussing here are at the very forefront of emerging discussions on civil society and modern governance. I am sure that the results of your meeting, when integrated with other work at the NEA and the OECD, will have an impact that goes well beyond the area of radiation protection.

Again, I would like to thank you, in advance, for what I am sure will be very fruitful discussions. I look forward to participating in these discussions, and to listening and learning during these three days.

AROUND THE INTERFACE BETWEEN RADIATION PROTECTION PROFESSIONALS AND THE PUBLIC OR BETWEEN RADIATION PROTECTION AND THE SOCIETY

S. Prêtre

There are two interesting interfaces which will be discussed in this paper:

- The interface between radiation protection professionals and the public, which is a relationship between experts and laymen; and
- The interface between radiation protection and the society, which is a relationship between a system for protecting health and the cohesion mechanisms of the society.

These two interfaces seem to be two different things, but they are strongly interconnected. What they have in common is the glue connecting the two elements of each interface; and this glue, as we will see, can be called social trust or confidence.

Three years ago, at the first Villigen Workshop (in January 1998), I raised a fundamental question regarding the topic:

Is it: Integrating societal aspects into radiation protection decisions
or: Integrating radiation protection into societal decisions

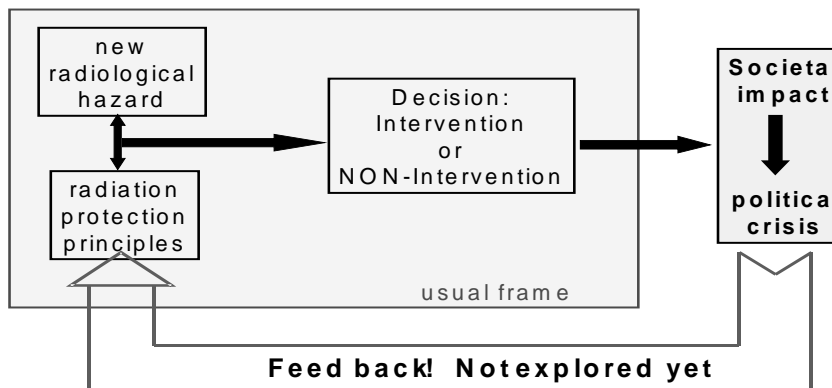
At that time I recalled that radiation protection had always enlarged its horizon by engulfing other sciences like radiation physics, radiobiology, radiopathology, radioepidemiology and that the time has come now to realise that radiation protection should not try to engulf sociology.

The alternative, mentioned above, is in some way a choice between arrogance and modesty. The attitude chosen can lead to anything situated between distrust and confidence.

In many cases, what we (the radiation protection professionals) believe to be a radiation protection problem with some societal implications, is rather a societal problem with some radiation protection implications. In such societal problems, several aspects are important and will influence the decision, not only radiation protection. Accepting that arguments other than radiation protection will influence the decision means that diverse stakeholders will sit at the decision table. And they will wish flexible radiation protection arguments allowing for case-by-case decisions.

At the NEA Workshop “Radiation Protection on the Threshold of the 21st Century” in January 1993, Jacques Lochard and myself presented the following scheme (Figure 1):

Figure 1 From NEA/CRPPH “Turn of the Century”, January 1993



It shows that within the usual frame, radiation protection works mechanistically: the evaluation of a radiological hazard on the basis of the radiation protection principles triggers the decision. Within this usual frame, there is little room left for arguments other than those of radiation protection. But the scheme above suggested for the first time that there might be a feed back coming from society or from politics that could influence radiation protection principles. In the past, radiation protection was a paternalistic system, treating the public like small children. The time has come now to listen carefully to stakeholders.

But there is a fear among the radiation protection fathers: they are afraid to lose control and to become bystanders of scientifically poor decisions. The question is: from which point of view shall the decision be a good decision? From the point of view of science, or from the point of view of the people to be protected, or from the point of view of the stability and cohesion of the society?

What society wants is a radiation protection system that is intimately part of the society, and not a system giving the impression of acting from outside of society and of being unworldly.

The question raised by this workshop is: how to better integrate radiation protection in modern society. And the first part of the answer is simple. It reads:

Listen to the stakeholders

They will show us the way.

Unfortunately there are obstacles which complicate the issue:

- Strong symbols connected to radioactivity influence and perturb the perception of radiation protection within the public.
- Unfortunately there is a large backlog of suspicion and mistrust towards radiation protection experts. Our image in the public is poor. We are seen sometimes as arrogant sorcerers, sometimes as confused opportunists.
- Mankind is at the beginning of a deep change in mentality.

Let us have a closer look to these obstacles:

The symbols linked with radioactivity are well known. They are recapitulated in the following figure 2:

**Strong symbols are linked with
radioactivity and with ionising radiation**

Mutagenic and carcinogenic capability of ionising radiation
endangers Mankind and Nature :

- ➡ The sorcerer's apprentices do not master their inventions
- ➡ Generation of innocent mutants
- ➡ The purity of Nature is tarnished
- ➡ Plutonium etc. = Stuff of the Devil
- ➡ The divine punishment of Prometheus
- ➡ On the way to the Apocalypse

There is not much that can be done to eliminate this obstacle. It is our role to remain patient and objective, and to wait for the obstacle to melt slowly under the growing influence of a new generation being more indifferent toward this sort of issue. The recent story of the depleted uranium ammunition employed in Yugoslavia has shown once more how quickly the archaic symbols mentioned above can be re-awakened, and how strong they still are. Symbols cannot be erased, but they can be replaced by new symbols. The professionals in publicity and communications know how to do this.

The perception of radioactivity and ionising radiation among the public is disturbed by these archaic symbols. This is a fact making our modern society collectively more sensitive to radiation than its individual members. Why? Because if society believes that a situation is dangerous, then this situation is effectively dangerous for its own stability, even if the radiation level for each individual member of the society is negligible. If we accept that mutual trust is for society what health is for man, and that a disruption of mutual trust can destabilise the society, then we must also accept the strange fact that society is collectively more sensitive to radiation than individual persons. Should a new radiation protection framework take this strange effect of radiation into consideration?

A related obstacle we have to face is the high level of suspicion or mistrust directed toward scientists in general, and radiation protection experts in particular. Parts of the public and the media believe that even very low doses of radiation lead to pernicious effects (on health and nature) that science does not yet know, or that certain organisations keep secret. They support their theories by politically motivated government reports claiming for financial compensation or help after a radioactive contamination. These persons are angry with us because we refute this explanation or are not willing to envisage such a possibility. They feel we have a mindset, are arrogant and are not open to novelty.

How to react in such a case? We, the radiation protection professionals, should accept such groups of people as stakeholders and listen carefully and patiently to them. We should avoid getting irritated, and be sincere, objective, impartial and stay modest. Why not confess that our knowledge is limited and that there are a lot of uncertainties. Nevertheless we can explain what we believe to be the international state of knowledge. It is important that we begin to learn from such stakeholders. They have a message for us. And from this message we can envision some elements of the feed back mentioned above (Fig. 1). This feed back could help us to build a new radiation protection system that has more chance to be understood by the public.

If our image in the public is not good, there might be a historical reason for that. In the eyes of the public, who is radiation protection serving? Who gets the profit of radiation protection? We are convinced that we serve the public health and the workers' health. But historically radiation protection was invented first to serve medicine and the enormous efforts invested in radiation protection between 1940 and 1970 aimed at supporting nuclear programmes; first military programmes and then the Atoms-for-Peace Programme. Therefore, in the mind of critical journalists, radiation protection is still an alibi for, or at least the indispensable support for nuclear energy. It will take time, patience and a lasting demonstration of honesty to slowly improve this unfavourable image.

Compared with protection against toxic agents, environmental hazards and diverse carcinogens, the protection against ionising radiation has the longest history, has received the most research funds, and the highest public attention. This was, on one side, suspicious and on the other side attractive. This suspicion lead to radioactivity being put in the role of the scapegoat, responsible for every badly understood illness. The attractive aspect put radioactivity in a pole position as compared with all other toxic agents potentially capable of being carcinogenic. It attracted both the scientific elite and all sorts of opportunists. That is why the radiation protection community is multicoloured and fascinating, but also incoherent.

But society is now undergoing fundamental changes. Values are changing, new symbols are appearing, and the new generations are focussing their interests on new things and new issues. In addition, let us mention that the EU-Commission has just published a white book showing that there are approximately 100 000 potentially toxic chemical substances for which the toxicity is unknown. Many of them might have a dose versus effect relationship of the LNT (linear non-threshold) type similar to that of ionising radiation. The public is beginning to realise this. Therefore it can be expected that radiation protection will soon begin to lose its pole position. As a consequence, radiation protection will become less suspicious, but also less attractive. Both, the elite and the opportunists will move to other areas. Radiation protection will become less colourful, less dramatic, less interesting and less incoherent. This evolution goes toward a sort of secularisation of radioactivity, and finally toward indifference and banalisation.

Secularisation could fulfil a wish of many of us, the de-dramatisation of radioactivity and the fading of archaic symbols. But this positive aspect of the ongoing evolution is accompanied by a negative one: indifference and banalisation. Radiation protection will become less glorious, less elitist, less noble, more common. This evolution from a glorious and magic pedestal down to the laity world has already been experienced by medicine, by railroad technology, and recently even by civil aviation.

In conclusion, it can be predicted that the normal evolution of mankind will finally provoke or accelerate the better integration of radiation protection in modern society. Nevertheless there are many improvements, especially in the field of attitudes, that radiation protection professionals could initiate right now. And once attitudes have evolved, a new radiation protection system will emerge, which will be more oriented towards human beings, society, democracy and social trust.

THE QUEST FOR “REASONABLE”

J. Lochard

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Abstract

Until the late thirties, the known effects of radiation were the injuries to the superficial tissues, the changes in the blood and derangement of internal organs. Because of the existence of thresholds for the appearance of these effects the corner stone of radiological protection was the limitation of exposure below a level considered as tolerable to avoid any dangers of over exposure. From the forties, the recognition of stochastic effect, coupled with the uncertainty concerning the existence of a threshold for this category of effects, led the radiological protection community to progressively adopt a prudent attitude and to add to the limitation of exposure the objective of keeping doses to the lowest possible level. From that time, one of the key question of radiological protection has been to find a reasonable compromise to satisfy both the objective of keeping doses as low as possible and of preserving the viability of medical, industrial and nuclear activities considered as beneficial to the welfare of societies. The paper presents the march of thought which, over half of a century, attempted to translate into practical recommendations this quest.

SESSION 1

The New Context of Risk Governance

Chair: C.R.Jones

INTRODUCTORY REMARKS

C.R. Jones

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Central to the new concept of risk governance is the issue of TRUST. In the widest terms, this refers to a mutual trust among all stakeholders implicated in a particular situation. As practically applied to specific cases, this refers to “the public” that might be affected by a particular decision concerning radiological protection having trust in its government, in the technical experts involved in the decision, and in the decision-making process itself.

In this first session of the workshop we will discuss the new context of risk governance from a pragmatically-based, theoretical viewpoint. Papers will focus on why people want a voice in the decision making process, what roles various stakeholders might have in the process, and how each voice can be heard and included in a democratic fashion that builds trust.

Trust, once developed, leads to confidence – in the process and in the acceptability of the agreed-upon outcome. To attain and build trust and confidence, however, the decision-making process must fully engage stakeholders. This will not only help to create a shared interest in actively addressing the issue at hand, but will foster a sense of individual and collective responsibility to move the process forward so that an agreed-upon outcome can be achieved. Once such shared responsibility is established, acceptance of the selected approach is promoted, which in turn allows and facilitates actions to be taken. Vigilant monitoring of the process, and feedback to participants, are necessary, however, to maintain confidence.

It should be recognised, however, that the process of building trust and confidence requires a significant short-term investment, as well as a long-term commitment. In fact, radiation protection issues may well NOT be the most important aspects of a situation in the minds of the implicated stakeholders, and radiation protection experts and decision makers will need to engage patiently with stakeholders to identify and prioritise concerns to be addressed. Although it takes time to fully engage stakeholders, efforts will be rewarded in the long term. Success will, in fact, promote success, and will facilitate the establishment of partnerships to address other risk issues. The fruit of this investment will be a general increase in trust and confidence in the government, in experts and in decision-making processes.

A key advantage of this process is that policy decisions are reached through a truly democratic process, and not through a series of legal challenges and court decisions. The fact that such policy decisions will withstand legal challenges can be taken as an indication of success.

In summary, and as introduction to the interesting papers of this session, trust will lead to confidence, both of which will create shared interest and responsibility on the part of all stakeholders to move forward and address the issue at hand in a mutually agreed-upon fashion. Monitoring of this

process, and feedback to stakeholders are necessary to maintain confidence, but the success of the investment in these efforts will be measured in acceptance of action plans and outcomes, in the establishment of partnerships for future actions, and in the willingness of stakeholders to collectively address other risks in the same fashion.

**FROM RISK PERCEPTION TO SOCIAL TRUST:
AN OUTLINE OF RECENT CONTRIBUTIONS OF PSYCHOLOGY TO RISK
MANAGEMENT**

T.C. Earle

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Abstract

As with many developing areas of inquiry, the psychology of risk management has progressed from an initial focus on proximal effects to an exploration of more stable distal factors, from risk perception to social trust. Risk perception is concerned with disruptions in the relations between individuals and their physical environments, specifically with the varying negative effects experienced by individuals. These effects have been found to be socially constructed, with systematic variations among groups (e.g., layperson and experts; among various groups of experts; men and women; those with economic interests and those without; etc.). The focus of risk perception research has shifted over time: from the likelihood of specific health effects; to the likelihood of a wide range of effects, including emotional effects, varying with context; and, finally, to general emotional effects, positive and negative affect. This shift can be seen to be from cognitive/rational to affective; from expert/technical to public. The second stage of inquiry moved away from the surface effects of risk perception to the study of confidence. Confidence is concerned with constancy, the underlying, not directly experienced order of the relations between individuals and their social/physical environments. Disruptions in confidence lead to concern with risk. Initially, confidence was said to be based on past performance and systems of control, objectively defined; the appropriate response to disruptions was risk communication, the provision of correct information. Failures in risk communication indicated that confidence must be based on subjective judgements of past performance and systems of control. The third, and present, stage of inquiry moved back from confidence, and from the physical environment, to the study of social trust. Social trust is concerned with the relations between individuals within social groups. Individuals tend to trust others whom they judge to be similar to themselves in salient ways, i.e., whom they take to be members of their group. Disruptions in confidence lead to concerns with social trust. Recent progress in understanding social trust has been made possible by its clear differentiation from, as well as integration with, confidence. Social trust is based on information that has moral, or value, implications for individuals; confidence is based on judged performance. Social trust affects confidence by conditioning (“biasing”) judged performance. Thus, social trust is of primary importance to risk management. Co-operation is driven by social trust, and social trust is based on common group membership. The inclusive redefinition of group boundaries is therefore the key to creating co-operation, successful risk management.

Introduction

Motivated originally by a desire to understand, and perhaps to narrow, the disparity between experts' acceptance and public rejection of expanded employment of nuclear power, the study of "risk perception" by psychologists and other social scientists is now twenty-five years old (Slovic, 2000). Over that time, the "experts" and the "public" have come no closer together on the subject of nuclear power, but our understanding of the gap between the two, and why it has persisted, has deepened and, we hope, become more useful. And, of course, risk perception and related concepts have been applied far beyond nuclear power, to every sort of hazard. In this paper, I will briefly outline the key stages in the development of our understanding of how people think about risk, from perhaps familiar forms of risk perception to emerging approaches to social trust.

Risk perception

The starting point for the study of risk perception was the practice of risk assessment by experts, the calculation of the likelihood of various negative events. It was observed that, when non-expert members of the public were asked to make risk judgements, their judgements, in many cases, differed from those of experts. The cause of these differences, according to the developers of the risk perception hypothesis, was that the experts and the public used different sets of attributes in making their judgements of the riskiness of technologies. Experts used quantitative attributes, such as the probabilities of health effects. The public relied more on qualitative attributes, such as voluntariness of exposure, dread, familiarity, and catastrophic potential. The initial response to this difference between experts and public was to attempt to make the experts' attributes, particularly the use of probabilities, more acceptable to the public and easier to use. The calculations of the experts were taken to be the standard. The problem, then, was to devise simplifying means of allowing the public to make those same calculations.

This cognitive, or risk communication, approach to closing the gap between experts and public has met with limited success. The fault, some researchers claim, is not in risk communication itself but in its direction: Instead of teaching the public to understand the experts, experts should be trained to understand the public and its concerns, with the eventual goal of mutual understanding on both sides. Toward this end, risk perception researchers developed detailed models of how the public thinks about various risks. Instead of a simple solution to the risk communication problem, however, they found complex variation among groups of persons, based on sex, race, age, occupation, economic interests, etc. There is no simple "public;" there isn't even a simple set of "experts." Confronted by this complexity, risk communication – which at least seemed feasible when it was conceived as one-way communication between two groups – came to be seen more as a problem-creator than a problem-solver.

The central reason for the failure of risk communication is that most of the public, most of the time, is more interested in, and preoccupied by, the ordinary, predictable, familiar flow of life's events than in possible, low-likelihood, disruptions in them. That is, under ordinary circumstances, experts are much more interested in thinking about risk disruptions in the constancy of life than the public is. Most people prefer to avoid this. When disruptions occur, however – accidents, epidemics, any events interpreted as threats (real or imagined) to ways of life – members of the public become very interested and devote a great deal of attention to risk. Disruptions cause thought about risk. But most of that thought is directed, not at the risk itself and its calculation, but at the control or elimination of the threat, the return of constancy – the status quo as formally understood and

experienced. Often this takes the form of organising and participating in groups. On this interpretation, the psychological study of risk has shifted from how we think about risk to how we think about risk management, from risk perception and risk communication to the study of confidence, how it is disrupted and how it is restored.

Confidence

Confidence is the belief that, based on experience or evidence, certain future events will occur as expected. Confidence is thus the psychological correlate of the stable relations, the constancy, that an individual strives to establish and maintain with all aspects of his/her environment. Constancy is “the essence of life” (Brunswik, 1956, p. 23). And the disruption of constancy presents a threat that induces affective and cognitive responses “intended to re-establish stability and thus survival” (Hammond, 2000, p. 69). Our confidence in the constancy of our ways of life is based on information about the performance of persons, organisations, or other aspects of our physical or social environments. Performance information is available to us through personal experience or through evidence from others. In the case of personal experience, we may be unaware of this information; we may simply experience a sense of familiarity. Or we may consciously process information about our experience. In the case of evidence from others, we may examine the information analytically. Most often, confidence is based on familiarity, our lives guided by automatic pilot (Bargh and Chartrand, 1999). This automaticity of being allows us to efficiently deal with everyday environmental complexities that, if confronted consciously, would quickly overwhelm us. Occasionally, however, certain information about performance exceeds our limits of familiarity and demands our attention. Our confidence is lost, and the constancy of our lives is threatened; we experience negative affect (e.g., “stress”), which we wish to relieve. One reaction to the loss of confidence is to gather more information; our individual capacities to do this are very limited, however. When confidence is lost, we need information and help from other people. Above all, we need emotional support, validation, from persons sympathetic to us, fellow supporters and defenders of our ways of life. When confidence is disrupted, we need social trust.

In comparing confidence research with traditional risk perception research, it is important to note how differently the individual is depicted. In risk perception research, the individual is focused on the risks and benefits of particular technologies, weighing these more or less rationally to make decisions of acceptance or rejection. Most significantly, the individual is alone, acting as a free agent. In confidence research, the individual is focused on disruptions in his/her way of life. The individual’s concern is not with specific attributes of intrusive technologies but with the restoration of constancy and confidence. And the individual is not alone; he or she behaves as a member of a group (or, potentially, a member of many groups). Guided by positive affect, it is to one’s group that the individual turns for help when confidence is lost, relying on trust in fellow group members. Significantly, this transition in the conception of the individual, from being data-driven to being affect-driven, and from being isolated to being supported by webs of trust, has recently been endorsed, at least in part, by pioneer risk perception researchers (e.g., Slovic, in Finucane, *et al.*, 2000; Sjöberg, 2000).

Social trust

Loss of confidence leads to an interest in, a need for, social trust. Social trust operates in a context of uncertainty and risk, enabling us to reduce uncertainty and minimise risk. Social trust acts as a bridge between two steady states, the previous, lost state of constancy and a newly constructed one. Psychologically, social trust is the willingness to make oneself vulnerable to another based on a

judgement of similarity of intentions or values. Whereas confidence is based on performance information, social trust is based on morality information, i.e., information indicative of the values that are salient in the current context. A person trusts another person (or other entity to which values can be attributed) who is judged to share currently salient values. Values are defined and shared within groups. Thus, we trust persons judged to be members of our group, and we are guided to these persons most powerfully by our emotions, by positive affect.

The interaction between confidence and social trust

Confidence and social trust are separate, but interacting, paths to co-operation. The key to understanding the interaction between confidence and social trust is the clear differentiation between the two. Among the ways they differ are the following:

Confidence

- a) The antecedents of confidence, identified as “performance information,” above, can include information about ways of constraining performance, such as regulations, contracts, record keeping/accounting, control, competence, social roles, standards, etc.
- b) A person can have confidence in any aspect of his/her environment, including other persons.
- c) Since confidence is based on the accumulation of experience or evidence, changes in confidence can be incremental.
- d) Since confidence is based on understanding the past, it works to preserve the past, and it provides a stable basis for everyday life. Trust is required when confidence fails.

Social trust

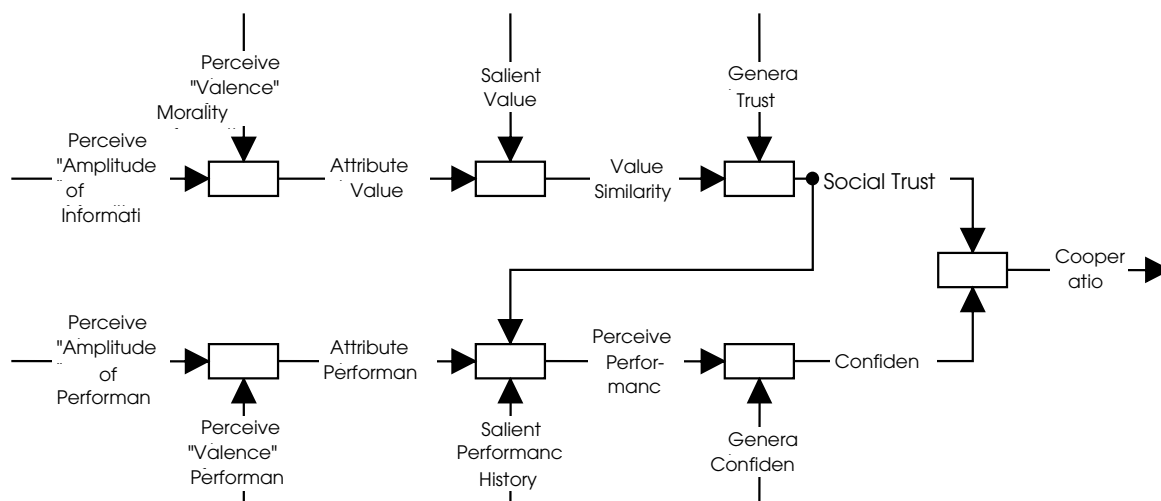
- a) The antecedents of trust, identified as “morality information,” above, can include a variety of information indicating shared values, such as benevolence, integrity, fairness, caring, and inferred traits and intentions.
- b) Since trust is based on inferred values, it occurs only in relationships between persons or between persons and person-like entities, i.e., entities interpreted as possessing values.
- c) Since social trust seems often to be based on categorical judgements (e.g., this person is/is not a member of my group), major changes in trust may require recategorisation, changes in group definition.
- d) Since trust is based on shared values and not on past performance (except, of course, when performance has value implications), trust can be a springboard to the future. Similarly, since it entails risk taking and vulnerability, and is associated with social uncertainty, trust is transitory, a bridge between steady states.

This set of contrasts between confidence and social trust parallels the distinction that psychologists make between two modes of thinking, associative and rule-based (Smith and DeCoster, 2000). Trust is associative, based on similarity. But confidence can be either associative, based on familiarity or experience, or rule-based (as in judgements of competence). In general, it is assumed that the two processes operate simultaneously and that interaction between the two consists primarily of associative thinking affecting rule-based thinking. Thus, social trust should affect confidence, but only when confidence is rule-based (“rational,” “analytical,” etc.). When confidence is assumed (i.e.,

associative), however, there is no social uncertainty, and trust is irrelevant. Therefore, whenever trust is in play it should affect judgements of confidence. Social trust has primacy and control over confidence; restoration of confidence depends on the prior establishment of trust.

The dual-mode model of co-operation

Our understanding of confidence, social trust, their antecedents, interaction, and consequences, is summarised in the following dual-mode model of co-operation (developed in collaboration with Dr. Michael Siegrist, University of Zürich):



The model depicts two pathways to co-operation, the upper via trust, the lower via confidence. At the far left of the model, the information perceived by a person is divided into two types, that which is judged to be relevant to “morality” and that which is judged relevant to “performance.” (Note that here, and throughout the model, the elements represent subjective judgements.) This division of information, although central in some areas of psychology, has been overlooked in most studies of trust and confidence, particularly in risk management contexts. Morality information tends to dominate performance information, i.e., it conditions its interpretation. For example, given positive morality information, negative performance is judged much less harshly than it would be if the morality information were negative. The elements of the model, which are aligned in parallel pairs for trust and confidence, can be briefly defined as follows: (Note that the model identifies constituent (in-coming) and product (exiting) elements but does not specify how the former are combined to produce the latter.)

- (a) Perceived “Amplitude” of (Morality/Performance) Information. The judged degree to which the given information has (morality/performance) implications.
- (b) Perceived “Valence” of (Morality/Performance) Information. The judged degree of positivity/negativity of the given information.
- ((a) and (b) combine to form (c))
- (c) Attributed (Values/Performance). The (values/performance) attributed by the observer to the other.

(d) Salient Values/Salient Performance History. In the case of values, these are the values that are currently salient to the observer – which may be the product of existing social trust relations. In the case of performance, this is whatever history of relevant performance that is currently available to the observer.

((c) and (d) combine to form (e))

(e) Value Similarity/Perceived Performance. Value Similarity is the judged similarity between the observer's currently salient values and the values attributed to the other. Perceived Performance is the observer's interpretation of the other's performance; note that this is a product not only of (c) and (d) but also of Social Trust, element (g), below.

(f) General Trust/General Confidence. General Trust is generalised interpersonal trust, the belief that most people can be trusted. General Confidence is the performance-based counterpart of the values-based General Trust: the belief that things in general are under control, uncertainty is low, and events will occur as expected.

((e) and (f) combine to form (g).)

(g) Social Trust/Confidence. These elements are defined and discussed in previous sections.

(h) Co-operation. Any form of co-operative behaviour between a person and another person or group of persons, or between a person and an organisation/institution.

Among the key features of our dual-mode model of co-operation are these:

- 1) It shows how social trust is based on morality-relevant information, while confidence is based on performance-relevant information.
- 2) It shows how, in times of low social uncertainty, when morality information isn't relevant, social trust doesn't play a role in co-operation.
- 3) It shows how social trust becomes important in times of uncertainty, when morality information is relevant.
- 4) It shows how social trust affects judgements of confidence via effects on perceived performance.

Although not shown in the model, above, judgements of risks and benefits could be included as the joint products of confidence and social trust. After twenty-five years of study, then, risk perception is seen as an epi-phenomenon of confidence and social trust.

Conclusions

The switch in focus and interpretation outlined in this paper, from risk perception research to studies of confidence and social trust, has a number of important implications for risk management theory and practice, particularly for the democratisation of decision making processes. It suggests, first, the legitimisation of movement away from a narrow, expert-derived, risk-based form of discourse to an inclusive discussion of the diverse concerns of groups of people. When problem definition is limited to risk, groups select experts, based on values shared with them, and proceed to engage in

often unproductive battles of competing experts (Tesh, 1999). Broadening the domain of discourse may suggest paths to solution that are blocked when the focus is solely on risk. Our dual-mode model of co-operation shows that discussions of the technical aspects of risk management are most usefully conducted after competing groups have formed a relationship of trust. And creating trust is simply a matter of forming, on the basis of a new set of values, one group out of two (or more). This central, creative step, necessary to counteract our tendency in times of stress to fall back on old, divisive group relations (Seligman, 1997), suggests, finally, the often overlooked importance of leadership to democratic decision making processes.

References

Bargh, J. A. and T. L. Chartrand. 1999. The unbearable automaticity of being. *American Psychologist* 54(7):462-479.

Brunswik, E. 1956. Perception and the Representative Design of Psychological Experiments. (2nd ed.) Berkeley, CA: University of California Press.

Finucane, M.L., A. Alhakami, P. Slovic, and S.M. Johnson. 2000. The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making* 13:1-17.

Hammond, K.R. 2000. *Judgments Under Stress*. New York: Oxford University Press.

Seligman, A.B. 1997. *The Problem of Trust*. Princeton, New Jersey: Princeton University Press.

Sjöberg, L. 2000. Specifying factors in radiation risk perception. *Scandinavian Journal of Psychology* 41:169-174.

Slovic, P. 2000. *The Perception of Risk*. London: Earthscan.

Smith, E.R. and J. DeCoster. 2000. Dual-process models in social and cognitive psychology: Conceptual integration and links to underlying memory systems. *Personality and Social Psychology Review* 4(2):108-131.

Tesh, S.N. 1999. Citizen experts in environmental risk. *Policy Sciences* 32:39-58.

RISK AND CONFIDENCE: TOWARDS A NEW SOCIAL CONTRACT FOR SECURITY

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Risk and Social Co-ordination

The existence of hazardous activities entails health and environment risks for different categories of actors. Among them are the one directly benefiting from the activity be they shareholders, workers, consumers or users. Some of them (workers for instance) are directly involved in the assessment and management of the related risks and, albeit at various degrees, aware of the risks at stakes. Some categories (consumers or users for instance) can benefit from the activity while being not aware of the risks entailed. Others can benefit from the activity (shareholders or consumers for instance) while not being exposed to the risks. Among the exposed actors are also categories of actors neither involved in the activity nor benefiting from it while being exposed to the risks (neighbour population of an industrial site for instance) generated by the activity. The nature and seriousness of the risk exposure resulting from the hazardous activity are linked with decisions taken by some categories of actors (shareholders, management, workers but also consumers). These decisions will impact on other actors having no information on the situation.

A very strong level of mutual dependency is therefore characterising the situation of the different categories of actors listed above.

The position of the different actors is however deeply asymmetrical in terms of information and power. Each individual is, according to the context, both exposed passively to risks entailed by decisions of other people while contributing to expose other persons as a result of its own decisions and behaviour. An increasing mutual dependency is observed in modern societies. It is linked with the development of complex sophisticated technologies and organisations. A degree of mutual dependency is however a characteristic of all kinds of society. Social mechanisms of co-ordination are therefore necessary in order to ensure the security of the members of the community. A state of security is characterised by a reasonable degree of confidence among society. This confidence is underpinned by the existence of social trust among the community (Earle 1995)¹.

The nature of the social co-ordination mechanisms of hazardous activities (Risk Governance) is often mixed and varied among contexts and cultures. Political, social, legal, ethical, and scientific mechanisms are combined. Risk governance is the sum of political, social, legal, ethical, scientific and technical components that allow the operation of hazardous activities. Risk assessment and management take place in the context of a global governance system where specific actors are

1. T. Earle & G. Cvetkovitch “Social Trust – Toward a Cosmopolitan Society”, Praeger – London 1995.

entrusted with the task of assessing and managing the risks. A more general definition of Governance is provided by the Commission on Global Governance:²

“Governance is the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and a co-operative action may be taken. It includes formal institutions and regimes empowered to enforce compliance, as well as informal arrangements that people and institutions either have agreed to or perceive to be in their interest.”

According to the type of governance of a hazardous activity, the assessment and management of risks are delegated to certain categories of actors such as the administration, the operators, the communities or the individuals. In a democratic society, the existence of social trust is a pre-condition for this devolution of risk assessment and management.

The traditional mechanisms of Risk Governance

Although varying among political and cultural contexts the mechanisms of social coordination are traditionally characterised by the same patterns of organisation in the developed societies. Progressively implemented in the democratic societies during the last centuries, these traditional mechanisms of risk governance of hazardous activities are characterised by a dominant role of the Public Authorities which are entrusted by society with the task of insuring security. The Public Authorities establish a legal framework for risk management usually grounded on experts’ risk assessments. The management of risks is more than often delegated to the collective operators while the other stakeholders are usually not involved. This mechanism is expected to produce confidence among the non involved individuals of society.

The legal frameworks are based on a definition of normality which is enacted by the Public Authorities. Although usually presented as grounded on strong scientific basis, the standards of risk exposure result from complex decision making processes of risk management entailing political, economic, ethical considerations. Such decisions usually have to make trade-offs between alternatives having different consequences for the same categories of people. In the traditional governance of risk, decision-making procedures are usually internalised by Public Authorities while the rationales and components of the context of decisions are scarcely disclosed to the non involved actors.

Risk regulation frameworks usually make explicit what can be expected as a normal state of operating an hazardous activity. According to its consistency with the available standards, a hazardous activity will be considered as normal or abnormal. The situations considered as abnormal will necessitate the intervention of Public Authorities in order to bring them back to normality. The situations considered as normal will not necessitate the intervention of Public Authorities. Normal here does not mean absence of risk but on the contrary the existence of what is considered by Public Authorities as a reasonable and tolerable level of risk.

Within traditional Risk Governance, the existence and enforcement of normative standards is a key contribution to confidence among society as long as the risk governance mechanisms are grounded on social trust. Normative standards of risk exposure also introduce a kind of discharge (*quietus*) between risk makers (enforcing the standards) and exposed individuals. In this context, public security is often confused with normality in reference to the standards established by Public Authorities and experts.

2. “Our Global Neighborhood” Report of the Commission on Global Governance Oxford University Press 1995.

Difficulties encountered by traditional mechanisms of Risk Governance

According to the conclusions of the TRUSTNET European concerted action on Risk Governance (EC 2000)³ the traditional patterns of risk regulations are encountering different types of difficulties in the context of several hazardous activities. Those reflections are extracted from the detailed analysis of some 11 concrete case studies (nuclear, GMO, EMF, pharmaceutical, flooding, POPs,...). The encountered difficulties are the following: a general loss of confidence from the actors non-involved in the risk assessment and management, the emergence of a disquieting dimension of risk in the daily life of the public, a difficulty to enforce the decisions achieved in risk management, an erosion of the credibility and legitimacy of public decision-makers as well as of experts, a growing public suspicion about technological development, an erosion of social trust among the concerned actors (administration, stakeholders and experts). The described difficulties do not arise everywhere but in complex decision-making contexts where:

- there is no perceived benefit from the hazardous activity;
- the benefits of the proposed activity are perceived as unevenly distributed;
- significant uncertainties or discrepancies in the experts' views result in public controversies on risk assessment (eg low dose effects);
- there is potential for large catastrophic effects as well as large economic impacts (GMO, BSE);
- the collective interest entails significant redistribution of risk between groups, between territories, between people now and future generations;
- centralised risk decisions do not make sense in local contexts and do not take into account local priorities;
- difficult decisions balancing safety with competitiveness and sustainability give rise to open discrepancies, controversies of advocacy science;
- the decision-making process does not respect the capacity and rights of each individual to participate in decisions which affect him.

As the initial objective was to develop more comprehensive and equitable approaches for assessing and managing risk, the TRUSTNET participants stated that discussing the risk issue does not answer the question: "Why should society take a controlled risk?" The observed difficulties also result from the absence of justification of the hazardous activity such as in the case of GMO in food. Whereas they are often interpreted as a failure in risk management, the observed difficulties are rather the consequence of inappropriate risk governance (of the way risk governance frames the decision-making process and determines the actors involved).

Emerging patterns of Risk Governance: the TRUSTNET paradigms

Having analysed the existing risk governance frameworks underpinning the activities considered in the case studies, the TRUSTNET participants have identified various parameters that characterise the governance of hazardous activities. Among the key parameters the roles of Public

3. The TRUSTNET Framework: A new perspective on Risk Governance – European Commission 2000 – EUR 19136 EN.

Authorities, Stakeholders and Experts were closely analysed in each case study. Two main patterns of relationships were identified in the case studies: the so-called Top Down paradigm of governance and the Mutual Trust paradigm of governance:

“The *Top-Down* paradigm of risk governance correspond to what was presented in the second section as the traditional mechanisms of governance. It is characterised by the dominant role of public authorities in the risk assessment and management process as well as in the justification (usually implicit) of hazardous activities. Public authorities govern by detailed problem-oriented regulations. Aspects of the decision making process such as scientific uncertainty, objective conflicts, trade-offs, and residual risks are generally not disclosed to the public. Experts are asked to provide the public authorities with optimal solutions integrating the various dimensions of decisions. The decision making process is internalised by the public authorities. Each stakeholder defends its own specific interest while the public authorities are entrusted with the task of representing the general interest.”

“The *Mutual Trust* paradigm of risk governance is characterised by a broad involvement of the stakeholders in the risk assessment and management process as well as in the justification of the hazardous activities. Public authorities govern as much as possible by framework and process oriented regulations, including a broad participation of the concerned stakeholders. Autonomy, accountability and responsibility of the stakeholders in the risk taking process are key values. Decision making is decentralised as much as possible to the relevant local context. Science is no longer presented to the public as an exclusive determining factor in the decision-making process. Expertise becomes pluralistic and available to all parties involved. Aspects of decisions such as uncertainties, and conflicting goals are exposed to public scrutiny. The Mutual Trust paradigm gives room for open political processes involving the concerned stakeholders in authenticating or rebuilding the common values which nurture social trust and social cohesion. Justification of hazardous activities according to the common values of the stakeholders is a condition for risk tolerability.”

When analysing the case studies the TRUSTNET participants also identified processes where a governance system can gradually drift to a situation where it encounters challenges such as those described above. It is observed when a Top-Down paradigm of governance is applied while the legitimacy of the public authorities’ decisions is in some way declining or questioned. Facing growing social concerns public authorities seek to legitimate decisions which do not encounter public support by reference to science. Such reference to science seeks to avoid explanation of the actual policy basis for decisions.

But as scientific controversies covered by the media unfold, the scientific input is seen to invite questions and emphasise uncertainties instead of explaining and reassuring. Stakeholders actively enter the scientific debate on risk assessment and engage experts to advocate their stakes and/or attack the integrity of the experts who advise the public authorities. Stakeholder relations become increasingly conflicting, reinforcing differences and further decreasing public confidence. Public authorities may respond by strengthening the standards of protection, but do not succeed in raising the level of public confidence. The underlying problems remain and the vicious circle continues.

Towards a new social contract for security

A major outcome of TRUSTNET is to outline that many difficulties encountered in risk assessment and management originate upstream in the global risk governance system rather than in risk management itself. “Top-Down” and the “Mutual Trust” paradigms were introduced in the TRUSTNET framework for heuristic reasons in order to delineate more clearly the different processes at work.

A governance system cannot be expected to anticipate all social crises or to maintain a continuous state of public confidence. Risk is inherent in any activity, and the best governance systems cannot hope to prevent every accident or incident. A governance system should be assessed according to its ability to overcome the events that would normally affect the current state of social cohesion. Flexibility, therefore, is a key feature when considering a governance system. A robust and efficient governance system should make it possible quickly to restore public confidence, or to create the conditions for society to authenticate or rebuild the common values that ground social trust and social cohesion. It should also adjust the resources needed to engage stakeholders, depending on the level of social trust.

But more than often the absence of common values and meanings among the concerned actors is an obstacle to the reaching of accepted and practicable decisions. Moreover the lack of a sufficient basis for social trust among the actors is hampering the mechanisms of devolution. A deficit of legitimacy is characterising the decision-making process while the institutions and decision makers in charge of risk assessment and management are neither perceived as trustworthy nor as accountable. In such contexts communication efforts as well as the strengthening of protection norms and standards by public authorities are often powerless to restore confidence and trust among society.

The purpose of TRUSTNET was not to present the Mutual Trust paradigm as a universal solution for the governance of hazardous activities. On the contrary, it was recognised that each paradigm brings specific complementary advantages from the point of view of society as a whole. It was also recognised that collective decision making should allow an efficient distribution of tasks among society and therefore should not always rely on extensive engagement of stakeholders. An inclination towards one paradigm or the other should be considered according to the historical, cultural and political context and the nature of the hazardous activity.

Analysing the case studies while observing the dynamic of social trust, TRUSTNET participants noted that in some cases where a Top-Down paradigm of governance is facing difficulties a shift to a Mutual Trust approach is likely to facilitate a dynamic process of maintaining social cohesion, whereas conversely a continuation of the Top-Down approach is likely to result in deteriorating social cohesion, leading to a situation in which the actors further radicalise their positions.

While still efficient in many contexts, the Top Down paradigm could however benefit from a clarification of the underpinning contract between Public Authorities and society. To ground the legitimacy of Public Authorities on a top-down authority or on scientific evidence does create the conditions for public misunderstanding potentially leading to severe loss of social trust. That is why the social contract underpinning the mechanisms of co-ordination of hazardous activities should be updated in order to explicit the terms of reference of the social devolution to Public Authorities in the area of risk governance. In this perspective, updated traditional risk governance patterns would be designated as belonging to a “Devolution paradigm” rather than to a “Top down paradigm”. The new contract should emphasise the fact that risk governance patterns should be adapted to the nature of the decision-making context. It should also be grounded on a risk culture shared among society in order to create favourable conditions to make explicit when necessary the rationales and content (including the non-scientific dimensions) of decisions in risk management.

Updated as a “Devolution approach”, the traditional risk governance patterns would be efficient in contexts where decision making is not characterised by complexity, when for instance the scientific expertise is providing a clear picture of the risks and when the considered options are clearly beneficial for society as a whole. Conversely a Mutual Trust approach would be necessary where the context of decisions is characterised by complexity. A Mutual Trust approach will make it possible to

maintain public confidence or to create the conditions for society to authenticate or rebuild the common values which ground social trust and social cohesion on the basis of which complex decisions can be adopted.

In the continuous social dynamic, Delegation and Mutual Trust approaches can operate successively in order to preserve social cohesion and social trust while allowing collective risk taking associated with hazardous activities that are considered worthwhile according to current social values. Mutual Trust approaches emerge in contexts where the Devolution encounter difficulties. But a Delegation approach is also likely to replace a Mutual Trust one as soon as a sufficient basis of social trust has been established.

The TRUSTNET perspective, therefore, provides opportunities for improving the current governance systems according to the societal expectations described above. The characterisation of a good governance system according to stakeholder values provides a list of diversified criteria on the basis of which the opportunity of switching from one paradigm to the other should be examined. For instance, injecting Mutual Trust procedures into a given Devolution regulatory system might be considered to restore social trust and, for example, to make the whole governance system more cost-effective, or to increase the autonomy and accountability of the stakeholders in the risk taking process.

An in depth strategic assessment of existing regulatory systems according to the TRUSTNET perspective is, therefore, to be preferred to tactical reactions in the context of a crisis. The maintenance of social trust necessitates time and distance as well as the creation of regular opportunities for processes of social dialogue within the relevant contexts.

Issues for a better integration of Radiation Protection in the new patterns of Risk Governance

Observing the evolutions described above in the area of risk governance, this last section will attempt to forecast how and to what extent the radiation protection can contribute to the improvement of the quality of decision-making processes according to the characteristics of the risk governance patterns.

Among the contribution provided by the radiation protection community to the decision making processes is the radiation protection expertise. A more general trend in the area of risk governance is the clarification of the role and mandate of experts in the decision making process. Another way to put it is to stress the necessity of clarifying the contract between experts and society. Expertise is often presented as essentially based on science in order to reinforce its credibility. It is however noted that expertise is actually a preliminary step to decision making. While integrating scientific knowledge, the expertise building is an attempt to integrate all the components of the decision context in order to prepare the decision making. If it is to be practicable, a good expertise must integrate not only the relevant scientific knowledge but all the dimensions involved in the context of the decision among them social, economical, ethical and even political considerations.

What is the mandate of the expert in the decision making? In order to preserve their credibility experts have to clarify the expectations of society on expertise according to the risk governance context. To what extent the expertise should be close to the final decision or should make explicit its rationales is a matter of contract between the expert and society in the decision-making context. It will depend on the complexity of the decision-making context, on the degree of confidence among society, on the existence of social trust among the concerned actors. These factors will hopefully determine the patterns of risk governance. Otherwise social crisis leading to social distrust can be expected if a breach in confidence occurs. This is why a key role of experts could be to advise the decision makers in determining the appropriate risk governance pattern according to the context.

Another step in this direction would be to make explicit the components of expertise: scientific inputs, uncertainties, economic, ethical dimensions, when necessary. For the same reasons, experts should also explicit and publicise the doctrine ruling the decision making, the trade-offs, the ethical principle implementation. This is for instance the strategy adopted by the UK administration involved in risk assessment and management (ILGRA).⁴ The same strategy is now adopted in Germany at the federal level. Different public institutions have also published guidelines for the practical implementation of the precautionary principle.

The radiation protection community is also frequently involved in the setting of risk regulations and standards of exposure at national and international levels. A better integration of radiation protection in the new patterns of risk governance is also linked with the capacity of risk regulations and standards to give room to contextual decision making processes involving the relevant actors when the complexity of the decision-making context or the social context requires it.⁵

In this perspective a particular attention should be paid to the process of justification of the hazardous activities. The acceptability of risk do not only lay in the characteristics of the risk itself but also in the justification of the activity generating the risk in the eyes of the exposed individuals and communities. The justification of hazardous activities as a condition to the related risks tolerability has been often stated in the past as a principle in risk management, but with limited practical consequences. As the justification cannot be established in theory but necessitates the informed agreement of the concerned actors, a sustainable implementation of hazardous activities should therefore be grounded on a clear justification of the activities in the eyes of the concerned actors.

A lack of perceived local justification is for instance at the origin of the multiple difficulties encountered by projects although grounded on global justification. In the same way, the respect of national risk regulations and risk exposure standards does not ensure the local justification of a hazardous facility. The local justification of a hazardous facility is also grounded on other dimensions and values that are found to be worth by the local neighbour communities. Risk regulations should therefore give room to open decision making processes involving the relevant stakeholders where the dimension of risk can be put into the contextual perspective taking into account all the dimensions involved in the justification process.

An example of this is for instance given in the Chernobyl post-accident context with the concept of voluntary relocation zone in the contaminated territories adopted in the post-accidental laws promulgated in the three concerned Republics of CIS (1991).⁶ Being exposed to an average annual dose of 1 to 5 mSv, local inhabitants were put in the position to decide by themselves the decision of living (or not) in the contaminated area. This autonomous position of the inhabitants is at the heart of the post-accident strategies of living conditions rehabilitation adopted in the ETHOS programme.⁷ It should be noted that in this Chernobyl context, the lack of social trust made it

4. "Risk Assessment and Risk Management: Improving policy and practice within government departments" – Second report prepared by the Interdepartmental Liaison Group on Risk Assessment (ILGRA) – HSE Book London 1998

5. The societal aspects of decision making in complex radiological situations – OECD 1998

6. Heriard Dubreuil, G., Girard, P., Conditions de vie dans les territoires contaminés en Biélorussie 8 ans après l'accident de Tchernobyl, Radioprotection, Vol. 32, pp. 209-228, 1997.

Heriard Dubreuil, G., Un premier bilan des effets psychiques et sociaux de l'accident de Tchernobyl, Radioprotection, Vol. 29, No. 3, 1994.

7. Heriard Dubreuil G. *et al* – ETHOS – Health Physics 1999

necessary to involve the population in the risk assessment procedure, with therefore a very limited delegation to experts in terms of decision preparation. The same is observed in the context of US military sites where collective risk assessment approaches are undertaken (CDC 1998).⁸

A better integration of radiation protection in society is also linked with the diffusion of a radiation protection culture. As stated in the first and second section of this document, the traditional mechanisms of risk governance usually do not involve the exposed actors and at first do not involve the public in the decision making process. When successful, the generated confidence does not make it necessary to involve the actors benefiting from the protection. This is for instance the case of neighbour inhabitants of a nuclear site. It is also the case of medical exposures where the radiation protection lays in the hand of medical operators and radiation protection experts. The same is observed for domestic exposure to natural radioactivity, for inhabitants of contaminated sites in Europe, etc. The delegation to public authorities and operators is grounded on the existence of norms and standards of risk exposure which constitutes for operators a framework for risk management. Even for operators in the day to day operation of their activity, the use of risk exposure standards is not necessarily linked to a clear consciousness of the risks involved.

A disquieting unveiling process is however observed in many contexts with notable consequences. It is linked with the occurrence of accidents and failures but also to the ALARA process itself. The continued improvement of standards in radiation protection is a matter of lack of understanding for the non-involved categories of actors. Improvement of standards is perceived as a recognition that former standards were not appropriate and synonym of a lack of security in the past.

The situation of radiation protection should also be put in the more general perspective of risk governance described above where new patterns of risk governance necessitate periodic updating of social trust within open decision making processes. This trend also affects the traditional risk governance patterns in the sense that their legitimacy is grounded on social delegation and no more on authority or scientific evidence. Whatever is the dominant pattern of risk governance there is consequently a real challenge for radiation protection to explicit and share with society the rationales of its expertise. This is why the spreading of a radiation protection culture is a key challenge for a better integration of radiation protection in modern societies. Standards and norms should no more be prepared in the darkness of internalised decision making processes limited to Public Authorities, experts and operators. The use of standards should also be clearly linked with the acquisition and maintenance of a radiation protection culture. Radiation protection cannot remain in the hand of a few specialists. It should become a concern for all the exposed categories of actors in the relevant contexts.

8. H.G. Stockwell & J.M. Smith Involving Communities in Environmental Health Studies – 1st Villigen Workshop – AEN 1998

TRUTH OR DARE: EXPERTISE AND RISK GOVERNANCE

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Abstract

There is increasing evidence that the public is as concerned with the risks associated with technology as it is enthused by the opportunities that technology presents. Experts are increasingly referred to not so much for solutions to social problems per se, but paradoxically to problems attendant on technological solutions themselves. In these circumstances, there is an urgent need for the role of the expert to be clarified. While the public and political actors have essentially looked to experts for certainty in an uncertain world, this is precisely what scientific rationality cannot provide. The inherent modesty of science (exemplified, for example, by the need for falsifiability) must always be compromised at the point when a decision is made, when “knowledge” becomes “action”. There is accordingly a need to be clear about the status of scientific information or knowledge on the one hand, and the effect of the decision to act on the other – and hence the appropriate locus of responsibility. Analysing the process from expert advice through to political or economic decision can help to clarify the point at which misunderstanding arises, at which the inherently provisional truth of science is transformed into the effectively absolute truth implied by a decision to apply knowledge as technology. Recognising that it is at this point that risks are run (as well as the opportunity for rewards created) may lead to greater clarity as to the respective roles. It may in turn offer some lessons as regards the design of risk governance arrangements and the place of experts in them.

Introduction

It is almost traditional to begin papers dealing with risk issues, at least in the field of the legal or broader social consideration of the subject, with an allusion to the diversity of risk issues with which we are daily bombarded in the media. Thus, when I was first asked to give this paper a few months ago, I noted that GMOs, climate change and mobile phones were once again making the headlines. In more recent weeks, at least in the UK, these issues have been displaced by concerns over the possible harmful effects of depleted uranium in NATO's shells and of the MMR vaccine. The prevalence of risk issues thus established, it is then traditional to make some sort of reference to the risk society. And even if the precise definition proposed by Ulrich Beck is often forgotten,¹ it does seem to be a useful shorthand for a society apparently obsessed with risk – or perhaps better, one in which risk is an easy way to achieve a banner headline and to grab public attention..

Now, in a paper supposedly concerned with expertise and risk governance, such an adherence to tradition might appear to be more superfluous than usual. In a gathering such as this, what is currently on the agenda of risk is well known and the potential for media simplification and distortion well-recognised. We are not concerned with the here-today-gone-tomorrow approach to the discussion of risk, but rather with the establishment of procedures for its measured, sustained and serious consideration. But I have begun with the traditional litany for a reason. Whatever we decide the role of the expert in risk governance to be, he or she will have to operate in a setting where the perception of what an expert is on the part of his or her interlocutors, whether lay, political or managerial, will in large part be determined by their portrayal in the media. This portrayal is complex and ambiguous, but neatly captures the problems we face in the design of risk governance arrangements.

The complex portrayal of expertise can be resolved into essentially two principal strands. The first is as the body of individuals responsible for the problems that constitute the daily headlines. We thus see experts being cross-examined over the reality or otherwise of global warming or over whether or not it is safe to use a mobile phone. And we frequently see such cross-examinations ending in outbursts of frustration because different experts say different things and, as far as an interviewer is concerned, refuse in any event to give a straight answer. In such examples, science (and by extension, the expert) is the problem and apocalyptic metaphors receive an airing: Prometheus unbound, Pandora's box opened, and technocratic hubris forced to confront its nemesis. And yet, and sometimes with remarkable speed and ease, the portrayal can be shifted fundamentally to a second strand, diametrically opposed to the first. In this the expert is portrayed as the hero. Here the deferential interviewer reflects the public's awe at the majesty of science. The new hope in the search for a cure for cancer, the new technique in cardiac surgery, a further step along the road to an AIDS vaccine. Science as the heroic discipline, the expert as the person who can alleviate suffering and enhance life.²

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1. For Beck, the risk society is one in which the logic of risk production dominates the logic of wealth production in contrast to the opposite relationship in industrial society. Ulrich Beck (1992) *Risk Society* London: Sage, p12.
 2. For a recent, succinct and cogent critique see Trevor Turner (2001) "Trust me, I'm a doctor", *New Internationalist*, 331, pp32-3. For a more sustained discussion of the end of the heroic notion of science see David Collingridge and Colin Reeve (1986) *Science Speaks to Power – The Role of Experts in Policymaking* London: Frances Pinter.

The problem is, of course, that both of these portrayals miss the point. Both do science a disservice and both fundamentally misunderstand the role of the expert. Nor is this problem helped by a tendency to conduct discussions using key terms in a very loose way. Thus, the terms *science* and *technology* are frequently used interchangeably, while *risk* too suffers from misunderstandings and a tendency to view it only as a negative. There may indeed be a *risk of harm*, but without *taking a risk* we are unlikely to receive any reward.

In moving forward in the discussion of the role of the expert in risk governance then, there is a need to counter the confusion and over-simplifications that all too often characterise popular and political debate on scientific, technological and risk issues. In this regard, the Programme circulated for this Workshop provides us with an excellent starting point when it identifies as one of its tasks: developing a better understanding of the difference between the role of the expert and that of the decision maker. The argument I will develop in this paper is that it is by grasping and insisting upon this key distinction that progress can be made towards clarity and understanding in discussion of risk, and towards enhanced risk governance arrangements. And I propose the short title of this paper as a useful shorthand for this vital distinction, a point I will clarify in due course.

From Scientific Revolution to Industrial Revolution

If we have identified confusion about the role of experts and about the nature of science as obstacles to progress in risk governance, we need to begin by attempting to provide greater clarity. There is no more fundamental question in this regard than: what is science? Apparently innocuous, it is a question that is rarely, if ever, asked. Despite the fact that the term is used on a daily basis by many who are instrumental in the formation of opinion or in the taking of decisions, and despite the fact that it is basic to their deliberations, its precise meaning is not questioned. The meaning is too obvious, too well known. In common with art, it seems, we may not necessarily be able to provide a definition, but we know science when we see it. Except that what we are seeing is usually technology.

Is this just the lawyer in me, raising his ugly head? Does this legalistic pedantry have a point? It does. A vitally important one. In order to reach it, we need to go back a little in history. In discussing the history of science, of course, we could go back quite a long way, but for present purposes, the seventeenth and eighteenth centuries are far enough. The era of the Scientific Revolution and of the Enlightenment represented a key turning point in human affairs and in the relationship between man and nature. There has always been a concern with truth, but until that period truth had been understood essentially as *revealed* truth. What was true about nature was, in the ultimate, what had been revealed by the deity and recorded in certain ancient key texts. Even truth-finding in difficult and controversial cases could be referred to the divine will in the form of trial by ordeal.³ The Scientific Revolution of the 17th changed all of that. Truth was now about observation, experiment, method. Truth was no longer revealed, it was discovered. And more importantly, man was the *agent* in the discovery of truth, not the passive recipient of revelation.

Despite this new found freedom, the seeds of the problems we now encounter as regards confusion about the nature of science were soon sown. Newton, perhaps the key figure in the Revolution, apparently saw the incipient difficulty. Spoken of by awe-struck contemporaries almost as a god on account of his groundbreaking insights and discoveries, he and others around him seemed to perceive that what he was doing was not only exceptional, but also inherently dangerous. Newton himself was notoriously reluctant to publish his work and insisted at all times upon what he called

3. Robert Bartlett (1986) *Trial by Fire and Water*, Oxford: Clarendon Press.

“philosophical modesty”. Similarly, Edmond Halley, the astronomer who was in large part responsible for achieving the publication of Newton’s *Principia*, wrote at the time, “*Nec fas est proprius Mortali attingere Divos*”– ‘it is not lawful for mortals to approach divinity nearer than this’.⁴

The Enlightenment of the 18th century, however, only saw mankind’s confidence increase on the basis of the new scientific methods at its disposal. Kant might have understood better than most the need for method and modesty, but he expressed the exuberance of the age in what might stand as its slogan: “*Sapere aude*”, ‘*Dare to know!*’⁵ But while in Kant we have a clear notion of science as the generation of knowledge, we also see in his contemporaries a desire to *do* something with that knowledge. Knowledge, after all, may be power, but frequently only when it is applied. To be sure, the impulse was, more often than not, pure. Enlightenment was in its essence a realisation that the order of things – natural or social – was not given, not fixed, but rather open to change for the better. And so it was that, unlike Kant, mankind, especially since the Industrial Revolution, has not been content simply to know but has, once knowledge has been acquired, then moved forward under another, albeit unspoken, slogan: “*Agere aude*”. “*Dare to act!*”

At the time when Kant was writing, the dominance of an essentially religious world-view was such that the quest for knowledge beyond the revealed truth was indeed to accept a dare. Perhaps that step once taken, it was less of a problem to proceed to its application. For whatever reason, however, it can be argued that until relatively recently the status of the knowledge on which action has been based has not been widely viewed as problematic. *To act* has, as a consequence, truly been a dare in a way in which simply *to know* never was.

It is easy to see, then, why the idea of hubris and nemesis, the key theme of classical Greek tragedy,⁶ is so attractive to the critics of industrial capitalism. Driven by a purported knowledge and understanding of nature, the last couple of centuries have seen exponential technological development which has not been seriously questioned until comparatively recently and which is proving to be difficult to moderate in terms of environmental protection or sustainable development. The last decades can thus rather persuasively be characterised as the final act in a tragedy where the hubris of the key actors is resolved by their inevitable encounter with nemesis. Stripped of the apocalyptic tone, however, there is something in this analogy. Insofar as it reminds us of the modesty demanded by Newton and Kant, it points to the fact that science is about knowledge, while action is another matter altogether.

The Nature of Science

In order to see more clearly what the implications of this distinction between knowledge and action are for our more immediate concerns of expertise and risk governance, we need to bring things

4. Quoted in Peter Gay (1973) *The Enlightenment: An Interpretation 2: The Science of Freedom*, London: Wildwood House, p131.

5. Immanuel Kant “What is Enlightenment?” in Peter Gay (ed.) (1985) *The Enlightenment: A Comprehensive Anthology*, Oxford: Basil Blackwell, pp383-90, 384.

6. “It is always the great buildings and tall trees which are struck by lightning. It is God’s way to bring the lofty low”. Herodotus (1996) *The Histories*, VII, 10e, Harmondsworth: Penguin.

more up to date, to a point at which we find a clear expression of the status of scientific knowledge.⁷ The best, certainly the clearest, account I have found in this regard is the one offered by Karl Popper:

“The empirical basis of objective science has nothing ‘absolute’ about it. Science does not rest upon solid bedrock. The bold structure of its theories rises, as it were, above a swamp. It is like a building erected on piles. The piles are driven down from above into the swamp, but not down to any natural or ‘given’ base; and if we stop driving the piles deeper, it is not because we have reached firm ground. We simply stop when we are satisfied that the piles are firm enough to carry the structure, at least for the time being.”⁸

A clear picture of science and its findings this may well be, but it apparently comes as a surprise to some and its implications for action are profound. Here I return again to the portrayal of science and expertise in the media and to one example in particular which is by no means exceptional. A few months ago, when the safety of mobile phones and the risk they may pose in terms of brain tumours was again a topic for public concern, the British medical scientist who had produced a report urging caution, especially in the use of such phones by children, was interviewed on what is possibly the foremost news and current affairs programme on UK radio. Confronted with the BBC’s most feared interviewer, the scientist was quite willing to state clearly that he did not know the answer to some of the questions asked about the risks from mobile phones. This was greeted with incredulity by the interviewer. Here was an expert who had written a report about the safety of mobile phones who *did not know* whether they were safe or not! The audience was effectively invited at the end of the interview to regard this as a quite scandalous state of affairs.

Well, frustrating it might be, but scandalous? No. Quite the reverse. Pejoratively, an expert may be someone who knows a great deal about very little. But surely the virtue of the expert is that he or she is also someone who realises that there is a great deal they do not know, including about their own domain of expertise. The rationality of science imposes this modesty. Science is, to the extent that Popper’s representation is accurate, an inherently modest discipline. In other words, the findings of science are provisional.

This in turn affects our understanding of truth. Given the roots of the notion of truth in the pre-modern world, it is perhaps not surprising that problems have arisen even in the post-Enlightenment era. When truth was understood as revealed truth and when even truth-finding could in the extreme be referred to the divine, truth could, indeed had to, be equated with *certainty*. In the era of science, however, truth is produced by rational methods and is equated only with *knowledge*. Now, whatever the popular perception of the relationship between knowledge and certainty is, the understanding of science proposed by Popper indicates that it is not, indeed cannot, be one of equivalence.⁹ This is a crucial point. The outrage and exasperation of our radio interviewer would evaporate in the face of this realisation.

Or then again, maybe it wouldn’t. The problem that experts face is that while science has in the last couple of decades come under widespread and sustained attack for its role in such problems as

7. For a discussion, see Hugh Lacey (1986) “The Rationality of Science”, in J. Margolis, M. Krausz and R. M. Burian (eds.) *Rationality, Relativism and the Human Sciences*, Dordrecht, Boston and Lancaster: Martin Nijhoff Publishers, pp127-149.

8. Karl Popper (1972) *The Logic of Scientific Discovery* (6th Impression – Revised) London: Hutchison, p111.

9. See also Anthony Giddens (1991) *The Consequences of Modernity*, Cambridge: Polity Press.

global warming,¹⁰ it is precisely to science that the public has turned for a solution. A function of the confused image of science I mentioned earlier is that while science has increasingly become the villain of the piece, it still retains its heroic attraction. And in this latter guise, it is not at all accused of hubris but instead is looked to as a source of *certainty*. No doubt psychologists would have something to say about this, but it is almost as if, bereft of the certainties inherent in pre-modern revealed truth as mediated by a priestly caste, society has turned to experts as the acolytes of science to meet a continuing deep human need. Even faced with continuing evidence that certainty is simply not there to be had (the unintended adverse consequences of technology), society is unable to submit itself to the apparent ontological insecurity that the inherent modesty of science implies.

Nor, to be fair, is this surprising. At a certain point, decisions have to be made if we are to go on. To fail to take a decision can of course be represented as a decision in itself, but unless society is to become bogged down in unresolved vacillation and aporia,¹¹ a positive act is required. And this is essentially what happens when science becomes technology, when knowledge is applied. Given what we now know about the nature of knowledge as only ever provisional truth, the importance of the distinction between knowledge and action I insisted on earlier becomes clearer. And this takes us straight to the heart of our concern with the role of the expert in risk governance and the expressed desire of this Workshop to develop a better understanding of the distinction between the expert and the decision maker.

Knowledge, action and the inevitable misunderstanding of science

To help develop this distinction we can usefully look at the way in which science interacts with law. In some respects, law is well set up to deal with the fact that knowledge cannot be equated with certainty. In the rules of evidence, for example, there is no requirement that facts be established as certain in court. Instead, in criminal trials, the standard of proof is *beyond reasonable doubt*, while in civil matters the standard is the less demanding *balance of probabilities*. Similarly in the field of regulatory law, there is no presumption that a regulation once passed will remain unchanged in all time coming. A point may be reached when it is recognised that a rule has fallen behind the state of knowledge in the domain it is supposed to regulate. What may have been an appropriate standard for exposure to a given carcinogen at one point, is recognised to be inadequate when further data have been collected. Consequently, there are procedures for the repeal of such laws and regulations, and their replacement with new rules which better reflect the current state of knowledge. Despite this apparently enlightened approach, however, there is a problem. At any given point, for the time being, law acts *as if* knowledge were certain, *as if* truth equalled certainty. Indeed, on one view, whereas science can go on making provisional findings of truth, law ultimately requires a definite answer and indeed ‘misunderstands’ scientific evidence in this way.¹²

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10. The publication of Rachel Carson’s *Silent Spring* (Boston: Houghton Mifflin Company) in 1962, for many marks the turning point after which the momentum of the environmental and anti-capitalist movements gather pace.
 11. For a compelling literary consideration of such a nightmare scenario, see Samuel Beckett, *The Unnameable*.
 12. See Henri Lévy-Bruhl (1964) *La preuve judiciaire: Étude de sociologie juridique* Paris: Rivière quoted in Roger Cotterrell (1992) *The Sociology of Law: An Introduction* (Second Edition) London, Dublin, Edinburgh: Butterworths, p51. See also Joel Yellin (1983) “Science, Technology, and Administrative Government: Institutional Designs for Environmental Decisionmaking” *Yale Law Journal* Vol. 92, no. 5, 1300-1333, 1312 where he notes the “important functional distinctions between scientific and legal evidence. Scientific evidence principally serves to define the limits of knowledge and help set directions for further work.”

Nor is law unique in this respect. The same holds true as between economics and science. To put it at its most simple, while science as pure science would go on producing provisional findings as regards a particular mechanism within the confines of the laboratory, meanwhile on the top floor, accountants are looking at the bottom line, investors are complaining about the burn rate and managers are determining the point at which the mechanism has to be brought to market or the company go bust. In other words, while the time horizon of science is open-ended, that of economics is definite.¹³ The process of economic decision making on the basis of scientific evidence can thus just as easily be characterised as an inevitable misunderstanding.

The consequences of deciding

The point at which a decision is made, then, is clearly of crucial importance. It is at this point that we not only decide to act, but that we decide that the inherent uncertainty in the knowledge produced by science can be accommodated. It is effectively at this point that risk comes into play. In taking a decision, we are taking a risk. It is at this point, then, that truth becomes dare. There is no escaping this transition point. It is there whether it is recognised or not. Nor is there any means of altering the nature of the transition. The fundamental essence of knowledge will not crystallise into certainty simply through the acknowledgement that the point of decision crystallises the risk. This is not to imply, however, that we are confronted with a yawning chasm of uncertainty. Focusing on the transition point from knowledge to action does not lead to a helpless fatalism. There are still important choices to be made, even if each choice, we can now see, is itself a transition point of the sort we are seeking to cope with.

Let me again turn to the relationship between law and science to begin to examine what we can do in this respect. The history of the legal treatment of occupational health and safety can be said to follow a trajectory from formal law, through substantive regulation to some form of law inspired by procedural rationality. What this means in practice is that, at the outset, occupational health and safety, insofar as it was an issue at all, was felt properly to be the concern of the individual contracts negotiated between workers and employers. The whole ethos of the classical liberal state of the 19th century was that government should not interfere in social relationships beyond providing and guaranteeing the basic legal mechanisms by which those relationships could be formalised. The market would stabilise even labour relationships (the worker was seen to be selling his labour) and part of the bargain that would be struck by rational, utility maximising actors would be an adequate level of health and safety for the worker and an efficient level of health and safety for the employer.

A recognition of the inadequacy of this approach in the context of the growing industrialisation of the 19th century (the problem of market failures or negative externalities) persuaded governments however that intervention was required and factories legislation began to appear which sought to regulate in detail every aspect of the work. This approach continued well into the 20th century until concern began to be expressed about its adequacy in the face of ever more complex and diverse work environments and an ever-increasing rate of technological change. Even in the early 1970s, it is possible to see examples of legislatures expressing the belief that law and regulation could accomplish these tasks, but within a few years the prescriptive approach to regulation in the field of health and safety at work has clearly been abandoned.

There are those who bemoan the abandonment of prescriptive regulation for the very certainty that it provided and who suspect the shift away from it as being essentially an economic-

13. For a discussion of a related point see Margaret A. Somerville (1999) "Doing Science in *Ethics Time*" UNESCO/ICSU World Conference on Science <http://helix.nature.com/wcs/c13.html>.

inspired deregulation. It is certainly possible to sympathise with this sentiment, and it is always necessary to be sensitive to the possibility that decisions are being driven purely by money rather than by other concerns. In the light of what we have discovered above about the nature of scientific knowledge, however, and the effect of the point of decision (of which the regulatory act is an example) it is necessary to approach alternatives to prescription with a more open mind.

Towards a mutual trust approach

Insofar as they represent a shift away from a top-down approach and towards a mutual trust approach¹⁴ to the regulation of occupational health and safety, or insofar as they aim at uniting disparate stakeholder groups (notably workers and employees) within a new grouping based on common values (and thus at the establishment of social trust and the rebuilding of confidence),¹⁵ new regulatory approaches are rather to be welcomed than criticised.¹⁶

Nor is it only in law that such developments are evident. In the field of radiological protection, we could cite the BNFL Stakeholder Dialogue exercise in the UK¹⁷ or the Pluralistic Evaluation Experience at Nord Cotentin in France.¹⁸ And this general direction in the approach to risk is only likely to be boosted by the publication later this year of the European Commission's White Paper on European Governance which among other objectives is concerned to democratise scientific expertise, particularly in the sensitive area of health and safety.¹⁹

How then does the insistence of the distinction between knowledge and action impact upon our understanding of such novel risk governance arrangements? Generally speaking we could propose the following:

- as regards the shift from a top-down to a mutual trust approach, it has implications for the locus and the nature of *responsibility*;
- as regards the development of mutual trust, it influences the *common values* upon which new unified groups of stakeholders may be built.

Whereas in the top-down paradigm responsibility rested ultimately with elected decision-makers, in the mutual trust paradigm responsibility will be shared among all of those involved in the decision-making process. In the top-down model, whereas when things went wrong decision makers could point to expert advice in order to try to escape responsibility,²⁰ in the mutual trust model

14. See Gilles Heriard-Dubreuil (2001) "Risk and Confidence: Towards a New Social Contract for Security", Paper 6 at the Second Villigen Workshop.

15. See Timothy C. Earle (2001) "From Risk Perception to Social Trust: An Outline of Recent Contributions of Psychology to Risk Management", Paper 5 at the Second Villigen Workshop.

16. For an in-depth study of such progression from formal, through substantive to procedural regulation, see John Paterson (2000) *Behind the Mask: Regulating Health and Safety in Britain's Offshore Oil and Gas Industry* Aldershot, Burlington USA, Singapore, Sydney: Ashgate-Dartmouth.

17. See BNFL's *Environment, Health and Safety Report 2000*.

18. Cristoph Murith (2001) "Pluralistic Evaluation Experience: the Nord Cotentin Radiological Group", Paper 17 at the Second Villigen Workshop.

19. SEC/2000 1547/7.

20. The behaviour of certain government ministers in the UK during the BSE crisis being a good example.

informed by the distinction between knowledge and action, the provisional nature of truth will explicit and responsibility for decisions will not be so easy to transfer to experts.

As regards the common values, these will have to relate to a willingness to accept uncertainty, to share responsibility and to face up to the fact that, when truth equals knowledge and not certainty, to decide to act is essentially to dare in the sense of taking a risk.

It is clear that the burden imposed on stakeholders by a mutual trust approach to risk governance is potentially a heavy one which has implications for law, regulation, politics, insurance and other dimensions of the risk equation beyond those I have discussed briefly above and well beyond the scope of this paper. What we can achieve, however, by focusing on the distinction between knowledge and action, between truth and dare, are some pointers to the sorts of features that such new modes of governance must possess if they are to fulfil their potential in coming to terms with some of the most pressing problems confronting society.

The Governance Project: the importance of collective learning

As part of the inspiration for the European Commission's proposal for a White Paper on European Governance, a project of the Commission's Forward Studies Unit in recent years has given thought to precisely this sort of question. Without pre-empting the content of the eventual White Paper, it is possible to look to that project for indications of what might be regarded as distinctive key features of such new modes of risk governance as are implied by the mutual trust paradigm.²¹ There we will certainly find such features as a concern with guaranteeing wider participation of stakeholders and addressing material and cognitive inequalities among them, or as a recognition of the impact of the provisional nature of knowledge on the production of relatively limited understandings of problems. We will also find suggestions which aim at improving coherence among policies and which seek to enhance sensitivity to context. In drawing towards a conclusion, however, I would like to focus on just one of the key features of new modes of governance identified by the Forward Studies Unit's project, and to consider in particular how it both relates to the difference between knowledge and action in risk governance and can thus clarify the distinction between expertise and decision making.

The key feature I have in mind is that of *encouraging collective learning*. Recognising that knowledge is inherently provisional and equally that it is increasingly fragmented, the governance project concluded that the only defensible orientation for a governance system is one of ongoing collective learning. In the sorts of areas characterised by complexity and uncertainty in which we encounter our most pressing risk problems, a mutual trust approach will need to accept that common accounts of the problem are unlikely to exist and that once-and-for-all answers are unlikely to emerge. Consequently, it will need to be so established as to encourage collective, or perhaps better a mutual, learning. In other words, it will need to encourage different stakeholders to explain and justify their accounts of a problem and their proposed answers, and that in the context of the feedback they receive from other stakeholders. In terms of the broader public policy process, such an orientation implies a willingness to monitor, evaluate and revise policy on an ongoing basis. In particular, such an orientation needs to replace the reactive, crisis-management approach to regulatory revision that we are all too familiar with.

21. For a fuller discussion see Notis Lebessis and John Paterson (2001) "Developing New Modes of Governance" in *Governance in the European Union* in Olivier De Schutter, Notis Lebessis and John Paterson (eds.) Forward Studies Unit Series, London/Paris: Kogan Page/Apogée pp259-94.

Challenges and opportunities for experts

Such an approach to risk governance confronts experts with both opportunities and challenges. On the one hand it allows them to clarify the status of the knowledge they are involved in producing and to minimise the danger of its constructive misunderstanding by lay, political or economic actors. The importance of the point of decision and the locus of responsibility for it will thus be clarified. Similarly, such an orientation for risk governance would imply a process that is inherently conducive to the nature of scientific rationality which demands modesty, falsifiability and learning. Lastly, the development of such an approach to risk governance can only contribute to a clearer and more realistic understanding of the expert on the part of his or her interlocutors. Heroic? Yes. But only in the sense of being the privileged bearers of the best means we have at our disposal for generating knowledge. Villains? No. But less than heroic if they forget the modesty their rationality demands and refuse to acknowledge that risk is not only about paternalistic technical solutions, but about democratic legitimacy and acceptability determined in more adequately complex ways than has heretofore been the norm.

On the other hand, such an approach to risk governance will confront experts with significant challenges. They will have to develop new skills of communication, more complex than those that have been honed in the adversarial procedures of rule-making in the US.²² They may also have to take on a quasi-pedagogical role in the context of a collective learning orientation – but they will equally have to be ready to learn from those whose take on a given risk may owe nothing to technical ability and everything to a personal stake in any downside.

Conclusion

The developing field of risk governance is already witness to arrangements that are pushing back the boundaries imposed by traditional models of decision making and regulation. An indication of a wider concern with new modes of governance, risk governance is nevertheless in many respects in the vanguard. This is not least because the problems that have come to light in recent decades, which essentially represent the unforeseen downside of otherwise useful technological innovations, have forced innovation forward more rapidly than in, say, the realm of social policy (where there is currently a manifest desire for more adequately complex arrangements than those bequeathed by the classical liberal state and its welfare successor).²³ Whatever form these new arrangements ultimately take – and flexibility must surely be one of their defining features – it seems clear that a closer focus on the roles of the various actors will be essential as well as on the nature and utility of the reasoning that they bring to the table. It is easy in a climate of panic to focus on science as part of the problem rather than the solution, when in fact this closer focus reveals science as the best answer we have – albeit when situated in more open and responsive arrangements. If truth must be understood as knowledge rather than as certainty, it is nevertheless still our firmest foundation. Developing and sharing a better understanding of just how firm (and thus of what the foundation cannot be expected to support) will help to strengthen and protect the role of the expert while ensuring that responsibility for action is accepted and shared by those with a stake in the outcomes. If we are to accept the dare that any decision implies – in particular in a context of complexity and uncertainty – we need to be sure that we do so with our eyes open.

22. See Alvin M. Weinberg (1972) “Science and Trans-Science”, *Minerva*, 209-222, 215; Giandomenico Majone (1989) *Evidence, Argument and Persuasion in the Policy Process* New Haven and London: Yale University Press.

23. See especially Anthony Giddens (1998) *The Third Way: The Renewal of Social Democracy*, Cambridge: Polity Press, and (2000) *The Third Way and its Critics*, Cambridge: Polity Press.

ACCEPTABILITY, ACCEPTANCE AND DECISION MAKING

H. Ackerschott

Abstract

There is a fundamental difference between the acceptability of a civilisatory or societal risk and the acceptability of the decision-making process that leads to a civilisatory or societal risk. The analysis of individual risk decisions – regarding who, executes when which indisputably hazardous, unhealthy or dangerous behaviour under which circumstances – is not helpful in finding solutions for the political decisions at hand in Germany concerning nuclear energy in particular or energy in general.

The debt for implementation of any technology, in the sense of making the technology a success in terms of broad acceptance and general utilisation, lies with the particular industry involved. Regardless of the technology, innovation research identifies the implementation phase as most critical to the success of any innovation. In this sense, nuclear technology is at best still an innovation, because the implementation has not yet been completed.

Fear and opposition to innovation are ubiquitous. Even the economy – which is often described as “rational” – is full of this resistance. Innovation has an impact on the pivotal point between stability, the presupposition for the successful execution of decisions already taken and instability, which includes insecurity, but is also necessary for the success of further development. By definition, innovations are beyond our sphere of experience; not at the level of reliability and trust yet to come. Yet they are evaluated via the simplifying heuristics for making decisions proven not only to be necessary and useful, but also accurate in the familiar.

The “settlement of the debt of implementation”, the accompanying communication, the decision-making procedures concerning the regulation of averse effects of the technology, but also the tailoring of the new technology or service itself must be directed to appropriate target groups. But the group often aimed at in the nuclear debate, the group, which largely determines political discussion, defines itself through the explicit and total rejection of nuclear energy. The opponents of nuclear energy are immune to conviction because of their specific decision-making strategy. Because they value the residual risk as a criterion against the use of nuclear energy that can not be compensated by any benefit, their strategy is described as non-compensatory strategy. Any communication about the technology but also concerning proceedings must be directed to target groups using decision-making strategies that are open to receiving new information. Also to be taken into account is that the opponents try to convince others about their decision strategy.

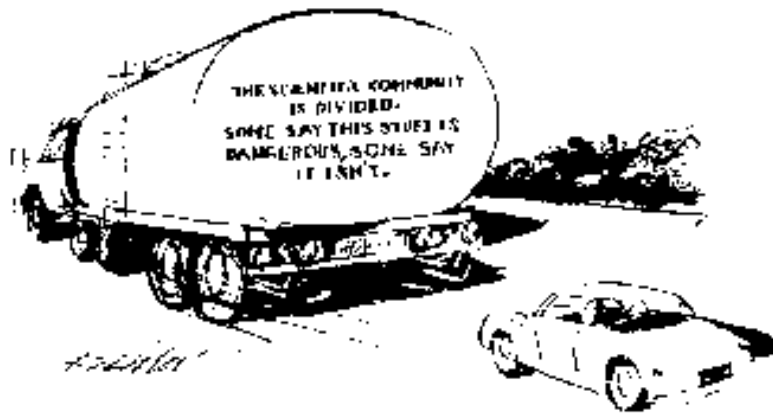
Openness and transparency in decision-making processes regarding radiation protection and the nuclear industry are necessary conditions for further progress on radiation protection issues. However, they are not sufficient, because discussion on energy policy is trivialised, simplified and politically abused. For society, the benefits of nuclear technology in the energy sector are out of focus.

The advantage to society especially in terms of ecology must also be shown as an advantage to the individual. This has not yet occurred but it is the prerequisite for a broad, solid and politically stable agreement on nuclear issues.

Introduction

The scientific community is divided. Dangerous or not? Who decides?

Figure 1. Drawing by Richter; © 1988 The New Yorker Magazine [1]



As an expert in radiation protection, you can gain respect through your work. You can earn trust over many years of reliable work, and you can find people who believe what you tell them. You encounter people who follow your judgement and trust you, but there will always be those who follow the judgement of others whom they regard as experts.

The following paper presents psychological comments on the concepts of acceptance and acceptability; points out some effects of decision making heuristics on the conflicts about nuclear issues, and describes the roles of public, industry and regulating bodies in this context. It will introduce the concept of residual resistance as completion of the search for social acceptance.

Acceptance and acceptability

The international nuclear industry regards “public acceptance” as the third pillar of success. The meaning of the term is only vaguely specified. In the discussions on acceptance of new technologies in general and, specifically of nuclear energy, “acceptance” is most often used in terms of “high acceptance”. This definitively reflects an unrealistic goal.

While it is reasonable to ask that the majority of clients of the power-supply industry tolerate or condone the usage of nuclear energy as the means of production for the electricity that the clients use in their homes, it is presumptuous to ask for active approval or applause. Even the wish for active analysis is quite a lot to ask of the general public. The same goes for legal procedures – the rules and regulations. It must be enough to have the consent of the silent majority.

Acceptability stands for the option to accept something. In the context of a quantifiable, material demand - of safety, for example – acceptability is ambiguous. A risk can be accepted, even if it “really” is not acceptable; and it can “really” be acceptable, yet for some reason it is not accepted.

In the context of ionizing radiation, it is therefore recommended to operationalise the term “acceptance” on an individual level as a varying attitude which can be positive (support, high acceptance, adoption), indifferent (medium acceptance, toleration), low, and negative (zero acceptance, refusal, militant opposition). On a societal level, the operationalised goal for the radiation protection community should be toleration of its rules and regulations, proceedings and operations. The acceptance of the technology includes as a prerequisite the acceptance of the related rules and regulations, laws, technical and procedural norms.

Interference through fear

With the acceptance of nuclear energy, of the common practice of authorities and regulatory bodies, even of the framework of existing legislation, emotion interferes. Concerning nuclear energy and matters of radiation protection, fear or even emotional angst acts as an antagonist towards acceptance. This emotion influences the relations between industry, regulatory bodies, the government and the general public as well as their communication. A rational framework stands against emotion. It is important, that the expert community adopt a perspective, that accepts the fear of technological risks in the general population and that respects those fears as a normal reaction. Fear must be taken into account by the protagonists of any technology or even by anyone who wants to introduce change in a given stable system; so must the resistance resulting from it. Fear of the peaceful use of nuclear energy is neither something special, nor something new created by high technology.

The possibility of damage or loss is a fundamental characteristic of the world we live in. The fear of risk is not a phenomenon of our time. Some 200 years ago, the astronomers Jean-Baptiste Delambre and Pierre Mechain were eyed with suspicion as they measured the meridian between Dunkirchen and Barcelona in order to find a universal standard for measuring length. Again and again, their landmarks were burned down and they had to save their optical instruments from being destroyed. People felt threatened by these tools of “magicians and the devil”. Delambre and Mechain were continuously driven away from their work. [1].

In the first years of the railroad, people discussed the danger of insanity that strikes passengers travelling on a train going at more than 30 kilometers per hour through a tunnel. Many people were afraid even of the introduction of the electric streetlight. An illustrated article published in the “Kölnischen Zeitung”, the Cologne Newspaper, in 1819 wrote (extracts).

Every Streetlight Must Be Rejected:

- For Theological Reasons - Because they are an intervention to God's order. According to this (order), the night belongs to darkness, and is interrupted only by moonlight at certain times. We must not rebel against this; not dictate the world plan; not want to turn night into day.
- For Medical Reasons – The evaporation of oil and gas are disadvantageous to the health of frail or nervous people, and create the basis for many illnesses – making it easy and comfortable for people to stay outside and, therefore, catch a cough, cold and sore throat.

- For Philosophical Reasons – Streetlighting drains the moral character. The artificial light chases away the horror of the darkness, which prevents the weak from sinning. The light makes the drinker feel secure, and he will carouse the inns until late in the night.
- For Police Reasons – It makes the horses shy and the thieves daring [2].

The arguments go on with economic, popular and legal reasons, and show a broad argumentative basis as well as a strong engagement against such a now-simple technological innovation.

Fear of new technologies are part of the fear of the new

Experts in regulatory bodies or in the industry regard these historical examples of the fear of technology more as party jokes than real chances to learn from past experiences. They aren't proof of the ignorance or silliness of a group of stubborn, inflexible people as proclaimed by technical protagonists. Instead, they are proof of the stability of a psychological phenomenon through the times.

There also have been cases in which fears and warnings were justified, ignored, and then proved true. The case of Contergan (Thalidomide) was the origin of modern medical regulatory legislation in Germany. Approximately 7 000 infants were born disabled; warnings given by doctors were dismissed and ignored. At this time, it was stated that there was no evidence for the connection between the deformity of the infants and the medication. Thalidomide illustrated painfully that the absence of evidence was not the evidence of absence – a basic rule of scientific theory that is often neglected today as well.

Decision making heuristics as determinants of attitudes

Fear of risk and opposition towards innovation are not only old phenomena, but they are also ubiquitous. They are not restricted to certain populations or homogenous groups. Even the business community, which is often described as rational, is full of this emotional resistance to change. That is so, because innovation has an impact on the pivotal point between stability, the presupposition for the successful execution of decisions already taken, and instability – which includes insecurity – but is also necessary for the success of further development. By definition, innovations are beyond our sphere of experience, not at the level of reliability and trust yet to come. Yet, they are evaluated by using simplified heuristics for decision making, which have proven not only to be necessary and useful, but also accurate.

One particularly powerful heuristic to orientate oneself in everyday routines, and to judge and estimate positive or negative qualities of almost anything, is the recognition inference. The recognition heuristic exploits the capacity of recognition to make inferences about unknown aspects of the world. Consider the task of inferring which of two objects, persons, technologies, experts, has a higher value on some criterion (e.g. which is faster, higher, stronger, more knowledgeable or trustworthy or dangerous). The recognition inference for such tasks is simply stated: If one of two objects is recognised and the other is not, then infer that the recognised object has the higher value [3]. This heuristic is not a phenomenon of our time, and it is not an effect experienced only by the everyday person. It is a basic way of orientation. And the judgement resulting from it is extremely unfavourable to the unrecognised, the unknown and the new. As we all know, the fear of the new sometimes is proven valid. This is, of course, because no one can foresee the future and compute all probabilities. Even experts in their fields cannot do this.

In fields in which experts can work far from the “public eye“, huge mistakes and errors are possible. However, this is of course positive, because science, as any other domain, can develop further only when mistakes and errors are part of the process. However, it is important to note how far off the estimations of one’s own errors of judgement are, even in the “hard” sciences. An example of how scientists systematically underestimated the uncertainty of their findings is the history of measuring the velocity of light.

In 1986, M. Henrion and B. Fishhoff compiled 27 studies on the speed of light, dated between 1875 and 1958. All of the studies informed readers on the formal estimates of uncertainty. The official value of the speed of light, as of 1984, was outside of the confidence intervals of all reported estimates [4]. The point is that scientists are human and can make errors. In addition, experts use in their familiar world of science simple – and sometimes not adequate – decision heuristics, such as “one reason” decision making. They are also prone to mistakes of perception and errors in estimation and of all different kinds of group-phenomena, giving them a false sense of security.

So much about scientific estimates of error inside the scientific community. When human lives depend on the decisions and experts’ estimates of their own errors, then formal decision processes under public participation are useful dimensions of control and security.

Therefore, “danger” comes from both sides. Sceptics who are continuously scrutinising any new development may impede beneficial innovations; experts who underestimate the dangers of a technology can end up threatening the environment and human lives.

Another decision-making strategy relevant in this context is the class of non-compensatory strategies. Non-compensatory describes a heuristic that uses a special strategy for evaluating sets of information to come to a decision. A strategy is non-compensatory, if a cue cannot be outweighed by any combination of other cues in a given set of information [5]. The polarisation of attitudes towards the peaceful use of nuclear energy in Germany is based, amongst other reasons, on the circumstance that a stable group has defined itself through the explicit and total rejection of nuclear energy. This group largely determines the political discussion. These opponents of nuclear energy are immune to communication because of their specific decision-making strategy. Because they value the residual risk as a criterion against the use of nuclear energy that cannot be compensated by any benefit, their decision-making strategy can be described and analysed as non-compensatory strategy.

The role of the public

In Germany, the institution of formal public participation in authorisation and licensing processes under the law determining the peaceful use of nuclear energy and its procedural by-laws (Atomgesetz AtG and Atomrechtliche VerfahrensVO AtVfV) developed differently from the intentions of the legislator. The processes underwent redefinition through practice because of psychological assumptions of regulating bodies. De Jure is the formal public participation instrument for the equalisation of interest and the taking into consideration of the influence of projects on the people. The legal system in which this is adequately and currently practised is traffic planning laws. The farmer who is concerned about a new road that is to be built across his property informs the authorities of his concerns – the intrusion on his grounds, noise, pollution, etc. The case will be checked, equalised, considered in terms of modification, or else rejected. The same system doesn’t fit the needs of nuclear issues. In nuclear authorisation processes, opponents appear with a variety of experts presenting counter-opinions on the project at hand. The officially presented documents are checked and counterchecked, technical solutions are debated in depth, the state of the art and latest developments of technology are disputed, and deficits in the proposed plans – real or assumed – are pointed out. Because planners of course also make mistakes, opponents have been successful in

finding planning defects and exposing them publicly. The resulting sense of achievement produced the effect that public hearings, besides other elements not intended by the legislator, always include a sort of fundamental public quality audit of the project concerned. The different, sometimes arbitrary, interpretation of the law by the authorities is a signal to opponents of nuclear energy projects and various other types of projects – a signal that undermines the trust of the authorities.

The opponents – at least the qualified and professional ones -know that the authorities will give in to their demands and welcome their concessions regarding questions of process management, time frame, public admission to non-public hearings etc. However, they draw their conclusions and assume that the same authority will, as well, make concessions to the project sponsor when there is no public scrutiny. Their suspicions will go further; they fear that the authorities' concessions to the industry go beyond procedure, that they concede substantial aspects of the certification as well [6]. So opponents feel themselves not as participating in, but as controlling, supervising the whole certification process, and they feel that it is legitimate to call the authorities to account.

The role of the Industry

It is always the task and duty of the initiators of a technology to convince people and establish markets. I call this the debt for implementation of the technology. Regardless of the technology, innovation research identifies the implementation phase as most critical to the success of any innovation. In this sense, nuclear technology is, in some countries, at best an innovation, because the implementation has not yet been completed. The industry must responsibly share information and participate self-critically in the social processes of finding a consensus on procedures and evaluation standards. Self-critical, because along with the legitimate communication efforts of an industry, the security-relevant investments and developments must not become secondary. In more than 15 years of consulting in the field, we had to, at times, refuse the demands of industries to equalise real security gaps through specially-skilled communication instead of cleaning out those insecurities and risks.

Equally, the rejection of the opposition as a pure “not-in-my-backyard” phenomenon, as well as the complaints that there are pregnant women who smoke yet, at the same time, demonstrate against industrial enterprises, are fruitless.

Figure 2. **The analysis of individual risk decisions has no relevance for the advancement of radiation protection in society. [7]**



The roles of the legislature and the regulatory bodies

Regulatory bodies and legislators who want to judge and control the potential risks originating in a technology should completely abstain from taking over tasks concerning promotion and implementation.

Unfortunately, we often see that in the early stages of a technological development, governments will be enthused about new technologies and take over duties of the industry, evaluating obstacles in going to the market, sorting out ways to overcome those obstacles, and to promote a new technology. The two traditional governmental roles, the one responsible for a nation's or region's infrastructure and development, and the other, the impartial regulatory body, are incompatible. In the public perception, this is a classical dilemma permanently endangering confidence.

Legislators and regulatory bodies must be aware of the mechanisms in risk perception, judgement and decision making of all involved parties. And they must be aware of their own tendencies toward bias and oversimplification as well as of the limitations of rational decision-making strategies.

The best approach for legislators and regulatory bodies is to balance the interests and the power of an industry with the powers of public control. They ought to act as impartial agents and as translators. But, unfortunately, the role of the authorities as accepted translators between the stakeholders is not the standard.

Figure 3: The sign in the back refers to the Tower of Babel



When the legislature identifies itself with a clear position for or against a certain technology, the credibility of a policy and decision making process is already minimised; but the amalgamation of the authorities with the proponent is prohibitive.

The constellation in the nuclear authorisation process for the final nuclear storage site in Germany, Schacht Konrad, was an example for such a constellation. The resulting conflict still has its effects, which were devastating in terms of public perception for the licensing procedure itself; and for the case of final storage in general, harmful to the credibility of scientists or science and detrimental to the image of either of the environmental ministries (state and federal) involved at that time.

The proponent of the plans was the Federal Agency for Radiation Protection, a federal authority that reports to the federal minister of the environment. This one is authorised to give orders to the certification authority, the minister of the environment in Lower Saxony, who executed federal law. The same environmental minister of Lower Saxony opened the public hearing with an inflammatory address, promising to make a final nuclear storage site impossible in Lower Saxony, if not in Germany.

Figure 4. **The container was placed, by Greenpeace Germany, on the same premises as the public hearing concerning the plans of the final storage site “Schacht Konrad”. It is decorated with photographs of the former German Minister of the Environment, Prof. Klaus Topfer, subtitled “I apply! I assess! I approve! Will he get his final storage site?”**



The public hearing took place in an enormous marquee with a capacity for 3 000 expected attendees. It lasted more than 70 days. After the opening ceremonies, only some hundred opponents participated; on the second day, the numbers dropped to a few dozen. After the media coverage of this “event”, no one had to bother any more about the acceptance of procedures or technology. The damage was so severe, that it could be corrected only if there were a consensus in the different political sides that public trust in regulatory bodies is really wanted.

Residual risk and residual rejection

To put the institutionalised opposition in a more general perspective, I would like to return to the starting point. The desire for acceptance, either of a technology or a process, can never be completely fulfilled.

Because the residual risk as a single criterion against nuclear energy in a non-compensatory decision heuristic leads to an unconquerable refusal of nuclear energy, I propose as a cognitive model the concept of residual rejection. Residual rejection is the amount of criticism, aggression and doubts that you should be willing to accept – because its reduction would be not only extremely expensive, but also simply impossible. Everywhere nuclear plants are licensed, where scientists work on the further development of nuclear energy, even where authorities control plants, and yes, even where investments in more security are planned to be licensed, experts will experience residual rejection, that they must accept.

Acceptance is a two-way street.

References

- [1] Improving Risk Communication, National Research Council, Washington D.C. 1989.
- [2] Kölnische Zeitung 1819, quoted from Kultur & Technik, 1/1999, Zeitschrift des Deutschen Museums, München 1999.
- [3] Note that where recognition correlates negatively with the criterion, “higher“ would be replaced by “lower“ in the definition. Daniel G. Goldstein, Gerd Gigerenzer, The Recognition Heuristic in G. Gigerenzer, Peter M. Todd, Simple Heuristics That Make us Smart, New York, 1999.
- [4] M. Henrion and B. Fishhoff, American Journal of Physics. 54, 791,1986.
- [5] Laura Martignon, Ulrich Hoffrage, Why does One-Reason Decision-Making work? G. Gigerenzer, Peter M. Todd, Simple Heuristics That make us Smart, New York, 1999.
- [6] Bürgerbeteiligung in Genehmigungsverfahren für industrielle Anlagen und Deponien, Ein Leitfaden zur wirkungsvollen Nutzung der Beteiligungsrechte, Peter Küppers, Koordinationsstelle Genehmigungsverfahren, Darmstadt, 1994.
- [7] Chemie Report, Heft 11/12 2000, Verband der Chemischen Industrie, Frankfurt, 2000.

THE NEA/RWMC FORUM ON STAKEHOLDER CONFIDENCE: OVERVIEW OF FIRST MEETING AND WORKSHOP

Y. Le Bars, C. Pescatore, H. Riotte

Introduction

Any significant decisions regarding geologic disposal will need a comprehensive public review and a thorough involvement of all relevant concerned parties, such as waste generators, waste-management agencies, regulatory authorities, local communities, elected officials, etc. The participation of non-technical stakeholders in decision making will become increasingly important as more countries move towards siting and the implementation of geologic repositories. Public perception and confidence is thus one of the strategic areas¹ where the NEA/RWMC intends to promote common understanding and further dialogue. The NEA strategic plan provides a broad framework for initiatives in this area.

At a broader level, trends towards a participatory democracy are more and more evident in OECD countries and the strengthening of public participation, transparency and accountability and, ultimately, policy effectiveness in Member countries constitute major areas of the work of the OECD. Within this wider context, the RWMC has taken up the challenges to better understand the needs of the broader segments of stakeholders and to provide a neutral forum where experience can be exchanged and analysed, and lessons can be drawn in stakeholder involvement and decision making in radioactive waste disposal.

The RWMC Forum on Stakeholder Confidence (FSC), which met for the first time in August 2000, is charged to act as a centre for informed exchanges of opinion and experiences across institutional and non-institutional boundaries, and to distil the lessons that can be learnt. While it is recognised that the decision-making process and avenues for stakeholders' involvement differ from country to country, it is important to identify similarities and differences, understand the key concerns of various stakeholders, and document means to interact effectively. The Forum mandate is relatively broad and covers a period of three years, at which time the efficacy of the Forum will be assessed. The FSC is composed of representatives of national organisations with responsibility, overview and experience in the field of stakeholder confidence.

This paper provides an overview of the inauguration, first workshop and meeting of the FSC. The event took place over three days in August 2000 and saw the participation of 75 attendees from 14 countries and three international organisations. The participants had widely varied backgrounds, spanning both the technical and social sciences. Affiliations included universities, national academies, technical oversight bodies, safety authorities, implementing agencies, and advisory bodies to government. In addition, a mayor from Sweden and a parliamentarian from France were amongst the inauguration speakers.

1. Strategic Areas in Radioactive Waste Management: The Viewpoint and Work Orientations of the NEA Radioactive Waste Management Committee, NEA 1999.

During the three-day meeting, the world-wide experience in the field of stakeholder confidence and radioactive waste disposal was reviewed. The proceedings of the meeting are in press.²

The workshop

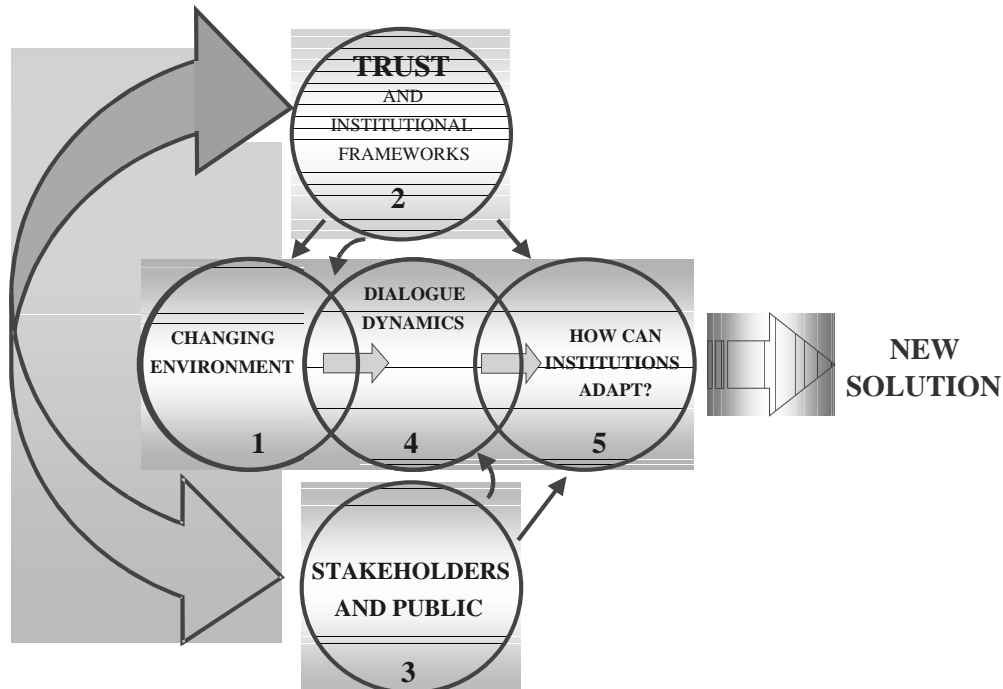
The workshop was inaugurated by five speakers presenting the viewpoints and experiences of implementers, regulators, policy specialists, and elected representatives at national and local level. A round table then took place, which was followed by a plenary address reviewing the experience of SKB, in Sweden. The workshop developed thereafter around five major topics:

1. The changing environment for waste management programmes.
2. Trust and the institutional framework.
3. Stakeholders and the public: who are they?
4. Is there a new dynamics of dialogue and decision making?
5. Are the waste management institutions set up for achieving stakeholder confidence over the long-term?

Each topic was framed by two plenary talks, one reviewing the broader societal picture and the other reviewing specific field experience, and it was subsequently developed in working groups. This was therefore a highly interactive workshop.

During the workshop, the interrelationship amongst the five topics was analysed and is captured in Figure 1.

Figure 1. **The five workshop topics and their interrelation**



2. Stakeholders and Waste Disposal, NEA 2000.

It is a fact that the environment for decision making has been changing in an important way in society (Topic 1). In particular, technology is no longer being perceived as the bright future; those who contested the old order are now in decision-making positions; and centralised decision has ceded to a stronger involvement of local authority. Development projects in general are rejected when stakeholders have not been actively involved in creating them and developed a sense of responsibility for them.

The OECD countries are increasingly implementing forms of participatory democracy that will require new or enhanced forms of dialogue amongst all concerned parties (Topic 4). The new dynamics of dialogue and decision making were characterised in discussion as a shift from the traditional “decide, announce and defend” model, for which the focus was almost exclusively on technical content, to one of “engage, interact and co-operate” for which both technical content and quality of process are of comparable import to a constructive outcome. In this context, the technical side of waste management is no longer of unique importance; organisational ability to communicate and to adapt now moves into the foreground. The obligation to dialogue and to demonstrate to stakeholders that their input is taken into account raises the questions of who can take on the role of communicator, what skills and training are needed, which tools should be developed, and what organisational changes are necessary.

Institutions must be able to accommodate these changes in order to carry out the long-term projects for which they are responsible (Topic 5). The workshop offered views on what would characterise an organisation capable of achieving stakeholder confidence over long time periods. Participant input could be organised into three main areas: organisational aspects, missions, and behaviour. Organisational features include independence, clarity of role position, public ownership, dedicated and sufficient funding, a non-profit status, structural learning capacity, an internal culture of “scepticism” allowing practices and beliefs to be reviewed, high levels of skill and competence in relevant areas, including stakeholder interface, strong internal relations and cohesion, an ethical chart or code of conduct, and a general “quality consciousness”. Mission features implied in achieving long-term confidence include clear mandate and goals, a specified management plan, a grounded and articulated identity, a good operating record, and responsibility for the back end of the nuclear fuel cycle, including decommissioning. Behavioural features were explored and defined, and include openness, transparency, honesty, consistency, willingness to be “stretched”, freedom from arrogance, recognition of limits, commitment to a highly devoted and motivated staff, coherence with organisational goals, an active search for dialogue, an alert listening stance and caring attitude, proactive practices, emphasis on stakeholder interface, a policy of continuous improvement, use of allies and third-party spokespersons, and a level of commitment comparable to that displayed by NGOs.

Stakeholders and trust will play an important role all along the decision-making process. The term “stakeholder” (Topic 3) could signify different things to different people: it can mean someone with a vested interest or a preconceived view, or simply someone with a role to play in the process. This latter definition allows the regulator, as well as international organisations, to be considered stakeholders. However the designation of the regulator as a stakeholder is not necessarily acceptable in all countries. The workshop concluded to a majority that the term “stakeholder” should be understood as somebody with a role to play in the process. The identification of stakeholder groups is less difficult than the definition of interactions among groups and their respective roles, responsibilities and rights. Stakeholder groups may not be characterised by unitary opinions or needs. Stakeholders change with time. Regarding future stakeholders, the opinion was that we can only do what we think is best for them, but there was recognition of the conflicting priorities of leaving a passively safe situation, or leaving enhanced possibilities of future intervention.

Trust needs to be given and to be won continually from stakeholders if the process is to go forward. (Topic 2). Trust implies that an individual is willing to give up a certain measure of control to another person, an institution, or a set of institutions. Trust must be earned, typically by verification through actions and meeting commitments. The actions of individuals in an organisation (including policy making) will affect the perception of the institution at large; interpersonal trust with agents of the institution can form a basis for regarding the institution with trust. Trust is much easier to lose than to win. Technical competence is necessary but insufficient in itself to earn trust. Other measurable components include caring, integrity, fairness, credibility, reliability and openness. If there is a failure on just one of those components, it may result in failure of the entire set, and in loss of trust. The parallel activities of an organisation involved in more than waste management must also be conducted in a trustworthy fashion to preserve overall trust.

Lack of trust may not necessarily be at the root of public rejection of a repository project: at issue rather may be unacceptable changes in lifestyle or other undesired impacts.

Waste retrievability and programme reversibility alleviate mistrust of technology and its implementation. Enhanced oversight by authorities and stakeholders constitutes a “defence in depth”, and the sharing of responsibility and control, as well as financial and other compensation, may work to build public confidence in the process.

Insights from practical experience in radioactive waste disposal projects

The workshop provided a wealth of information regarding the broader context in which decisions are taken in present-day society and it provided insights for how this may evolve and how institutions could adapt. Many presentations covered the actual experience of member countries disposal programmes and the lessons that were drawn. A bulletised list gives a broad overview of the practical lessons learnt:

- Management programmes have often included substantial public information and consultation efforts in their initial phases. However, these do not elicit massive response. Only when programmes move into a site-specific phase do non-technical stakeholders appear to take an active interest. It is thus a challenge to find ways of involving stakeholders early.
- Of special concern is the link between achieving a repository for radioactive waste and the future of nuclear power. This link – whatever it is in each country – must be spoken of openly and clarified. In particular, whilst it is clear that the debate on waste disposal is important to the debate on the future use of nuclear energy; it is also clear that a disposal solution is needed regardless of the future development of nuclear energy.
- A number of points must be demonstrable and clearly demonstrated to stakeholders:
 - The implementer is performing a service to society.
 - The waste generators provide finance under arrangements that provide value for money.
 - Financing arrangements are transparent.
 - Within its independent oversight role, the regulator is actively involved in assuring that the national policy on disposal is carried out in a safe manner.
 - Institutional arrangements are robust, and meant to survive changes in political orientation.

- Policy makers should review and communicate the assumptions, sources and consequences of policy choices. The same is true for regulators. The public needs/wants to participate early in the decision-making process, when the “rules of the game” are being defined. In particular, regulators must clarify the reasons and basis for changing regulations at later stages in repository development.
- Independence, competence and effectiveness are essential for public confidence in the regulator. The regulator’s role and responsibilities must thus be clearly defined, and separated from nuclear energy policy and promotion.
- At initial phases of repository development everyone is a stakeholder, albeit often unaware of that role. In later phases of a programme, concerned citizens in siting communities take on a more central role. Also, local and regional officials move into place as potential mediators when the programme shifts into the site-specific phase. A range of mechanisms for dialogue is needed to accommodate such shifts.
- The present generation must take responsibility for the choices made, or left unmade, e.g., in deciding, or less, to move forward in implementing a repository.
- Localities should receive economic resources upon entering the (potential) host community role. Allocations to favour local development have been wrongly criticised as “immoral” or a source of pressure. There is no reason that participation in waste management, as in other industrial activities, should not generate prosperity.
- The messages given by the decision makers must be clear.

Conclusions

Development projects in general are rejected when stakeholders have not been actively involved in creating them and developed a sense of responsibility for them. Radioactive waste is not perceived to be a shared societal problem, and the priority assigned to resolving energy-related issues may be low today when economic and energy shortages are just a memory.

In this context, the technical side of waste management is no longer of unique importance; organisational ability to communicate and to adapt now moves into the foreground. The obligation to dialogue and to demonstrate to stakeholders that their input is taken into account raises the questions of who can take on the role of communicator, what skills and training are needed, which tools should be developed, and what organisational changes are necessary.

Implementers and regulators alike perceive the importance of role clarification, within the organisation and within the national waste-management system, such that responsibilities are identified, transparent and taken on. Finally, local and regional officials move into place as potential mediators when the programme shifts into the site-specific phase.

FSC will act as a forum for reviewing the map of roles, the modes of function and engagement of stakeholders. An important role will be to provide a neutral ground where the exchange of experience can be achieved, lessons can be learnt for future improvements in waste management programmes, and mutual understanding is promoted across both institutional and non-institutional boundaries. The FSC is the sole forum of this type world-wide.

REPORT ON THE CNRA WORKSHOP “INVESTING IN TRUST, NUCLEAR REGULATORS AND THE PUBLIC”

J. Laaksonen

The workshop was held in Paris on the 29th November – 1st December 2000. Its objective was well captured in the title: Investing in Trust, Nuclear Regulators and the Public. The general public is concerned with the risks involved in the use of nuclear power, and has a legitimate desire for reliable and impartial information. The nuclear regulators have answers, but in order to fulfil the information needs of the general public and their elected representatives, they need to be regarded trustworthy.

Most of the about 80 participants were from nuclear regulatory bodies and radiation protection agencies. The discussions gave regulators an opportunity to change views and experiences on how to gain trust in their openness and honesty, and in their will and capability to protect public interests. The weight given to the topic was indicated by participation of nine heads of national regulatory bodies, among them top regulators from four countries with largest nuclear programmes: the USA, Japan, France, and the UK.

The number of papers presented was 33, and their topics were considered well chosen by the organising committee. Throughout the workshop “posters” were available; these were electronic links to the web sites of the attending regulatory bodies. Proceedings of the workshop will be published during the first half of 2001.

Public communication is considered a key function in all regulatory bodies

In the discussions it was concluded that maintaining public confidence in the nuclear regulatory body is essential for effective nuclear regulation. Public confidence is of equal important as technical competence, independence, and adequate resources. If it is lost, also political confidence is lost, and the regulatory body will no more be provided with means that are necessary for its continued successful operation.

In order to gain public confidence, each regulatory body needs a long-term strategy for public communication. The strategy must be built on a culture of openness and on active collaboration with media.

It is important to convince the people that the regulatory body works for them and for their safety, and is not promoting the use of nuclear energy or any other interests. Therefore, the public communication should not give an impression that the regulator is trying to gain public acceptance for nuclear power or other activities it is regulating. Instead, regulators need to build confidence in regulatory programmes and decisions and in their own capabilities and will to provide the public and the elected decision makers promptly will all relevant information. The target is to become a confidential agent of the public in matters of nuclear safety and radiation protection, an expert organisation at the service of the public.

Public interaction and consultation was suggested to be done separately from other organisations. In specific, the regulators are advised to keep adequate distance to stakeholders involved in energy policy – government, industry, and pressure groups.

Where public confidence has been lost, it must be restored. This is very difficult and may take long time. For this process, unambiguous assignment of responsibilities and the accountability of the responsible persons are essential.

A generally accepted view was that one should not aim for too high or “blind trust”. More important is to aim for “sustainable trust” which is not at risk of being suddenly lost as a consequence of an unexpected incident. A sustainable trust can be aimed for by confessing openly the weaknesses in the regulatory programmes and the shortcomings in knowledge. It should also be made clear that incidents and accidents can not be absolutely eliminated.

A necessary condition for being trustworthy is to be well known

The only way that regulators can be perceived as being credible in emergencies, or in any other events where public has a reason for concern, is to have earned credibility in advance in the daily dealings with the public. If the regulatory body’s existence, role, and responsibilities are not known, the public cannot make a difference between the information coming from a regulatory body and the ad hoc messages from sources that have limited understanding of the situation.

Being known requires proactive information. A regulatory body benefits from a high profile, which it should shape by itself.

Good examples were presented on how to increase and maintain the visibility of a regulatory body among the public. A common observation is that the news threshold in this field is very low. Especially the regulatory organisations with broad responsibility in the nuclear and radiation matters are in a good position to keep the public informed on their work, because they are in the news in various connections. In one presented case, proactive information has brought a situation where messages issued by a regulatory body on one or another field of its work are distributed weekly in the news media.

Direct personal contacts with certain stakeholders are also valuable. In some countries journalists have appreciated encounters where they are briefed by regulatory experts, and can ask any questions on selected topics of their interest. The aim of such encounters is not to produce immediate news, but rather to make sure that the journalists get to know the experts personally, and can request for information from the right source when they need it. However, such encounters have often resulted in news or articles on topics that were discussed.

Other important partners for direct personal communication are local politicians and citizen’s groups in the neighbourhood of existing or proposed nuclear sites. They are often participants to the regulatory process, and have a desire for interaction and consultation with the regulatory experts. Meetings with local people, who have a genuine personal interest in nuclear safety and radiation related issues, also provide insights on how the public perceives the risk and what are their main concerns.

Efficient communication channels are needed

The most important communication channel is through the news media. It is the only way to call the attention of a large audience. Press releases, press conferences, and articles written by the regulatory experts are the standard means for approaching the public through the news media. Some regulators even have an own text page in nation-wide TV channels where they can provide current information. At a more advanced level of media relations, the regulators well known to the journalists are often asked to be interviewed or make statements on current issues of interest. Personal acquaintance with media representatives is therefore valuable. Some regulatory bodies have an information manager with journalist background, and these persons have brought their own personal contact networks to the benefit of the regulatory body.

Regulatory web sites are most important to day, and each regulator seems to have such a site. A web site gives a possibility to provide information at low cost after it has been properly established. It also gives a possibility to inform different audiences at various levels of depth. Less efficient in reaching laymen are periodical publications, but some regulatory bodies have their own magazines distributed mostly to professionals in the field.

The role of direct communication should not be overlooked, and a wide network of direct contacts was commended. Of special value is a partnership with persons and organisations that have credibility with the public. Such persons are, for instance, leading politicians and other opinion leaders, medical doctors, pharmacists, teachers, and civil defence workers. Commendable partner organisations are the authorities working in other domains of public safety or being in charge of environment protection, institutions providing public education, and scientific community at large.

A presentation on a public nuclear safety information centre, operated by a regulatory body, was received with great interest. This centre could serve as a model for similar centres elsewhere. Such a centre could stand alone, or alternatively be erected and operated under an umbrella of a larger public science centre.

Another way to reach a good number of publics is to attend various larger exhibitions with an own stand, and to distribute topical information leaflets to interested visitors. Such exhibitions can be for instance in the field of medicine, housing, or energy. A smaller number of people can be informed on visits to the regulatory body's premises, but many regulators have a practice of receiving special groups such as school classes.

Good communication is information transfer to two directions

In order to make the communication with the public and other stakeholder's right, and to address the issues of real interest, it is necessary to listen to the stakeholder concerns. In this communication the contacts with the local people in the neighbourhood of nuclear facilities are a most valuable source of feedback.

Issues of public concern have in many cases turned out to be different from what the experts regard as most relevant risks. Public has little confidence on probabilistic approaches, and risks expressed in probabilities are not understood. Instead, people think that zero risk is possible, and they expect that their direct questions be answered clearly and in plain language.

A most difficult thing is to respond to emotional, irrational fears. Such fears cannot be removed by telling facts but a proper way must be found to respond at the emotional level.

Science and technology are poorly understood by the public, and concerns after some event easily create a crisis false, either false or somehow justified. Crises are frequently driven further and amplified by the media. The regulatory body can do nothing but explain the facts and try to put them into a right perspective, but public reaction to this information strongly depends on the trust built earlier.

It should also be found out what the public expects from the regulatory body in general. All communications should respond to the expressed concerns and needs.

Information must be easily available to the public

A regulatory body must be reachable any time when needed. The news media, and even the members of the public, need an easy access to experts who can tell them about matters of immediate concern. Such matters may typically be incidents at domestic or foreign facilities, or other alarming news transmitted by international news agencies.

Some regulatory bodies provided examples on how their experts can be contacted also outside office hours, should a sudden information need appear. For instance, one regulatory body has a communication contact person reachable 24 hours a day from a given phone number. This person has a task to find a regulatory expert who has adequate knowledge on the topic of interest and can be interviewed.

A general consensus was expressed that official documents need to be easily accessible to the public, although regulations in this matter vary amongst countries. Some regulatory bodies routinely publish in the Internet all public documents, or at least documents on issues that have raised general interest. Many others make such documents available at request.

Public communication is a joint effort by all regulatory body staff members

The role of professional communicators in regulatory bodies was considered important. However, a common view emerged from the discussions that public communication should not be left to the communication experts only. Rather than increasing their number, communication duties can be integrated into the other tasks of suitably qualified technical staff.

All managers of the regulatory body must understand the importance of public communication, and meet their responsibility in this matter. Also the entire regulatory staff must be prepared for giving complete, clear, and accurate answers to questions on their own work. Training on communication skills is thus an essential part of staff training.

Internal openness and good information exchange within the regulatory organisation is needed to ensure that external communication is done in a consistent and coherent manner. Communication officers must closely follow the daily decision making within the regulatory body, and assess the relevance of decisions from public interest point of view. However, the technical staff must also understand when to submit an issue to public information.

Openness can sometimes strain the resources and have adverse impact on primary functions, but if communication is not done timely in the right manner, the efforts needed later on may be much larger.

Lack of harmonisation between countries could destroy the trust

Good co-operation between regulators of different countries, and especially the need to harmonise emergency plans internationally, was emphasised. In today's global information environment, news on regulatory positions and actions spread quickly from one country to another. Any differences between the regulator's response to the same issue are easily attacked by journalists and public interest groups.

Confidence can quickly be lost if the information and guidance given by regulators is not consistent and coherent in neighbour countries. A warning example was presented on iodine prophylaxis: practices and guidance are different in nearby communities that are next to the same nuclear power plant but in two different countries.

Lessons can be learned from other fields

An interesting parallel was presented by a speaker who told about the experience from communication within the food and agriculture industry. The public perception of risks deviates from the expert's view in a similar manner as in the nuclear field. Abnormal incidents are hastily reported and uncritically accepted, and the public reactions are very strong. There is excessive media interest, dubious validity of scientific reports, and defensive researchers. Laymen find it difficult to cope with large amounts of information, to differentiate between essential and unessential data, and to distinguish between reliable information and junk data or groundless opinions.

Public communication will be on the agenda of CNRA also in the future

As a key recommendation for the further international work in this field, it was recommended that the CNRA should consider establishment of a standing advisory body with a mandate to help developing public communication of the regulatory bodies. The core of such a body could be formed from the public information officers of some regulatory bodies that have advanced programmes in this domain.

A question that has hardly been addressed by any regulatory body is how to measure the trust. The goal of public trust should be put into the context of the regulatory programme, but then success definitions, success measures, and effectiveness measures need also be developed. A proposal was made that public criticism should be perceived as a "resource", the same way as operational feedback provides useful information to improve plant operations.

SESSION 2

Emerging Expectations of Society Towards Risk Policies

Chair: K. Huthmacher

INTRODUCTORY REMARKS

K.E. Huthmacher

The history of nuclear energy in Germany, marked by the turning point of 14 June 2000 when the Federal government and the operators of nuclear power plants agreed on its phase out, is also the history of a failed relationship between experts and the public. Apart perhaps during the early years, in the decades of peaceful use of nuclear energy in Germany, there was basically a failure to bridge the gap between the faith in technology expressed by the advocates of nuclear energy, and the German public's declining willingness to put up with the rare but, where occurring, possibly very serious risks.

Today, the latest opinion polls on the nuclear phase-out reveal a clear picture of the attitudes in the Federal Republic of Germany. 85% of the population consider nuclear technology to be dangerous, and as much as 76% of those questioned support the Government's new goal of achieving a phase-out of nuclear energy "as soon as possible".

Since Chernobyl, it has no longer been possible to rebuild the trust which was lost across a broad spectrum of the population. On the contrary, trust was further undermined by a number of scandals, both major and minor. Sometimes, the issue was less about the magnitude of the problems, errors, and inadequacies arising, as about the fact that the public was always being given the impression that errors simply could not occur. Consequently, there is an increasing readiness to play down or hush up problems, and wide-ranging calls for precaution are rigorously rejected.

A black and white type of thinking prevailed, in which the advocates of nuclear energy made the spectacular false assumption that the critics could be silenced by casting doubt on their technical and moral qualifications.

A critical analysis of operator behaviour reveals that dialogue was not attempted, or was attempted far too late. While it is true that hundreds of millions of Marks was invested in advertising nuclear power, this advertising did not reach many people, because it ignored the mood among the population, and did not really take the fears and concerns seriously. The fact that nuclear power was not subject to competition, but belonged to the monopoly of the energy industry, which was never obliged to take the customers really seriously, might also have contributed to this situation.

Radiological protection in Germany missed its opportunity to take an active role as moderator in this highly controversial topic within society, although it would have been excellently suited to this, as it combined technical understanding with the task of protection.

Radiological protection did not see the post of advocate for critical citizens as part of its task. Up to now, those employed in radiological protection have seen themselves primarily in the light of what is technically feasible. This thinking results in the attitude that, once a technically and economically viable protection of employees and public is ensured, problems can already be considered as solved. Social risk management and risk communication is only slowly being accepted into the highly scientific thinking of specialists in radiological protection.

Radiological protection has at its disposal excellent scientific principles and an extremely detailed set of legal regulations. What it lacks is the ability – and sometimes also the willingness – to communicate, beyond the circle of specialists concerned, highly complex material, including the remaining risks, to the public, in such a way that the latter really is in a position to form its own picture of the remaining risks.

The need to take citizens seriously on the route towards introducing new technologies, thus creating acceptance, must no longer be seen as a necessary evil or an irritating additional chore. This is true for those in politics and administration, but also especially for those who materially benefit from the development of these technologies.

Technologies which carry risk can only be permanently achieved in a climate of trust. Trust, however, can only grow where complete transparency is possible, including possible sources of error and related risks. The more openness and dialogue are practised, the greater the willingness to examine new technologies without prejudice.

**PUBLIC EXPECTATIONS AS WE LOOK TO THE FUTURE:
STAKEHOLDER INVOLVEMENT AND PUBLIC PARTICIPATION**

J.D. Edwards

Director, Center for Radiation Information
U. S. Environmental Protection Agency

and

R.L. Olson

Research Director
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Abstract

The U.S. Environmental Protection Agency (EPA) and the Institute for Alternative Futures are involved in an ongoing project on *The Future of Radiation Protection*. The Futures project explores the most important radiation-related challenges that may emerge between now and 2025, and the role of stakeholders in influencing future decisions to meet those challenges.

First, interviews and small group discussions with over 125 thought leaders in the radiation protection community elicited a wide range of views and possibilities for the future. This information was crafted into four scenarios of how issues related to radiation protection might unfold over the next 25 years. Scenarios developed in the project explore a wide range of plausible radiation protection futures, from highly desirable futures to futures dominated by problems and crises. The scenarios are not predictions of the future, but rather tools to help people think broadly about the future and the prospects for improved methods of stakeholder and regulator interaction.

Then, these scenarios were used as a framework for discussion in six sessions with participants from industry, science, environmental groups, and federal and state agencies concerned with radiation issues. One of the most promising results of these discussions is the identification of a common ground among diverse participants through agreement on “principles for guiding action.” These principles – pollution/exposure prevention, public right-to-know, total accounting, risk harmonisation/cumulative risk assessment, inclusive science, regional or place-based tailoring, and stewardship – can become “a common language” of communicating with stakeholders about the regulatory decision making process, and may transcend traditional debates and revitalise the field of radiation protection.

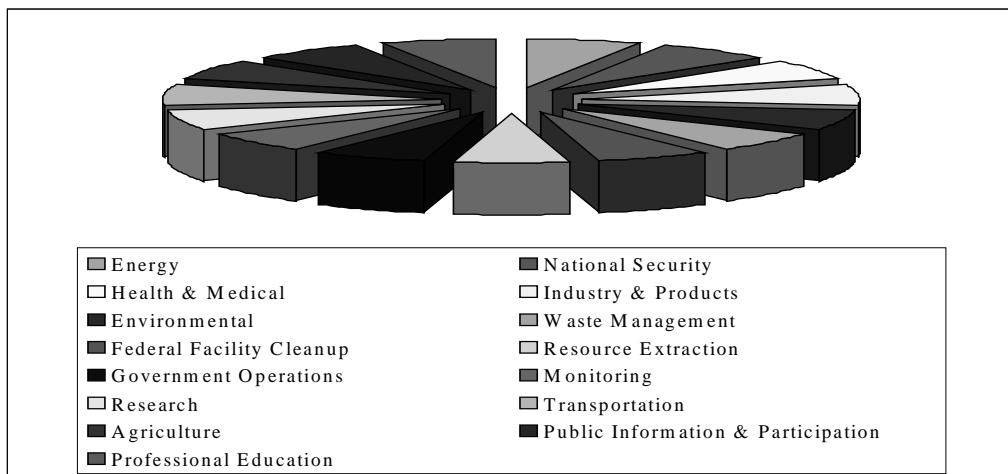
Interviews with thought leaders

Potential future challenges were explored through a process of personal interviews and small group discussions involving over 125 thought leaders in the field of radiation protection. Discussions were conducted with professionals at the 1999 Conference of Radiation Control Program Directors (CRCPD); an Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Radiation Task Force meeting; a session at EPA's National Air and Radiation Environmental Laboratory in Montgomery, Alabama attended by scientists, NGO, university and state officials; and an International Atomic Energy Agency (IAEA) International Symposium in Arlington, Virginia on the Restoration of Environments With Radioactive Residues. In these discussions, and in personal interviews, the key question that all participants were asked was:

What are the most significant radiation-related challenges that will need to be dealt with between now and 2025?

Hundreds of potential challenges were identified and grouped into the 15 sectors below. The list below presents examples of challenges that participants judged to be both important and highly uncertain in their outcome.

Figure 1. Sectors



Examples of radiation protection challenges 2000-2025¹

Energy

- Decommissioning nuclear power plants.
- Next generation of nuclear power – yes or no.
- Alternative energy sources and strategies to limit global warming.
- Nuclear accidents.
- Radiation issues related to coal, oil and gas, geothermal.

1. Data gathered from one-on-one interviews and small group meetings of experts in radiation protection from a variety of perspectives

Health and medical

- Radon.
- Changes in technology that increase or reduce medical exposures.
- Training and professional certification to reduce inappropriate medical uses.
- Better understanding of genetics; understanding of genetically sensitive populations.
- Preventive approaches and new modalities for diagnosis and prescription to reduce uses of ionising radiation.
- Non-ionising radiation issues: e.g., lasers, UV, EMF.

Environmental

- Assessment of ecological risks of radiation.
- Synergies between radioactive and chemical toxic wastes.

Radiation facility cleanup

- Radiological assessment of DOE, Superfund, and other sites.
- Remediation technologies and strategies.
- Remediation standards.

Government operations

- Public/community involvement in radiation protection issues.
- Co-operation between federal agencies.
- Support for state radiation programs.
- Developments in accounting systems (total accounting).
- Setting standards over long periods of time, revising standards as new knowledge and models arise and assumptions change.

Research

- Understanding risks at low doses.
- Risk harmonisation/ cumulative risk assessment.
- Effects of radioactive nuclides that cross the placenta on foetuses – non-cancer effects.
- Assuring good science amid controversy & influence of big money from government and industry.

Agriculture

- Use of contaminated sewage sludge as fertiliser.
- Food irradiation.

Professional education

- Maintaining the professional/technical infrastructure for radiation protection.
- New emphasis on prevention, public health.

National security

- Weapons decommissioning.
- Preventing radiation-related problems in future weapons development.
- Nuclear terrorism – “loose nukes” and nuclear dispersion devices.
- Radioactive materials in former Soviet Union.
- Third World nuclear proliferation/testing/use.
- Emergency response capability.
- What to do with weapons material.

Industry and products

- Orphan sources (materials that end up in unexpected places)
- Occupational exposures
- Exposures from consumer products
- New industries using radioactive materials
- Proliferation of low level sources – cumulative risks, impact on recycling
- Building construction
- Import of contaminated metals/materials
- Non-ionising radiation exposures, e.g., rapid growth of wireless communication

Waste management

- Finding a good solution for managing the increasing volumes of waste – not “saving money” or “blocking nuclear power”
- Lack of system for low-level waste management
- High-level waste management and disposal, U.S. and abroad
- Aligning funding with real risks, avoiding pork barrel waste politics
- Local economic effects of waste sites

Resource extraction

- Technologically Enhanced Naturally Occurring Radioactive Material (TENORM)
- Source material for nuclear fuel

Radiation monitoring

- Cheap, miniature sensor technology
- National monitoring system
- Inexpensive, efficient tracking systems
- Community monitoring
- Monitoring performance of repositories

Transportation

- Transportation of spent fuel, high-level wastes, mixed- and low-level wastes

Public information and education

- Public right-to-know - availability of public information about sources and risks
- Education to increase public understanding of radiation protection issues
- Public perception of radiation risks vs. scientific assessment

Scenarios of 2025

The interviews and small group discussions highlighted a wide range of divergent trends, viewpoints, and possibilities for the future. The Institute for Alternative Futures compiled this information into four internally consistent scenarios of how issues related to radiation protection might unfold between now and 2025. The scenarios were crafted to explore the whole range of future conditions that different interviewees saw as plausible, from a future dominated by problems to contrasting images of highly desirable futures. None of the scenarios is likely to come to pass in full, but the future is likely to be somewhere within the broad “possibility space” that they map out.

The purpose of the scenarios was not to predict the future, but to serve as a framework for discussion in a series of discussion sessions with different stakeholders in the radiation protection community. Participants were asked not to “argue” with the scenarios, but rather to use the scenarios to:

- Reflect on the range of possibilities for 2025 that appear plausible today,
- Clarify views about what they want the future to be like, and
- Consider what principles are appropriate for resolving disagreements, finding common ground, and guiding action.

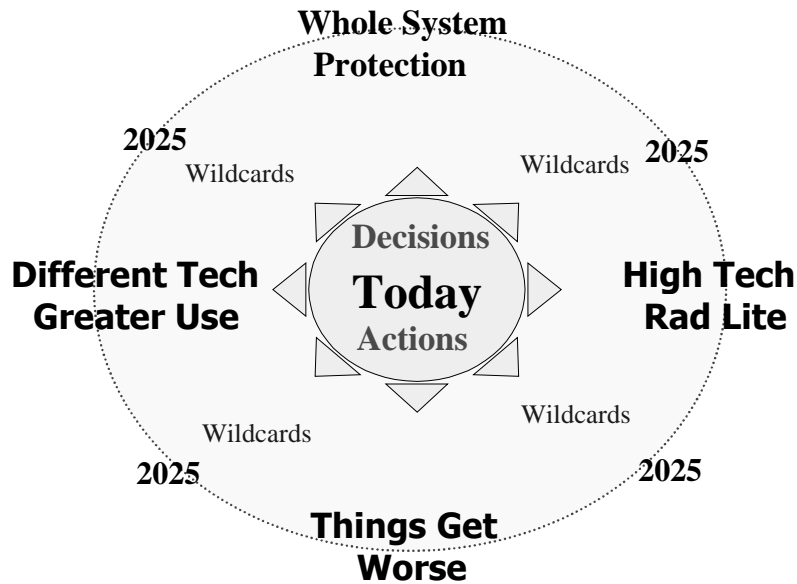
Things Get Worse – Today’s major controversies remain unresolved. Without decisive action, limited problems evolve into much bigger messes.

Different Technology, Greater Use – Problems in the Things Get Worse scenario are mitigated by improvements in technology and management. A second generation of nuclear power is initiated. Expanding uses of radiation in industry and health care provide benefits that clearly outweigh risks.

High Tech Rad Lite – The market favours energy efficiency, natural gas, wind, and other renewable sources over nuclear energy. Advanced technologies increasingly substitute for conventional uses of radioactive materials in industry and health care. Economics and health concerns drive change.

Whole System Protection – Concepts like pollution prevention, public right-to-know, total accounting, and risk harmonisation reshape radiation protection.

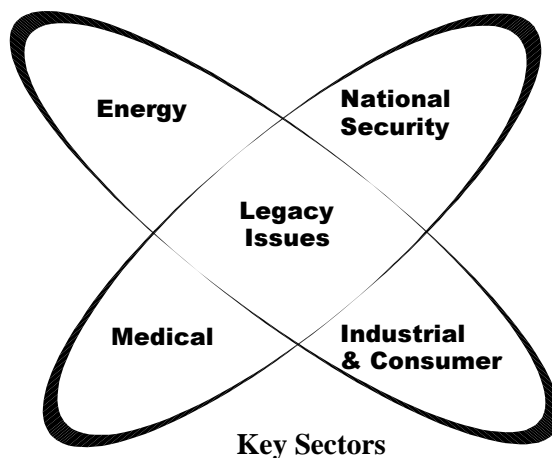
Figure 2. Scenarios of Radiation protection in 2025



Finding: Most Challenges Come from Four “Key Sectors”

An insight that stands out from the analysis of the discussions is that participants believe most of the challenges that the radiation protection community will confront between now and 2025 will come from four “Key Sectors”: Energy, National Security, Medical, and Industrial and Consumer.

Figure 3. The Future of Radiation Protection



The Key Sectors image above represents these sectors as four lobes within an image of an atom. In the centre, where the lobes intersect, is a fifth key sector: Legacy Issues. Wastes and other risks from the Energy, National Security, Medical, and Industrial and Consumer sectors eventually become the responsibility of people working in the “Legacy Sector.”

Finding: Widespread Agreement on Principles for Guiding Action

One of the project's most important findings is that people across a wide range of organisations, disciplines and policy positions are able to reach substantial if not unanimous agreement on a number of principles for guiding action.

The "Whole System Protection" scenario initially set out three principles for consideration: public right-to-know, total accounting, and risk harmonisation. In the scenario discussion sessions, participants were asked to comment on these principles, suggest how they should be defined, and discuss their appropriateness for decision making in radiation protection. They were also asked to suggest additional principles that might be just as appropriate and important for guiding action. At the end of the series of discussion sessions, the seven principles below emerged as the ones viewed as both most important and most acceptable to all parties.

Principles for guiding action

1. *Pollution/exposure prevention*

Pollution Prevention involves adopting practices that reduce at the source the amount of any hazardous substances or pollutants being released into the environment. It includes processes that eliminate the use of hazardous materials or increase the efficiency of their use. Exposure prevention involves adopting practices that reduce exposures to any hazardous substances that are released.

Pollution prevention approaches include substitution of materials, technology innovations, process modifications, redesign of products, improvements in training, and mass balance measurement to assess progress in reducing emissions. Exposure prevention includes inventory control, isolation and storage, and improvements in maintenance and housekeeping. Pollution/exposure prevention often saves money by reducing waste and health-related costs. Even where costs are substantial, it is justifiable to eliminate or reduce the use of hazardous materials and reduce exposures to them if the risks of damage to human health or the environment are high.

2. *Public right-to-know*

Right-to-Know involves assuring easy public (and public manager) access to complete and up-to-date information on the state of chemicals and radiation in the environment.

Actions to foster this principle include:

- Providing high quality, credible information.
- Filling in important information gaps with monitoring and research.
- Providing information in understandable, usable forms.
- Integrating information on chemical and radiation exposures into community-specific formats.
- Providing guidance to the public in interpreting data.
- Eliminating unnecessary secrecy.
- Integrating information on radiation into environmental databases.
- Integrating information from different Federal agencies.

3. *Total accounting*

Total Accounting involves assessing the full cradle-to-grave costs and benefits of decisions, including impacts on human health and natural systems.

Challenges that arise in applying this principle include:

- Building agreement on methods.
- Doing life cycle analyses (cradle-to-grave, and cross-generational where appropriate).
- Valuing environmental resources and ecosystem services in doing environmental accounting.
- Assessing social costs to individuals and society as well as costs to the bottom line.
- Dealing with uncertainties and lack of data.

4. *Risk harmonisation/cumulative risk assessment*

This principle involves harmonising approaches to radiation and chemicals based on a careful crosswalk between chemical and radiation models, parameters, risk calculations, and measurement techniques. It also requires a focus on understanding risks posed by cumulative exposures and interactions between hazardous agents.

Many of the major environmental risks we face require the simultaneous evaluation and control of both radiological and chemical risks, yet separation of the two persists along legal, regulatory, programmatic, training and operational lines. An additional complexity is the possible interaction between hazardous agents. Risk harmonisation is necessary to allow us to evaluate cumulative risk and evolve beyond today's inadequate carcinogen-by-carcinogen approach to public health.

5. *Inclusive Science*

Inclusive Science involves bringing a wide range of disciplines and viewpoints to bear in research related to important issues of public policy.

Sound, rigorous scientific methods that can stand up to public and peer scrutiny are essential in all areas of research dealing with health and environmental risks. In many research areas related to public policy debates it is also essential to take an inclusive approach, drawing as appropriate on disciplines within the social sciences as well as the physical and biological sciences. Parties with views that are currently non-mainstream in character should have a role in the formulation of research agendas if their views are an important aspect of particular policy debates and their overall approach is evidence-oriented rather than ideological. Where apropos, an inclusive approach may employ alternative dispute resolution techniques to foster agreement on questions and methods for research.

6. *Place-Based Tailoring*

Place-based tailoring involves deliberate efforts to adapt policies to fit local or regional circumstances, and to encourage experimentation.

While uniform national policies and regulations are justified in many circumstances, they are sometimes adopted merely for bureaucratic convenience. As a result, "one size fits all" approaches sometimes fit no one. Place-based tailoring requires adopting a grass roots perspective as well as a

national perspective. It also requires encouraging local and regional participation in the formulation of policies and regulations. Where appropriate, research can be tailored to address local questions, and information should be organised so that communities can look at local end exposures across media and disciplines.

7. *Stewardship*

Stewardship involves taking responsibility for providing the expertise and resources to maintain across generations an adequate level of protection to human well being, health and the environment. Stewardship can be viewed as a “master principle” that encompasses all the others.

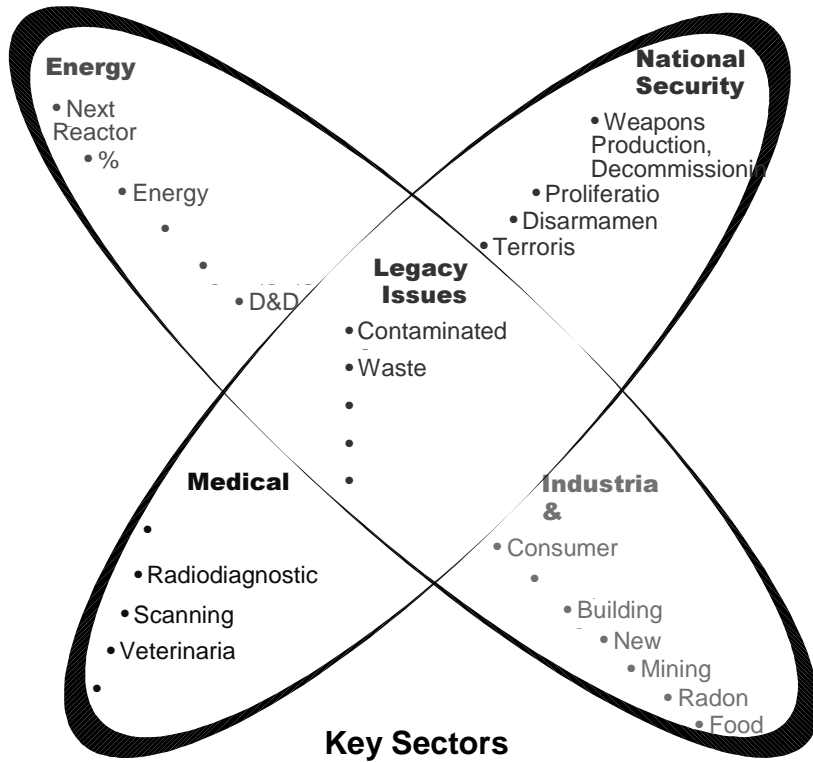
Stewardship is to hold something in trust for another. Historically, it was a means to protect a kingdom while the king was away or to govern for the sake of an underage king. Stewardship in today’s context is willingness to choose service to the next generation over immediate self-interest. It is accepting accountability and providing leadership to assure the success of future generations. Stewardship is closely related to the concept of *sustainability*. Sustainable development is development that meets current needs without compromising the ability of future generations to meet their own needs.

A shift in perspective

The expert interviews and discussion session findings, taken as a whole, suggest that looking systematically at challenges and alternative futures out to 2025 leads to a significant shift in perspective, and may offer a method (a “common language” around principles) that regulators and stakeholders can use to transcend traditional disagreements and conflicts.

From Current Approach	To New Approach
Focus on current issues, programs, budgets	Focus on major radiation-related challenges facing society as a whole, which leads to rethinking current priorities
Tacit assumption that the future will be much like the present	Common theme that the future is likely to become significantly worse than the present if business-as-usual continues
Radiation protection defined by a focus on “Legacy Issues”	Assessment that legacy issues will decline in importance & that future needs center primarily around developing more preventive approaches to four Key Sectors: Energy, National Security, Health, and Industrial & Consumer
Continuous conflicts between parties with entrenched positions	Focus on shared principles and good science for working toward better positions
Limited emphasis on public information due to habits of secrecy from the Cold War era	Primacy of public right-to-know – strong emphasis on public education and open access to credible, usable information
Radiation protection as a community unto itself	Integration of radiation, public health and environmental protection through risk harmonisation, combined databases, and shared principles for guiding action

The Future of Radiation Protection



ENVIRONMENTAL EXPECTATIONS: PROTECTING THE ENVIRONMENT, TRANSFER OF A HERITAGE

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In my contribution to the Second Villigen Workshop, I want to discuss some important aspects that should be considered when a future radiation protection system is developed. As I see it, any future system of radiation protection should take public opinion much more seriously than is true today. To make this happen, specific aspects should be taken into account. Furthermore, a future radiation protection standard should guarantee not only protection of people (individuals and the collective) but also of the environment.

In the first part of this paper, I want to give a few examples for shortcomings in the existing system and in current public debate. The second part recommends some important aspects that should be kept in mind in order to overcome the difficulties prevailing today.

Shortcomings in the discussion on radiation protection between the public, scientists, authorities and industry

With regard to the situation in Germany, some shortcomings can be identified that make the discussion of radiation protection problems between the public, scientists, authorities and industry very difficult. Due to these difficulties, it is impossible to reach any consensus, in many cases even a certain degree of consensus. If I judge the discussion in other countries correctly, these difficulties and deficiencies are not specific to the German situation but manifest themselves in similar ways in other countries.

In Germany, the majority of people seem to oppose the use of nuclear power. There are strong arguments for such an attitude: To date, for example, no reactor concept is available or has been implemented that absolutely excludes severe nuclear accidents which have a disastrous impact on a large number of people. Another aspect that often serves as a viable argument against nuclear power is the fact that so far there exists no safe and licensed final disposal site for radioactive waste in Germany.

So, on the one hand there is strong opposition against nuclear power, while on the other hand industry has an understandable interest in operating the existing nuclear facilities as long as operation is profitable. The conflicting opinions are incompatible. When discussing radiation protection problems, both sides concentrate on and project their fixed basic ideas on the effects of radiation exposure. Two extreme viewpoints might help to make clear what I mean:

- Some people still believe – and argue – that in principle artificial radiation is more dangerous than the natural one, because artificial radionuclides are incorporated and thus cause radiation exposure from within the body. At the same time, those people assume that the natural radiation background result in an exposure that occurs only outside the body. Of course, this argument does not hold when, for example, the

important contribution of radon daughters to the naturally occurring radiation exposure is taken into account. It is obviously impossible to convince such a person that a certain technology-induced radiation level could be relatively harmless as compared to the natural background radiation.

- The pro-nuclear side often tends to downplay the risks. An extreme attitude is the hormesis theory (low radiation doses are beneficial for health) that is frequently spread by certain scientists.

In my opinion, it is not very low doses to which the public is exposed during normal operation that pose the major problem of nuclear energy use. Rather, as mentioned above, we are confronted with the lack of absolutely safe reactor technologies and of a solution to the waste problem. It seems that the public debate of radiation protection is not guided by scientific knowledge but by repeating fixed standpoints. Unluckily this means that scientific knowledge has hardly any impact and little chance to promote progress in mutual understanding.

Another important disadvantage of this situation is that there is virtually no consensus on radiation protection standards in general. Besides radiation protection at nuclear facilities, ever more regulations deal with other radiation sources, especially interventions and natural sources. These aspects of radiation protection are also often discussed controversially. A lot of these discussions, however, could be avoided if they were not limited to the dangers of nuclear power but included – or even focused on – radiation protection in context of other, for example medical, nuclear applications.

In the following section I will describe some requirements to reach a consensus.

Requirements for a future system of radiation protection that might perhaps find broad acceptance in the public

An important basis of the common radiation protection philosophy is the non-threshold theory of radiation effects. This means that no radiation protection standard can exclude health effects to people, irrespective of how low the threshold value is set. As a consequence, every radiation protection philosophy has to define an “acceptable risk”. It is very desirable that this “acceptable risk” is also an “accepted risk”, accepted by the public.

At the moment “acceptable risk” and “accepted risk” in this sense vary considerably. Actually, the definition of acceptable risks is based on publications of the International Commission on Radiological Protection (ICRP). The ICRP and its individual members have often been criticised by the anti-nuclear side. I guess it is no surprise that the basic definitions of acceptable risks are at the centre of public criticism. Indeed, a scientific committee should be no means be the only body involved in the definition of an acceptable risk level. In order to achieve wide acceptance, it is necessary to invite the public to participate in the definition process. This aspect has been vastly neglected in the past.

In an appropriate decision making process, several risks must be investigated, evaluated and related to specific acceptability criteria, for example:

- acceptable individual mortality risk (needed for radiation protection during normal operation and after accidents);
- acceptable individual risk of other health effects (also needed for normal operation and accidents);

- acceptable risk of loss of living space (resettlement after severe accidents);
- acceptable risk of loss of areas that can be used for agriculture or infrastructure (after severe accidents),
- acceptable collective risks (this means that the area and time horizon under consideration must also be defined).

The examples given above are related to radiation protection of people. Another aspect that needs more attention in a future radiation protection system is the protection of the environment. Today, it is quite common to assume that responsible radiation protection of people (individuals and the collective) also ensures adequate radiation protection of other forms of life. When it comes to toxic impacts on the environment, the philosophy is often much more sophisticated.

But everyone who is involved in environmental impact assessments (EIA) for a facility that emits ionising radiation knows how difficult it is to evaluate the radiation effects on animals and plants. Often, the evaluation has to be based on plausible conclusions (educated guesses) rather than on sound scientific knowledge. It is not to be expected that a zero-risk-threshold for impacts on animals and plants can be determined in the future. Therefore, in addition to advanced scientific knowledge about the behaviour of radionuclides in ecosystems, we need a public discussion and definition of what is considered acceptable and what is not.

TRANSGENERATIONAL ETHICS: PROTECTING FUTURE GENERATIONS AGAINST NUCLEAR WASTE HAZARDS

Some Ethical Considerations

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Abstract

This paper describes the activities launched at SCK•CEN, intended to explore ethical and other non-technical aspects when dealing with the time scales considered in the high-level waste disposal program. Especially the issues of retrievability and precaution will be focused on which will be philosophically contextualised. Many questions will be raised in order to sensitise all stakeholders for the transdisciplinary character of the transgenerational problem at hand.

Introduction

Ethics is a concern of humans who have freedom of choice, when faced with alternative courses of action. In the present Belgian high-level waste disposal concept, the whole system is designed to provide both active protection and passive safety, the latter meaning precisely that a certain level of protection can be reached, independently of active measures to be taken by future generations. The Belgian approach (NIRAS/ONDRAF) does not exclude retrieval, but states that it is not the intention to date to retrieve.

The current and future treatment of high-level and long-lived radioactive waste implies questions beyond the merely technical level. Different strategies and policies, from geological disposal of reprocessed waste to direct disposal of spent fuel, are therefore to be studied from another than a purely technical standpoint.

The proposed solutions carry specific implications towards society and the environment which complicate the decision process and give weight to the arguments in favour of a long-term storage option or a concept with possible retrieval. Disposal may generally be considered as a reference solution, but many questions still remain to be answered. One of these questions is whether the favoured option is ethically acceptable or not. In this paper we will elaborate this problem. Because more than one generation is implicated, we rather speak of transgenerational ethics.

The project “transgenerational ethics in the context of high-level waste disposal” aims to explore the ethics involved with disposal of high-level nuclear waste, to clarify what the ethical options are, to provide the necessary background for the ethical choices to take, to propose answers to the ethical questions asked, to initiate a sensitization-program, and to give recommendations to whomever may be concerned.

This project is one of five research projects (“Nuclear Liability,” “Sustainable Development,” “Risk perception,” and “Coping with Uncertainty”) that SCK•CEN started within the framework of “Nuclear Research and Society,” in order to make a survey of the existing link between the technical and socio-economical aspects of nuclear energy and the humanities. Research is performed in close relation with these other projects and the two so-called “reflection groups” (“Culture of the Expert” and “Ethics and Radioprotection”). As far as methodology is concerned, the different semi- and ethical opinions actually considered by all stakeholders are gathered through bottom-up (questionnaire) and top-down (normative, from philosophical principles through literature study) approaches, and are catalogued and philosophically assessed subsequently. The overall guiding methodology is a problem-solving analysis. [1]

Retrievability

Spent Fuel

Why do we want spent fuel (SF) to be retrievable? Some argue that it is a downright shame to treat SF as useless HLW and to dispose of it. Others merely take retrieval of SF into account in the context of sustainable development or environmental protection. Why should we not make SF available to future generations? This kind of availability implies retrievability. At face value, the benevolent intention is indisputable. How noble these arguments may sound, there is much more to retrievability. Besides, are these motives really sincere? What are the presuppositions? Are these the only motives? Is it not reasonable, given the political relevance of radioactive waste management (RWM) to suppose the existence of other, possibly even more influential factors than ethical principles? Are there hidden agenda's?

It could be the wish of a future society to utilise our SF. However, if the future generations do not know about it, how can they wish for it? In other words, should we take all possible wishes of future generations into consideration? If our generation thinks the probability of retrieval is high, e.g. for resource use or alternative management (as waste), then the material should not be put in a repository at all. Why should we make it difficult to retrieve? However, it looks rather that the probability is rather low. Should permanent surface storage not be dismissed for that reason, combined with the conclusion that institutional control does not seem feasible and long term societal stability is a fantasy? Does this mean that in this case final disposal is what should be chosen?

Reprocessing SF appears to be desirable as the world cannot afford to dispose fuel rods still containing significant amounts of suitable fissile materials. From this perspective, SF should be stored in an environmentally safe way with minimum cost and easy retrieval. What does it cost to future generations to keeping SF retrievable? Making SF effectively and efficiently retrievable is not enough. Surface installations and reprocessing facilities should be made available (maintained) or rebuilt. Knowledge should be preserved, if not, developed later, possibly from scratch. Nuclear reactors should be kept in a good condition or rebuilt. Plutonium can be used directly, but uranium needs enrichment or a breeder-reactor. Does this mean that we have to make the difference between the different sorts of SF we would like to make retrievable? All of this clearly implies (huge) supplementary costs for retrieval. Future new technology or understanding could – based on revaluation of the cost/benefit balance – motivate modifications in earlier disposal, or retrieval of disposed waste packages.

It is not yet clear whether there is indeed a transgenerational-economical benefit to the retrieval of SF. Easy retrieval is expensive for all generations (in case of permanent surveillance) to the generation that could but not necessarily will decide to retrieve and reprocess SF. There is

maximum loss when our generation and the next generations make retrieval maximally possible, while future generations make no use of it either but continue the surveillance hoping that somebody will eventually retrieve SF (which in that case will not happen).

For hundreds of generations into the future these fissile materials will be an available source of materials for any organisation desiring nuclear explosives or radiological weapons of mass destruction. The consequences of deliberate damages are most likely to be greater than any potential effect of leakage into the natural environment. Therefore, the most important function of a system for the management of SF is the long-term ability to resist attempts to recover the fissile materials for destructive purposes and in a offensive way. From a pacifist point of view, plutonium should not be retrievable at all. From a nationalistic point of view, plutonium should be kept retrievable for defence. This supposes a long time economical and national stability, something that historical studies to date do not endorse. If SF is retrievable in view of a military use, this means that retrieval implies the possibility of intentional loss of future lives. Is a military reason an acceptable reason to consider retrievability? If so, does nationality stretch transgenerationally? Does not history show that migration happens continuously? Taken this for granted, should we not rather approach the problem at hand from an international point of view? Given that we do export nuclear energy, is not absurd to keep on tackling the problem of SF (and HLW) locally?

Making retrieval possible means that the adoption of SF for mass destruction purposes is kept possible too. Ethically speaking, there is a difference between making mass destruction possible (in a defensive and offensive manner) on one hand, and having the possibility of military use as an unintended consequence of future retrieval on the other. Are these ethical considerations sufficient to decline SF-retrievability? Are there any other ethical considerations one can think of that would be sufficient to decline SF-retrievability? Can ethics be sufficient to take decisions regarding RWM or is and will ethics always be minor? Why was retrievability considered recently? If we consider retrieval in the future, should we not think of disposal concepts that put retrievability first, instead of integrating possible retrieval in existing disposal concepts?

The fact that total long term safety cannot be assured might be considered to be an argument in favour of SF-retrievability. On the other hand, postponing the closure of a repository or parts of it could have negative implications for both the operational and long-term safety. If it is our duty to keep risks for future generations as low as reasonably possible (that depends on the ethics one adopts and the consequential interpretation of the concept of duty), it might be more sensible not to encourage action than to make easy retrieval possible. Can we risk the life of future workers? Will we not risk their lives more and more through the expected loss of information? And if retrieval is kept possible, should SF not be retrievable as long as possible?

Ethical systems supply answers to all these questions, but there is no consensus. An absolute ethical system is not to strive for, and a general accepted one is not (yet) available. It is the purpose of the project on transgenerational ethics to look further into this problem.

High Level Waste

Why do we want HLW to be retrievable? It is argued that we do the best we can to treat it safely but maybe future generations can do better. However, can we be sure that the future generations will do better? Philosophy of science actually shows us that absolute scientific progress is a figment of our imagination. Why do we think future generations will do better? Is it just because we want them to do better? The argument goes: "Future generations should have the chance to adjust what we did wrong." The opportunity we want here implies retrievability. Why do we want HLW to be retrievable? Some argue that we do the best we can to treat our HLW safely, but future generations may do better.

Future generations should have the chance to adjust what we did wrong. Is retrieval reasonable and achievable? Do we have the right to burden future generations with retrieval? Do we have the right to burden them with a (possibly not completely safe) repository?

How do we think the future generations will react if we burden them with waste, costs, and dangers? Do we have the right to burden them? Even if we do burden them to one extent or another, should we not do the best we can to make the burden as light as reasonably possible? What would we consider “light and bearable”? What would we consider reasonable – not from our current position, but in comparable circumstances the future generations will live in?

Through retrievability of HLW, do we not create an inequality between our generation (taking a decision not to dispose definitely), the next two generations (leaving the disposal to them), and future generations (hoping a future generation will do better than we do)? Are we not opportunistic in taking for granted that the future generations are likely to solve our problems, to take care of HLW? If so, is it acceptable to show optimism (“future generations will probably do a better job than we do”) to mask opportunism (“actually, we make HLW retrievable for other reasons”)? To place the waste we have produced in repositories in such a way that our own and the next few generations will not have to bother about the problems may create an illusion that the waste problem is solved. Establishing that illusion may, in turn, encourage our generation to increase the waste production further, at the cost of generations’ health and opportunities to satisfy their basic needs. However, one can construct the same argument for retrievability: making HLW retrievable can create the illusion that if something goes wrong or the next generations come up with new ideas to deal with the waste, then there is always a loophole, i.e. retrieval. If we consider that easy retrieval is necessary, then we acknowledge not to be absolutely sure that disposal is safe. It then looks to the public as if the scientist and decision makers alike are not confident about what they are doing. If retrieval is possible, the decision can be seen as revocable, easing the burden on the decision makers. To consider retrievability can be viewed as an excuse for doing a “sloppy job”: the next generation will (have to) clean up our mess because “they will have better techniques anyway” (which is, as history and philosophy of science show us, a contingent expression).

Is the concept of retrievability consistent with the European Commission’s objectives (1) to construct, operate, close and seal a repository for long-lived radioactive waste in a safe manner, and (2) to achieve permanent protection of humans and nature, without the need for future generations to remain or become actively involved to ensure this safety? [2] To what extent is safety guaranteed? What does it mean to protect permanently humans and nature? What does it mean to protect humans and nature? Is nature protected if humans are? Who decides that is or is not the case? Politicians? Biologists? Theologians? Philosophers? Is this questioning not a sufficient reason to make it a transdisciplinary problem? What does retrievability demand from future generations? What is the real cost of retrievability (to this generation, to the next one, to all future generations)? Can we make an estimate of that cost? Indeed, what about economical precaution? Therefore, since this and the next generation have the benefit of nuclear energy, the future generations should get a compensation (for not getting it), or at least not another burden, i.e., the problem of decision-making and additional costs for retrieval. Should the current generation make the necessary funds available (1) to the next generation for the disposal and (2) to all generations that have to assure retrievability the cost to do so? However, the generation that decides to retrieve the waste must have a reason to do so and will thus benefit from the retrieval, hence, it has to defray the costs. One could argue that the intermediate generations (those who do not have any benefit, but have to assure retrievability) could call the ‘last’ generation to account for the accumulated costs. Who decides on this one? We could look for comparable situations the previous generation have saddled us with: e.g., environmental problems, toxic waste dumping grounds. It seems (1) that previous generations did not have put money aside for clean-up operations, nor recovery of waste, although (2) we try to make (limited) money from their

waste (small-scale alternative energy production). If there are cases in which the present generation is recovering chemicals on a large scale, we do have here a reason to choose in favour of the retrievability-option.

A cost aspects study is a critical input to decision-making on HLW-retrievability. Supplementary costs for enhanced design for retrieval may be relatively low, but opening a closed repository will be very costly by all means. The bulk will be paid (automatically) by those who decide to retrieve, unless the money is saved by those who decided to make the waste retrievable. Given that we acknowledge our responsibility and taken that we cannot burden the next generations, our generation should provide enough money to open the repository in the future (equality-principle), keeping in mind that this act is not viewed as a compensation – not by our generation, not by future generations: some harms are so serious that no amount of money could possibly compensate the victims or their survivors (compensation has its limits). On the other hand, saving money and taking devaluation into consideration, given that it is not certain that retrieval will be actually performed, one could argue that this money should be spent on other and current humanitarian projects: “our generation first”. Or one could argue that those who retrieve will have a good economical reason to do so: they will make their own calculations. Then again, if previous generations have forced the “last” generation to retrieve waste, by having consumed all other resources (gas, coal, oil) and having polluted the environment doing so, should the previous generations not exempt the ‘last’ generation? Although a cost-aspects study is relevant to the problems at hand, time scale reasons (uncertainty) make it almost impossible to give meaningful predictions, leave aside accurate predictions. Economical predictions of more than fifty years indeed seem totally absurd. However, this does not mean the ethical reflections are superfluous.

Introducing retrievability can be seen as a decline of responsibility, another “wait and see” interpretation. Is it acceptable to pass the decision onto the next generation? One thing is for certain: due to the sixty year cooling period, the generation that did profit from the waste-production (i.e., energy-production) will not finish, not even start the disposal process. Two generations from now, decisions will have to be made and real action will have to be taken. Are we not in a rather comfortable situation right now compared to the situation future generations have to cope with? Is this acceptable?

An analogue reasoning to the one that implied a surplus burden through retrieval of SF, can be made in view of the possible retrieval of HLW. Retrievability may imply further research on transmutation, because transmutation is considered to be a good alternative when one decides not to start final disposal after a period of possible easy retrieval. However, transmutation needs a continuation of nuclear energy production. Is research on transmutation still useful if one has taken the final decision to close down the nuclear power plants in about fifty years from now? Should we conclude that decisions about retrievability should be closely connected to what we want with our research programmes and our decisions taken on the subject of nuclear energy? Do we not have to check this with the considered strategies regarding NPP and HLW-management? Are policies that take such an overall strategic plan into consideration manageable from one generation to another?

Precautionary principle

During the last decades of the twentieth century, the Precautionary Principle (PP) gained attention. Although everybody likes to talk about the concept as if it is widely accepted and clearly defined, there is not one interpretation that enjoys general approval. If there is an air of agreement, it is precisely because all relevant terms are kept ambiguous. In a recent draft paper the EC acknowledges the elusiveness of the PP. [3]. The problem is not that terms are vague, but that there are so many different widely used interpretations on the meaning of the PP.

Strictly speaking, if we cannot prove its universality, is the PP not completely useless as a principle? What else, in a political context, especially from a democratic point of view, is a principle than a by all stakeholders accepted postulate? Besides, is universality an aspect to be looked upon as feasible in a political context? If it is, the PP is not yet to be acknowledged as such. If not, the PP, for sure, should not be treated as one. Should the PP not be looked upon as merely a guidance hypothesis?

Still, as a working hypothesis, there is a use for the PP: we can recognise its ethical ambition (i.e., the intention of its designers) and try to combine it with other philosophical and technical considerations as well. As will follow, a reverse methodological interpretation (a proactive or analytical application) will be quite helpful.

Whether or not to invoke the PP is, as many approve, a decision exercised where scientific information is insufficient, inconclusive, or uncertain and where there are indications that the possible effects on the environment, or human, animal or plant health may be potentially dangerous and inconsistent with the chosen level of protection. [4] On what will the indications be based? Do we have all information about the possible effects on humans, animals and plants? What levels of harm do we accept? Will we take individual hazards into consideration or only work with mean values? The application of the PP implies many uncertainties (besides, we do not know yet what decisions we will take on the PP itself).

A central question is this: Is the PP an ethical principle? The German philosopher Hans Jonas (1903-1993) studied the way of decision making in technological society. Science and technology certainly imply a new sort of responsibility: “we have to hand over to all future generations a habitable Earth and make sure not to alter the biological conditions of humanity.” [5] It is an imperative that limits our freedom, but constraints to our freedom are necessary given the power that science and technology have on the future.

Jonas pleaded for a new kind of responsibility. He wanted to surpass the framework of the past and break out of the usual assignment of responsibility. Should we take long term consequences of contemporary decisions into consideration, apart from the implications for the present-day generation and the possibility of indemnification? Such a responsibility is individual and collective at the same time. It is obvious that this particular concept of responsibility demands an understanding of the long term implications of the decisions taken today, in order to assess them ethically. Such knowledge is evidently quite uncertain, by its source, content, and by scientific methodology. This kind of uncertainty can be obscured by another sort of anticipation: it is the so-called “heuristics of fear”: one is obliged to envisage before making any decision that could have irreversible or uncertain outcomes, a worst-case-scenario, and to minimise the feeling of insecurity. Evidently, such an approach cripples all technological enthusiasm and optimism, viz. the idea that technology can overcome all its and all other problems. The PP is presented as a realisation of this future oriented interpretation of responsibility in the context of political engagement. The PP would make a democratic procedure (contemplation, scientific inquiry, public debate) possible before taking a decision with far-reaching or irreversible consequences.

Granted that the PP has ethical roots, apart from the fact that one can dispute its ethical content, should the PP be viewed as a personal rule or should it be taken up in legislation? It is clear that two distinct positions are taken, viz. economical and commercial decisions are made on the basis of laws derived from the PP and economical and commercial decisions cannot be based on the PP because it is a rule only to be used by singular instances (individuals and/or institutions), in other words, if there are uncertainties, consider not to act, [6] but do not forget that you cannot prohibit others to do so beyond uncertainty.

Are we clear in what we want from science and ethics through the PP? Regulatory or trade restricting actions taken as a result of concerns could be classified as based on ‘preliminary’ science. While there is some science suggesting a basis for concern, the actions are based mostly on politics because the science is only preliminary. [7] Most of the time, however, they are and will be based primarily on a reaction to public concern about a dreaded risk and not strong scientific evidence of a risk. [8] This is consistent with the position taken by the EC: the assessment of a situation by the public is of great concern. This could mean that ethical considerations are referred to in order to justify actions (or the delay to act) although they are taken (or not taken) mainly on a political interest in the people’s choice (which is, evidently, not based solely on science, nor a global concern).

Science clearly plays second fiddle in the debate. If there is time for a scientific assessment, the PP can be invoked to push a particular policy. If a decision has to be made quickly, one can use the PP too and refer to the uncertainties in the scientific results. The PP is indeed a powerful tool for politics. One should ask the question whether it is appropriate to apply the PP. It is not far more better, in both cases, to take an initial decision based on preliminary scientific results, which, of course, can always be reviewed? In that case, incentives for scientific research are provided and regulators are not locked into a decision because public perception makes it impossible to make a risk management action less stringent when new science justifies doing so. Public trust could improve if decision-makers are honest enough about their decisions to classify them as being based on policy because there is no adequate science for the time being to do otherwise. If there are uncertainties in the scientific results one can still take a preliminary decision which can be revoked after new results are available or when countermeasures are known and can be applied. In this case the decision is not based on a imprecise principle that looks ethical, objective, and which contributes to the people’s aversion towards science. A decision-making approach should incorporate both science-based risk analysis and the policy of precaution, albeit on the same level.

In general, the precautionary principle is deemed relevant (and one step further: applicable) if the following conditions are met: [9,10]

1. The risk is novel.
2. Relevant science is less than conclusive. Future knowledge about the risk does not allow to act. There is a full range of variability and uncertainty. We should ask ourselves what the consequences are of the most pessimistic and optimistic assumptions.
3. The risk is hard to evaluate, because of its incommensurability.
4. It creates a situation which is irreversible.
5. The hazard has catastrophic potential in the worst case, even if it is considered of low probability. The damage implied is irreparable.
6. There are many social aspects, many stakeholders. The risk bears disproportionately on disadvantaged or vulnerable groups.
7. Measures to tackle the suspected risk would be more effective to be taken promptly.
8. Accepting the risk provides little public benefit.
9. Risks are imposed on people involuntarily.
10. There are cumulative effects, social impacts, distributional issues and ethical implications: a precautionary approach includes these complex and indirect effects. It involves the assessment of societal, scientific and technological developments.
11. There are several options without straightforward preferences among them.
12. There are definitely pros as well as cons. There is a full range of viewpoints.

An evaluation of the characteristics of the RWM issue proves that indeed the PP is relevant to it, as the following list (corresponding to the previous list of conditions) shows:

1. RWM concerns matter man never before has been confronted with. It is a new problem in this sense; however, all toxic waste does imply the same situation, if not even worse, since toxic waste is not degradable. So, the problem is in essence not that new. Then again, it is the first time that waste is seen as a problem in view of the future generations.
2. This is the key point of discussion: science is not inconclusive about the risks of final disposal. However, there is uncertainty about the implications of retrievability.
3. The risks are indeed hard to evaluate, for sure if all stakeholders's perception is taken into account. Whether we agree upon doing that or not is not relevant here. The risks can be compared with other risks, so they are not incommensurable.
4. Final disposal of the radioactive waste makes it an irreversible situation.
5. There is a worst case scenario in the context of RWM: burdening many future generations to a great extent.
6. All future generations are stakeholders so there are indeed many. They are disadvantaged in the sense they cannot be heard. They are vulnerable if they are not capable to deal with problems that crop up after we are long gone.
7. The faster we decide to disposal or storage the more we limit the risks (at least, that is what we think).
8. Whatever option is chosen, public opinion is against all what is nuclear. It looks like final disposal, although the best option available at this time, is certainly not the people's favourite.
9. The agencies do make an effort in getting the public involved to some extent. The final choice is not completely involuntarily. However, the future generations are burdened with risks which they have to take voluntarily.
10. Research about RWM involves the anticipation of the evolution of society and public policies in order to build adequate knowledge.
11. There are several options (storage, final disposal, ..., and all degrees of retrievability) and choosing between them is hard.
12. In conclusion, there are many different views, many antipodal positions in RWM.

In addition, the PP looks interesting enough to entertain in RWM just because of the length of the envisioned time periods in the case of HLW.

It appears that the PP is relevant to RWM. However, we have to consider that the extent to which the PP is applied in decision making depends partly on the confidence that can be placed in a risk assessment, but also on the nature and severity of the risk concerned, the likelihood that the new data would change a risk management decision, the effectiveness and feasibility of the risk management action under consideration, and a wide variety of other considerations, like politics, public health, economics and law. There is a danger that, if applied in the extreme, the PP will be used as license to ignore these other elements of risk management decision making. The PP can be carried to extremes and become an ideological tool. When that happens, science is ignored and emotional and financial resources are diverted towards worrying about every potential risk, no matter how far-fetched or unlikely. Part of the problem with relying on precaution as a basis for decision-making is that decisions are made on the basis of hazard (possibility of danger), not on the basis of risk. [11]

Subject to review in the light of new scientific data, means measures based on the PP should be maintained so long as scientific information is insufficient, incomplete and inconclusive, and the risk is still considered too high to be imposed on society, in view of chosen level of protection. The philosophy of science shows us that scientific knowledge is always limited by logical considerations

(e.g., incompleteness theorems), by methodological considerations (e.g., confirmation and falsification do not logically forces any conclusion), and by extra-scientific elements (e.g., sociological, economical and political elements). Relativism, and perhaps worse, arbitrariness threatens when the PP is applied loosely.

Conclusion

An ethical reflection puts the question to consider retrievability or not in an altogether different light. Several systems are relevant, none is absolute or prevalent. Depending on the weight one wants to give to philosophy in comparison with politics, economics, science for that matter, these systems (depending on the a priori or a posteriori choice) make it possible to select or eliminate solutions in the problem-solving space.

As a candidate universal principle the PP has its potentialities, but too many interpretations are currently possible. The use of vague terms does not have to be a problem, the issue is that there is no consensus yet on its full meaning. Some say it is an advantage of the PP to be vague enough to have a broad field of application. The problem is that the PP is already deeply imbedded in political discourse. Political actors interpret the PP freely which is possible because so many parameters are involved. The PP is crystallised a posteriori (which makes it an empirical rule for the time being), its meaning depending on the context and situational needs.

On the meta-level, the following remarks and questions could be stated:

- One should avoid making an ideology out of the PP.
- One should develop a deontology for the use of the PP.
- Should we not make an effort to quantify the PP?
- Should we not make an effort to qualify the implicit concepts?
- Should we not make an effort to bring the PP in relation to (other) basic principles?
- Is the primary intention to adopt the PP safety or are there interdependent motives?
- Evidently, the PP itself has to be applied cautiously.

These statements clearly have an indisputable ethical content. It follows that the ethical aspects of the PP should get more attention. Many consider the PP as an ethical principle itself, but that does not mean that it is beyond all ethical investigation.

RWM raises philosophical, especially ethical problems, and philosophy at least points out several ways to tackle the questions raised. For the time being, however, no definite answers can be given.

Footnotes

- [1] Cornelis, G.C., 2000, *Zoeken naar oplossingen*, VUBPress, Brussels.
- [2] EC Concerted Action on the Retrievability of long-lived Radioactive waste in deep underground repositories, 2000, Main Report and Annexes, Final Draft, 2000/02/29, p. 8.
- [3] Commission of the European Communities, 2000, Communication from the commission on the precautionary principle, COM (2000)1, Brussels.

- [4] Commission of the European Communities, 2000, Communication from the commission on the precautionary principle, COM (2000)1, Brussels, p. 8.
- [5] Jonas, H., 1998, *Le principe responsabilité*, Flammarion, Paris.
- [6] La lettre EMERIT, 2000, *Expériences de méditation et d'évaluation dans la recherche et l'innovation technologique*, 25, p. 3.
- [7] Charnley, G. and Elliott, E.D., 2000, Risk versus precaution, in: COTTAM, M.P. *et al.*, *Foresight and Precaution*, Balkema, Rotterdam, p. 210.
- [8] Charnley, G. and Elliott, E.D., 2000, Risk versus precaution, in: COTTAM, M.P. *et al.*, *Foresight and Precaution*, Balkema, Rotterdam, p. 211.
- [9] P.G. BENNETT, Applying precautionary principles: a conceptual framework, in: COTTAM, M.P. *et al.*, *Foresight and Precaution*, Balkema, Rotterdam, p. 226.
- [10] Mormont, M., 1999, *Sociologie de la précaution: risque et connaissances pertinentes*, Séminaire. Le principe de précaution. Comment le définir, comment le faire appliquer ?, 18-11-1998, Actes du séminaire du centre d'études du développement durable, preprint, IGEAT/ULB, Brussels, p. 4.
- [11] Charnley, G. and Elliott, E.D., 2000, Risk versus precaution, in: COTTAM, M.P. *et al.*, *Foresight and Precaution*, Balkema, Rotterdam, p. 210-211.

SK POLICIES THE VIEW OF NUCLEAR MUNICIPALITIES

M.V. d'Abadal

I am the general secretary of the Spanish municipalities with NNPs and member of the staff of GMF (Group of European municipalities with NNPs). So, I have some experience in the management of local interest in the nuclear world, whether in the relations with other administrations at national or international level or with the social agents who take part in these issues.

First of all, I would like to thank the Nuclear Energy Agency for this opportunity to express the opinion, the feeling, of local authorities in relation to nuclear security or radiological protection.

Nowadays, nuclear energy represents 25% of the total production in Europe, and its importance is the subject of an important debate whose origin is the new environmental challenges in relation to the need of reducing the emanations of CO₂ and controlling the chemical agents responsible for the green house effect. During the last environmental summit held in The Hague, the advantages of non polluting and abundant alternative energy were mentioned repeatedly in opposition to the traditional resources of energy.

However, the use of nuclear energy is still a subject of debate due to the problems related to security and nuclear wastes.

The nuclear policies of the most important countries in Western Europe, already influenced by the evolution of the public opinion, have experimented strong changes together with political evolution. The future of NNP in some important countries is doubtful, as for the case of Sweden, Germany, Spain, Holland, Belgium,

The large democratic discussions that affect permanently our society, as well as the new society of information that is being implanted, have turned the decision making processes into what is referred to as public participation and transparency, especially when these affect the environment or the immediate future of the citizens.

The installation policies of nuclear plants are very similar in all the countries. Most of them are located in low density population areas, with low activity rate, high rate of elder people. These territories have many water resources, low communication infrastructure level, etc. So the typographic aspects of the European municipalities are alike (in eastern countries as well).

Nuclear energy whose existence is sometimes called in question by press media, citizens and inhabitants, needs full agreement within the territory in order to work at its best. Moreover, the territory on which the plant is installed must have the necessary means of infrastructure (development from a social and economic point of view) as well as the clues for its future and for a new positive reality as far as the citizens are concerned in order to face the corresponding challenges.

Having got to this point, a territorial debate should be focused on the balance between the state's general interest and the local one as normalised operation of nuclear facilities is and will be possible only in a context of mutual respect.

The new European political map and the last governmental decisions in energetic strategies grant more value to the opinion of the local authorities on the territories affected by these facilities. So, in order to express their opinion, these authorities should gather within a European forum where the communication would become a lot more fluent.

With this goal the European Municipalities created the GMF, a group of municipalities which think that they have to take part in decision making process in order to defend any interest dealing with the people living in nuclear territories.

The will of GMF is to work together in favour of the security and the quality of life, which means socio-economic progress for their citizens. The municipalities wish to stay away from the general and typical debate about yes or no to nuclear energy.

Once we have reached this point we must define our main objectives: **the security and the socio-economic future.**

Security

In the surrounding of NNP, as in other risk facilities, the perception of security depends on two factors: information and measures to be taken into account in case of an emergency.

The most important challenge is to gain a certain level of confidence among the different agents taking part in nuclear debates, if it is necessary to succeed when looking for future nuclear sites or decommissioning activities or any event related. The daily work experience directly with people and the fact of explaining all their decisions to the citizens make local authorities the "key persons" in the process.

When someone wants to obtain people's trust they have to work respecting two principles:

First, in order to work directly on the territory you must be involved in everyday life. The idea is that nuclear issues are very wide, very special and also very technical with a very specific language.

There is a certain kind of anxiety among people when a nuclear facility is built or decommissioned. If people are not well informed, their anxiety may provoke suspicion. Even more, the people responsible for reporting about nuclear aspects among the population must become regular members of the community and get involved in normal events of everyday life. If so, confidence is given a chance to grow.

The second item would be that information should be reported on a regular basis. If we are used to explaining what it is going on within the daily nuclear operations, avoiding unnecessary technical terms, it should not be a problem to communicate any information concerning nuclear activities and obtain people's trust.

Information

In order to assure the first factor we must consider two aspects: transparency and participation in the decision making process.

Transparency

First condition, transparency is the opposite to opacity and it is based on mutual confidence. Transparency has to run in two directions. So, whoever gives information has to tell the truth but, at the same time, whoever receives it has to believe what they listen to. Otherwise it would be a nonsense dialogue.

Second condition, information has to be available. Everybody should be able to access all the information and use it to defend their legitimate objectives.

And the third condition must be to tell the truth instead of trying to convince either the anti-nuclear or the pro-nuclear part. Citizens like the truth not what is tendentious. Local authorities avoid debates about yes or no to nuclear energy, because while we argue in these sterile debates we forget to talk about what is going on about the future.

The content of the information is very important. Sometimes we would like people to learn what they, however, aren't interested in, especially when we talk about radioactivity. They want to find somebody to trust but not to understand boring technical aspects.

Participation

How can we put these ideas into practice? How can we make sure that in nuclear territories people won't be against nuclear facilities or, at least, that they will listen to the information about reality?

Everybody with some kind of responsibility in the nuclear field should try to find answers to these questions, but the main idea is that the solution is in the co-operation among whoever is concerned directly or indirectly with the nuclear world.

The public's will of participating in the decision making process has increased progressively and this fact has conditioned each national legislation. Most of the industrial countries have been taking this fact into account in their legislation contents. A basic movement has emerged and it aims at allowing the public to a participation in the decisions in relation to the use of this energy (thanks to a system of previous debates or during the authorisation process), following the best possible procedure and through representation mechanisms according to the texts of the Law.

In fact, many western countries have already integrated these principles in their legislation, allowing the public representatives to be informed as well as consulted and in many cases authorised to participate directly in the decision making processes in relation to the development of nuclear issues.

The solutions adopted by some states concerning the public's participation in the successive stages of the decisions – legislative, regulation or administrative – depend directly on their political régime, on their constitution and in particular on the structure and the participation of the powers as well as on the social and psychological context.

Today all the western countries admit that the public should play a role, direct or indirect, in the nuclear policy elaboration or at least in its settings, although a direct participation still constitutes an exception. There are, of course, notable differences in the setting modalities in relation to this participating principle, clearly due to the constitutional, political or social traditions, sometimes old, and also due to the fact that the public sensitivity to nuclear risk differs from a country to another. These differences may also imply different forms and mechanisms, as well as various participation degrees in the definitive decision.

When we ask for participation we are actually asking for co-operation, because local authorities and the citizens on their territories are directly involved in the future of nuclear energy. We are used to hearing a lot of opinions about nuclear energy, above all when someone argues whether to close or not a NNP, as if NNPs were only an idea and didn't affect people, families, jobs, etc. In order to face this we need to take part in all the forums where our future is debated, and we also need efficient systems to guarantee some basic knowledge of the reality in our areas.

The first step towards this should be an agreement among members of international organisms in order to assure the participation in all the countries where nuclear energy exists.

It is very important to introduce the ideas of local democracy into the operation of nuclear facilities, because it is the way to involve the inhabitants of these areas in the future of this kind of industry and to spread the feeling of security among people.

At the same time, we have to create concrete participation systems in order to allow municipalities and social representatives to take part in the decision making process and to receive permanent information about their nuclear installation or about the general debates concerning the future of nuclear energy.

Currently, the most successful experience is the "Local Commissions of Information or Security" created at local level in some countries. With this tool, local authorities and other opinion leaders keep in touch with the actual situation as far as security and radioactive control are concerned and, at the same time, citizens receive information from their most direct representatives. It is an example of creating confidence among people who live in the surrounding of nuclear facilities.

There are other situations where participation takes place. The most common is the possibility to express opinions at certain periods of the authorisation procedures. In these cases the system changes from one country to another, oscillating from a simple publication of the project in the state bulletin to a referendum with general participation.

As a representative of GMF, I would like you to give attention to the fact that not all of the countries in western Europe have the right method to guaranty a real local democracy in nuclear procedures.

Finally, I would like to put together some very short ideas.

- The information has to be trustworthy, permanent, timely and opened to everyone.
- It is necessary to create local information agencies with the participation of all the agents involved, even those whose activity is related to nuclear facilities.
- Decision making process has to forecast the real possibility for the population and their representatives to take part in it and express their opinion in order to have some influence on the final decision.

- Local authorities have to accept the information that they receive and transmit it to the citizens on their own decision or on people's request.
- Local authorities should take part in organisms of participation but also safeguard their citizens' participation.

At last, the international organisms should make a strong effort in order to harmonise the transparency and the participation in all the countries where nuclear facilities exist.

SESSION 3

Experiences in Stakeholder Involvement in Radiological Risk Assessment and Management

Chair: G.J. Dicus

INTRODUCTORY REMARKS

G.J. Dicus

Commissioner, U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

I would like to thank the Nuclear Energy Agency and the Swiss Nuclear Safety Inspectorate for hosting this fabulous workshop. I am really very honoured and pleased to be here.

During the past day and a half we have all heard some excellent presentations that have provided suggestions on ways to improve our risk communications and how to better define our regulatory expectations. It is with those thoughts in mind that we are now looking forward to this afternoon's session: *Experiences in Stakeholder Involvement in Radiological Risk*. As you can see from the list of upcoming speakers, we will be hearing their stakeholder involvement experiences from each of their country's perspectives. Before I introduce the first speaker, let me share with you a few of the NRC's public outreach experiences and my vision for the future of regulatory success in this area.

Overview

As you are all aware, effective regulation relies on co-ordinated and consistent actions facilitated by effective and clear communication to the public and interested persons. The Commission's decision to initiate a more effective process for involving the public in NRC decisions grew out of the Commission's experience with the July 1990, *Below Regulatory Concern (BRC) Policy* (July 3, 1990, 55 FR 27522). The BRC Policy was the Commission's first attempt to establish a framework to guide Commission licensing and regulatory decisions for exempting the use of small quantities of radioactive materials from regulation by the NRC. The BRC Policy attempted to establish an overarching framework to guide Commission action on these exemptions and on other health and safety actions in a number of areas, such as decommissioning, waste disposal, recycling, and the manufacturing of consumer products.

As you also may recall, issuance of the BRC Policy created widespread and intense public concern over the implications of the new Policy. This concern was evidenced not only by the many State laws and local ordinances that were enacted to prevent the Policy from being applied in those jurisdictions, but also in legislation and was introduced on a national level to invalidate the BRC Policy. This legislation was enacted in the U.S. as part of the National Energy Policy Act of 1992. The NRC, in response to this Act, formally revoked the BRC Policy on August 24, 1993 (58 FR 44610).

In response to the concerns that were generated as a result of this proposed Policy, the Commission initiated an evaluation of the feasibility of convening a consensus process to re-evaluate the Policy. This feasibility evaluation involved interviews with over thirty groups nationwide representing the industry, State and local governments, and citizen and environmental groups. The primary finding was that there was widespread dissatisfaction with the process that was used to develop the Policy – even from organisations that supported the Policy! As an example, most groups

felt that they had no control or influence over the Policy, and although public comments were considered, most felt that it was unclear how their comments were considered, if at all, in the formulation of the Policy. Although the Commission did hold public meetings on the Policy, it did so only after the Policy was issued.

Where we are today

Stimulated by the need for a more effective public involvement program than was demonstrated by the unsuccessful BRC process, the NRC has undertaken a number of initiatives for involving the public in generic and site-specific regulatory decision-making. As part of NRC's Strategic Assessment and Rebaselining efforts in 1996, the NRC reviewed and revised the status of its public involvement and communications program. After a review of the agency's mission and goals in this area, forty-three recommendations were identified that addressed five broad categories:

1. Clarity and Timeliness of Communications
2. Public Involvement
3. Responsiveness to Public Inquiry
4. Public Access to NRC Information
5. Public Outreach

Then, in 1997, we embarked on a plan to improve public communication by improving the quality, clarity, and credibility of communications with all NRC stakeholders, and particularly with the general public. In order to make this plan a success, the Commission focused its improvements in the broad areas of more effective written and oral communications with the public, early identification of public concerns, early involvement of the public in NRC regulatory decisions of substantial interest or concern, development of a network of contacts representing the broad spectrum of interests affected by NRC decisions, and more effective outreach to the general public on the roles and responsibilities of the NRC.

One of the best examples of how we now involve our stakeholders early on in a regulatory decision-making process is best illustrated by our "enhanced participatory rulemaking" in establishing radiological criteria for the decontamination and decommissioning of NRC-licensed sites. The objective of this approach is to provide representatives of affected interests with an early opportunity to actively discuss the rulemaking issues with each other and the NRC. This is a more modest objective than that of a "negotiated rulemaking" where the objective is to reach a consensus among the affected interests, including the agency, on how those issues should be addressed. On issues where a consensus-building objective may be intimidating to potential participants, an enhanced participatory process will still allow the agency to convene a dialog among the interests affected by the rulemaking in order to exchange information on viewpoints and concerns, to ensure that all important issues have been identified, and to identify major areas of agreement and disagreement.

A number of observations can be made about the enhanced participatory rulemaking process. First, this type of process was strongly supported by the workshop participants and the public. Participants welcomed the opportunity for early participation in the rulemaking process including the opportunity for participants to exchange information with one another about their views on the subject. Second, workshop participants also believed that the process was valuable in helping them to understand the concerns that formed the basis for other participants' views on the issues. Third, the process brought several significant issues to the attention of the staff that may not have been fully developed or pursued without this early dialogue provided by the workshops. Fourth, it also ensured a

thorough evaluation of the rule-making issues. And finally, but most importantly, there was a noticeable absence of the public “outrage” that had accompanied the BRC Policy, which would ultimately affect the acceptability of the rule.

NRC has also used some innovative public involvement techniques in the decommissioning of individual facilities through the use of “Community Information Roundtables.” In this approach, the NRC brings together local community leaders, including those from local government and citizens groups, the licensee, the State and various Federal agencies together for a series of meetings over the life of the project to discuss issues and concerns related to the decommissioning action. The overall objective is to provide the public with timely information about the NRC regulatory process, to provide the public with the opportunity to personally interact with the NRC staff on regulatory issues, to provide meaningful opportunities for the public to express concerns and any recommendations they have on regulatory options, and how to document these concerns or recommendations that were considered by NRC in its decision-making process. As an added benefit, the NRC, through this process, has developed a network of stakeholder contacts for future public involvement efforts.

Communication activities

As you are aware, the methods of communicating to the public are as important as the content of the message and it is clear that our nuclear regulatory programs are undergoing a significant culture change. Any communication plan should have general principles for effective communications with the public that are simple. Examples are being able to tell citizens what risk licensees pose to them, how safe the facilities are, and how those risks might be judged or evaluated.

NRC’s Program and Regional Offices have continued to define and implement actions to improve communication with, and to make participation more meaningful. Several examples include expanded regulatory response to public concerns regarding a recent issue involving a steam generator tube rupture, annually sponsoring a Regulatory Information Conference, more frequent technical meetings and workshops, and probably most importantly, staff training on public communication, how to effectively to conduct meetings and learning to “manage change.” As a result, the NRC has learned to focus its communication efforts to provide greater oversight and co-ordination of all communication activities. All of these efforts reflect improvements in communication with stakeholders.

Development of communications plans

The Strategic Goals in each arena in NRC’s Strategic Plan include the Performance Goal of *Increasing Public Confidence*. This structure reflects the recognition of the importance of building and maintaining public trust. While the strategies discussed in the Strategic Plan are intended to increase public confidence, a fundamental tool that can be used to achieve this goal is the development and implementation of Communication Plans for important programs supporting each arena. In order to complete these plans, several actions should be completed:

- 1. Development of a program supporting each arena for which individual Communications Plans should be developed.**
- 2. Identification of a person responsible for each Communication Plan.** Our review of the existing communications at the NRC suggested that the responsibility for implementing the methodology should reside with the program offices and regions. By asking these offices to be responsible for individual tasks, the implementation of this plan could then be incorporated into the operating plans and budgets of individual offices as envisioned by the overall Communications Plan goal.

3. **Preparation of Frequent Communication Interfaces**, such as stakeholder groups or organisations which communicate or interface with the NRC in each area of regulatory activity.
4. **Development of Mandatory Training Courses for Managers and Supervisors.** Developing and implementing any Communications Plan and achieving a cultural change in perspective or attitudes concerning the importance of communicating with internal and external stakeholders will be enhanced by improving our communication skills. Some of the types of training that will be required include: communication skills and techniques, communication plan preparation and implementation, managing change, conducting meetings, and plain language initiatives.
5. **Overall Review of Internal Communications.** This review includes data collection both within and outside the NRC to learn what we do well and to identify areas of improvement with regards to communication.
6. **Redesign of Web Site.** In addition to communicating effectively verbally, the web sites of our agencies are one of the best ways to reach a wide spectrum of individuals.
7. **Plain Language Initiatives.** This commitment to improving communications with the public and other agency stakeholders using plain language in documents and at public meetings stemmed from two related initiatives in the U.S. In 1988, President Clinton sent a *Memorandum on Plain Language in the Government* to the Heads of Executive Departments and Agencies. In addition, a follow-up memorandum from Vice President Gore provided clear, concise guidelines with examples for writing plain language documents. As a result, a government-wide Plain Language Action Network was created to improve communications from the Federal government to the public.

Summary

As you can see, the NRC is still in the process of learning, improving, and revising its communication and public outreach programs. These types of programs within regulatory agencies are intended to be fluid and should be expected to be revised as lessons are learned by all in this area. While we all take pride in being technically proficient and well-motivated, we also need to learn to communicate better and more frequently to the public. I believe that improvements to all of these areas are needed to not only advance the Commission's goal (or any regulatory agencies goal), which is to foster better public understanding of, and trust and confidence in, the regulatory program activities, but to also help to educate all of us in understanding the needs of our stakeholders.

Again, thank you for the opportunity to Chair this session and to share some of our U.S. experiences over the past decade with you. At this time, I will be pleased to answer any questions you may have. Thank you.

**A PLURALISTIC EVALUATION EXPERIENCE:
THE NORD-COTENTIN RADIOECOLOGICAL GROUP**

C. Murith

Swiss Federal Office of Public Health

Abstract

This presentation summarises the findings of the approach adopted by the Nord-Cotentin Radioecology Group (GRNC) in order to manage conflicting situations. “A clash of opinions is not a disaster, it's an opportunity”. According to this philosophy, the GRNC developed an evolving methodology which main objective was to realistically assess exposure to ionising radiation among young people (0-24 years) living in the canton of Beaumont-Hague and to deduce from this the associated risk of radiation-induced leukaemia for the period 1978-96. The following table gives an overview of the response of the Group to this public concern, published in 1999 after two years of work. The result of this work can be considered in the current state of knowledge as the best estimate, which must be interpreted in the light of the limitations inherent in the risk assessment process. Nevertheless it appears very improbable that exposure attributable to local nuclear facilities is implicated to any salient degree in the elevated incidence of leukaemia observed in this region among young people.

**Risk of radiation-induced leukaemia attributable to exposure during childhood
for each exposure source**

	Number of cases estimated in the cohort *	%	Risk for 100,000 person-years
Local nuclear facilities			
routine discharges	0.0009 **	0.10%	0.0012
sea pipe break	0.0001	0.02%	0.0002
silo fire	0.0004	0.04%	0.0005
Total	0.0014	0.16%	0.0019
Natural exposure	0.619	74.13%	0.893
Medical exposure	0.203	24.31%	0.293
Exposure due to atmospheric testing and to the accident at Chernobyl	0.012	1.44%	0.017
Total	0.835		1.205

* reconstructed cohort of individuals aged 0-24 years in the canton of Beaumont-Hague, 1978-1996.

** the contribution of *in utero* exposure has been estimated only for routine discharges from local nuclear facilities, and led to 0.0003 case of radiation-induced leukaemia that should be added to this estimation.

Introduction

The publication of the two studies (Viel et al 1995, Pobel and Viel 1997) suggesting an excess number of leukaemia cases by young people (0-24 years old) in the canton of Beaumont-Hague between 1978 and 1992 (4 cases observed compared with 1.4 expected) aroused a heated debate locally and nationally. Accordingly the French government requested to carry out a radio-ecological study (A. Sugier) and to analyse the epidemiological evidence more in depth (Prof. Spira).

The Nord-Cotentin Radioecological Group (GRNC), headed by Annie Sugier, director for protection at the institute for nuclear protection and safety (IPSN) brought together in all more than 50 experts from diverse organisations: inspectors, governmental experts, operators, experts from non-governmental laboratories and foreign experts.

The principal objective was to realistically estimate the local population's exposure to ionising radiation and to deduce the expected risk of associated leukaemia.

Four specialised working groups (WG) were formed, responsible for

1. An inventory of all discharges from nuclear facilities in Nord-Cotentin.
2. A critical review of the environmental radioactivity measurements.
3. An estimate of the environmental radionuclide activities obtained by comparing the forecasts of transfer models with environmental measurements.
4. A "best estimate" of the doses received by the local population and the risk of radiation-induced leukaemia.

The report of the group was finalised in July 1999 after 2 years of work. All the results of the GRNC can be consulted at www.ipsn.fr/nord-cotentin

Sources of exposure and radioactive releases

Four nuclear facilities are located in Nord-Cotentin. The Navy Yard at Cherbourg (since 1958), the nuclear fuel reprocessing plant run by COGEMA at La Hague (since 1966), the shallow land disposal repository facility, run by ANDRA at La Hague (since 1969) and the EDF nuclear power plant at Flamanville (since 1985). Other sources of exposure (natural, medical, fallout from atmospheric nuclear testing and from the accident at Chernobyl) were also considered, but with a lesser degree of precision.

In its retrospective approach, the Group started from the figures for radionuclide releases (liquid and gaseous) supplied by the operators. These were verified and missing radionuclides that had not been individually identified in the operator's measurements over the whole period were added. For COGEMA releases a total number of 39 out of 75 radionuclides considered (52%) were added. These additions did not modify the order of magnitude of the results supplied by the operator, but did help in defining the composition of discharges in more detail to gain a more exhaustive information about the composition of effluents which is necessary for a detailed dosimetric reconstruction. Two main incidents were also identified and studied to assess their impact on total doses:

- In 1979/80, a break in COGEMA's sea release pipe had a measurable impact on the radioactivity levels of many marine species in the immediate area around the break. The measurements taken at the time were used to reconstruct the dosimetric consequences of the incidence upon the cohort.

- In January 1981, a fire in a storage silo at the La Hague reprocessing plant led to discharges into the atmosphere, which impact was clearly shown in grass and milk measurements (e.g. ^{137}Cs and ^{90}Sr) They were used to make the necessary adjustments to the transfer model in the dosimetric reconstruction.

Environmental measurements and models

Next the Group performed an exhaustive inventory of the radioactivity sampling and environmental measurements that had been carried out by all the laboratories involved. No work on this scale had ever been done in the region. All the assessment factors being taken into account, results in general are consistent, and a consensus was reached between participants about the analysis of the radioactivity levels supplied. This inventory includes about 500 000 items of data up to 1996. It represents a very useful tool to satisfy social demands about distribution and variation of artificial radioactivity in the Nord-Cotentin and in indicating the lack of measurements of some radionuclides in the environment. Despite the great numbers of data, measurements were not available for each radionuclide, each year and each environmental compartment. That led the group to use transfer models to fully reconstruct the contamination of the environment.

The Group selected the environmental radionuclide transfer models and parameters that were best suited to local characteristics; whenever possible, the results of the transfer models were compared with environmental measurements in the data inventory. Correction factors were introduced to make the transfer models fit the data better. The Group used these two complementary methodologies through validating transfer models by comparing their results with measurements in the environment. Models validated in this way were used to evaluate contamination levels at all points in the environment, whereas the number of measurements is necessarily limited and expected values are frequently below the adopted measurement detection limits.

Population and red bone marrow doses

The reconstructed cohort comprised 6 656 individuals (17% of whom arrived in the canton in 1984), who were assumed to have lived in the canton for at least 1 year between 1978 and 1996, for a total of 69 308 person-years. The Group identified and studied exposure situations exploring geographic areas and dietary habits for which population groups are likely to be the most significantly exposed. The dose coefficients used to calculate the red bone marrow doses from individual exposures come from the international literature. The dosimetric calculations were then performed for each exposure pathway, each age group and each year.

The cohort's total collective red bone marrow dose attributable to routine discharges from the nuclear sites between 1966 and 1996 was 0.3 man.Sv (average per person of $3 \mu\text{Sv year}^{-1}$). The predominant exposure pathways for this dose were ingestion of seafood (42%, due principally to ^{90}Sr , ^{106}Ru , ^{137}Cs , ^{60}Co and ^{14}C) and external exposure to beach sand (22%, due principally to ^{60}Co , ^{106}Ru , ^{95}Zr and ^{154}Eu). The cumulated individual dose to red bone marrow varies between $4 \mu\text{Sv}$ for the generation born in 1996 and $77 \mu\text{Sv}$ for the one born in 1971.

Leukaemia risk and particular exposure scenarios

The risk estimate considers the same population as that found to have an elevated incidence of leukaemia in the epidemiological studies. The risk model assumes a no-threshold dose-risk relation, with a 2-year latency period between exposure and the expression of risk. The number of cases in the

cohort was obtained by the sum of the individual risks weighted by the number of young people in each of the 43 birth cohorts. The total number of cases of radiation-induced leukaemia in the cohort for the period 1978-96, from all sources of exposure to ionising radiation during childhood, was 0.835. Natural and medical exposures contributed massively to the collective risk (74% and 24%). Discharges from nuclear facilities in Nord-Cotentin contributed less than 0.2% of the collective risk (routine discharges 0.0009 cases and incidents 0.0005 cases). This risk thus appears to be more than 400 times smaller than the risk attributable to natural exposure estimated with the same approach.

The risk assessment for the reconstructed cohort is based upon a mean estimate of relevant lifestyle factors. The Group thus sought to estimate the increased risk for an individual whose values for specific behaviours were above the mean by multiplying the associated exposure by five. The risk estimates associated with particular exposure scenarios showed that intensive recreational beach use, either during gestation or throughout childhood, did not notably increase the individual risk from all exposure sources together calculated for mean habits (0.1% respectively 3%). An intensive consumption of local seafood would increase the risk by 73%, but essentially due to exposure to natural radiation (^{210}Po and ^{210}Pb). These particular behaviours were associated with the risk of leukaemia among young people in the 1997 case-control study. Attention was also given by the Group to 20 occasional scenarios in estimating the corresponding effective dose.

Discussion and perspectives

The result of the Group's work can be considered as the best estimate, in the current state of knowledge, of the risk of radiation-induced leukaemia attributable to environmental exposure to ionising radiation in the canton Beaumont-Hague. It seems very improbable that exposure attributable to local nuclear facilities is implicated to any salient degree in the elevated incidence of leukaemia observed in this region among young people. Nevertheless some of the Group investigations were limited by the insufficiency of existing data [content of impurities in spent fuel, lack of exploitable measurements of some radionuclides in the releases and in the environment, weaknesses concerning modelling of near field dispersion of liquid and gaseous releases and of sea spray, limitations for historical reconstruction of lifestyle factors over the study period, applicability of the risk model (UNSCEAR 1994)]. The principal disagreement concerned the ability to reach a conclusion in the absence of an uncertainty analysis. In its conclusion the group has emphasised the points of agreement between the experts as well as the reservations expressed by some members of group. With these reservations explicitly stated, all experts except those from CRII-RAD approved the work of the Group. Therefore one of the Group's recommendations was a supplementary analysis; this should allow a quantification of the uncertainty and the identification of the parameters for which a better estimate could improve the risk assessment. This analysis is currently under way.

Apart from the scientific value of this study, contact was maintained throughout with the local population, both via the "Commission Locale d'Information" in which various components of the population participated and especially with the collective "Mères en colère". This association concluded in a press release: "Concerning information, this study has shown that information is now accessible to general public, and that it can be considered as being credible since it is produced by a group of experts from different background. This multi-disciplinary nature is an essential objectivity criterion for progress with work on health safety, and secondly it is a decisive communication act and will remain a positive consequence of Professeur Viel's study published in February 1997". To reinforce the direct exchange between the local population and the scientists, the association "Mères en colère" also has taken the initiative to organise a large scale international measurements campaign in October 2000, which originality was that residents of the Cherbourg area have volunteered to provide accommodation in their homes for national team members participating in the measurements.

Also an overview of this technical and sociological experience is presented. Let Saint Exupery conclude, “To know is not to show, nor to explain. It is to reach the vision. But to see it is initially advisable to take part. That is a hard training”.

The work of the Nord-Cotentin radioecological Group was thus a dual experiment, scientific and human, in a setting in which the restoration of confidence required that any possible disagreements within the working Group not be masked. Thus, although the results indicate that nuclear facilities have contributed little to radiological risk and would not lead to any observable increase in health effects, the group clearly pointed out some uncertainty in the various steps of its study. Also exposures from medical practices and natural sources of radiation, which appeared of significance are concerned. One of the main concern in the future remains to engaged the appropriated strategy to fill mentioned lacks and weaknesses responsible for the major uncertainties, which seem to represent the main sources of disagreement.

Figure 1. **Approach to the assessment of the risk of radiation-induced leukaemia chosen by the Nord-Cotentin Radioecology Group (C. Rommens *et al.*)**

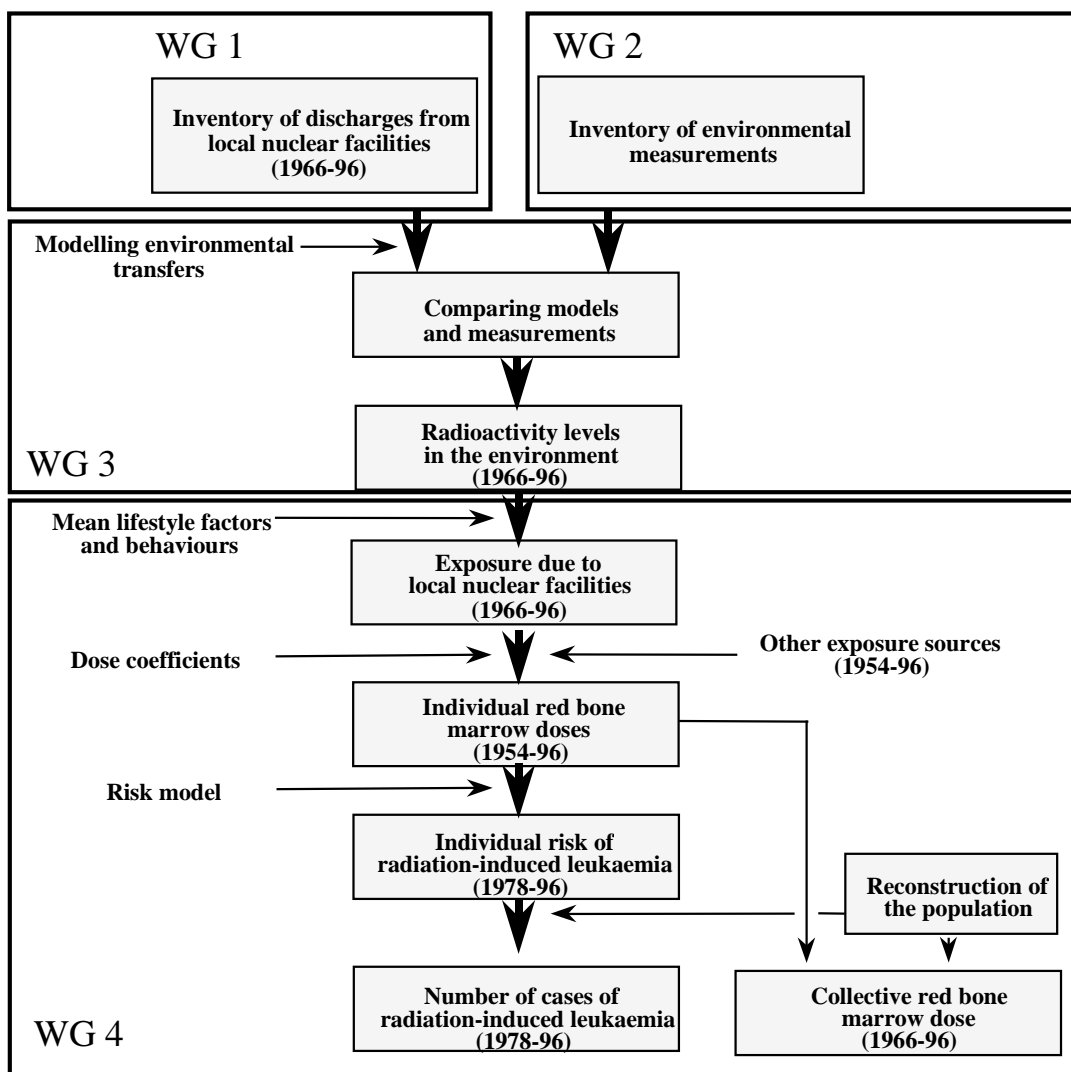


Figure 2. Radionuclides and incidents considered (C. Rommens *et al.*)

³ H	⁶⁵ Zn	⁹⁴ Nb	¹²⁶ Sn	¹⁵¹ Sm	²³⁶ Pu	²⁴⁴ Cm
¹⁰ Be	⁷⁵ Se	¹⁰³ RuRh	^{125m} Te	¹⁵² Eu	²³⁸ Pu	²⁴⁵ Cm
¹⁴ C	⁷⁹ Se	¹⁰⁶ RuRh	^{127m} Te	¹⁵⁴ Eu	²³⁹⁺²⁴⁰ Pu	²⁴⁶ Cm
³⁶ Cl	⁸⁵ Kr	¹⁰⁷ Pd	¹²⁷ Te	¹⁵⁵ Eu	²⁴¹ Pu	
⁴¹ Ca	⁸⁷ Rb	^{110m} Ag	¹²⁹ I	²⁰³ Hg	²⁴² Pu	
⁵⁴ Mn	⁸⁹ Sr	^{113m} Cd	¹³¹ I	²³² U	²⁴¹ Am	
⁵⁵ Fe	⁹⁰ SrY	¹²⁴ Sb	¹³³ I	²³³ U	²⁴² Am	
⁵⁷ Co	⁹¹ Y	¹²⁵ Sb	¹³⁴ Cs	²³⁴ U	^{242m} Am	
⁵⁸ Co	⁹³ Mo	¹²⁶ Sb	¹³⁵ Cs	²³⁵ U	²⁴³ Am	
⁶⁰ Co	⁹⁹ Tc	^{121m} Sn	¹³⁷ CsBa	²³⁶ U	²⁴² Cm	
⁵⁹ Ni	⁹³ Zr	¹²¹ Sn	¹⁴⁴ CePr	²³⁸ U	²⁴³ Cm	
⁶³ Ni	⁹⁵ ZrNb	¹²⁶ Sn	¹⁴⁷ Pm	²³⁷ Np	²⁴⁴ Cm	



	Fire in a storage silo, 1981	
Break in the sea release pipe, 1979/80		

Figure 3. Summary of effective doses associated with particular scenarios

	Particular scenario description		Associated dose in μ Sv
Adult living in the canton	1985 average scenario	/year	18
	1996 average scenario	/year	5
Chronic scenarios	Fishermen in the Huquets area in 1985	/year	226
	Farmers in the Pont-Durand district 1996	/year	59
	Adult living in the 1500 m zone in 1996	/year	24
Critical groups	Fishermen in the Goury hamlet 1986	/year	41
	Inhabitants of Digulleville 1996	/year	8
Occasional scenarios	Fishing close to the pipe	/occurrence	20
	Walking close the pipe	/occurrence	7.5
	Fishing at the bottom of the concrete block and posts	/occurrence	2.75
	Walking in the Moulinets Bay	/occurrence	< 1
	Diving near the pipe	/occurrence	2.5
	Eating a crab (250g) caught in the near field in 1985	/occurrence	313 (7-12 year old)
	Using Sainte-Hélène water in 1979	/occurrence	10
	Using Sainte-Hélène water in 1986	/occurrence	3
	Fishing in Sainte-Hélène in 1979	/occurrence	0.015
	Fishing in Sainte-Hélène in 1986	/occurrence	2
Playing at the mouth of the Sainte-Hélène in 1987	/occurrence	10	
Playing at the mouth of the Sainte-Hélène in 1991	/occurrence	0.5	
Walking close to the Centre Manche	/occurrence	0.5	

Figure 4. **International measurement campaign Nord-Cotentin 2000**



References:

Summary Report of the Nord-Cotentin Radioecology Group, July 2000.

C. Rommens *et al.* “Methodology and results of the Nord-Cotentin radioecological study”, J. Radiol. Prot. 20 (2000) 361-380.

STAKEHOLDER INVOLVEMENT IN REMEDIATION PROGRAMMES IN A URANIUM MINING AREA: CHANGES OF RADIOLOGICAL CONCERNS IN THE SOCIETAL CONTEXT

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Abstract

In 1990 after the political change in East Germany the public concerns on the radiological legacy of 45 years of uranium mining and milling in a densely populated area led to the launching of a huge remediation programme covering approximately 13 billion DM. Half of the remediation programme has been completed. Since the implementation of this programme the dominating attitude of the affected public has totally changed, from concerns for a great danger to health and mistrust of all planned activities to acceptance of the remediation programme and indifference about the radiological hazards.

The success in getting adequate public acceptance in decision-making for remediation actions could be accounted for as more dependent on the societal, i.e. the scientific-technical, political and social-economic context of the radiological problems to be solved, and less due to whether stakeholders are completely and formally involved in the decision process.

- ***The scientific-technical context:*** Within the radiation protection system the missing national and international guidance on intervention and on protection against enhanced natural radiation provides a certain flexibility in decision-making but may negatively affect the credibility of expert judgements and increase uncertainties. Therefore it was important that appropriate parts of the former East German radiation protection legislation were kept in force and flexibility interpreted with regard to the remediation of an area contaminated by natural radionuclides.
- ***The political context:*** After the political change in East Germany suddenly a totalitarian and closed political system that did not provide any information on the radiological and other impacts of uranium mining and milling turned into an open and democratic society delivering full and open information. As part of the following unification process the German Government took over the full ownership of the Wismut company from the Soviet Union and thus the responsibility for the remediation. Furthermore, the funding of the rehabilitation programme was secured within the federal budget.

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1. Wismut GmbH Chemnitz.
 2. Bundesamt fuer Strahlenschutz, Institut fuer Angewandten Strahlenschutz Berlin.
 3. Sächsisches Staatsministerium für Umwelt und Landwirtschaft Dresden.
 4. Thüringer Ministerium für Landwirtschaft, Naturschutz und Umwelt Erfurt.

- ***The social-economic context:*** Together with the political changes a tremendous economic and social restructuring took place in East Germany. The majority of industrial workplaces could not be saved because most of the industry was not competitive on the free market. The result was a high unemployment rate and an urgent need to attract investors. The remediation activities secured a lot of workplaces, and the public was interested in having the territory not stigmatised as radioactively contaminated.

Immediately after the political change in 1990 in East Germany complete information was provided to the public about the radiological impacts in the uranium mining area. Samples, including foodstuff which people had collected, were measured and interpreted on site. Countless discussions and information meetings were organised, and a lot of information centres have been operated in the region from the beginning. This was seen as a first step of stakeholder involvement, and particular emphasis was put on the continuous provision of information to the media in their role as essential stakeholders.

The affected public was involved in the decision processes by Wismut and the authorities in the Federal States on a voluntary and not on a legal basis. There are no general rules for stakeholder involvement at all except that the attempts should be adapted to the local conditions and that total openness, willingness to discuss all tabled problems and to show to the affected population that their concerns and proposals are taken serious are of utmost importance. Meanwhile more experiences have been gained and the procedures have been further developed. In this paper recent examples of stakeholder involvement in remediation decisions are presented. In general it was observed that the affected public is more and more interested in the development of the remediated sites for specific uses, i.e. in the post-remediation period. Therefore other authorities and local representatives in addition to those originally approached are involved in the decision making process. A formal environmental impact assessment was not applied but its most important part, the environmental impact study, has been carried out.

After 10 years of remediation of an area seriously affected by former uranium mining and milling a satisfactory acceptance of the public has been achieved. The main reasons for the success seem to be rather the scientific-technical, the political and, above all, the social-economic context in which the remediation programme is carried out. This societal context is historically unique. The authors therefore cannot present any general recipes how to involve stakeholders in the decision-making process.

1. Introduction

In 1990 after the political change in East Germany the public concerns on the radiological legacy of 45 years of uranium mining and milling in a densely populated area led to the launching of a huge remediation programme at a cost of approximately 13 billion DM. Half of the remediation programme has been completed. Since the implementation of this programme the dominating attitude of the affected public has totally changed, from concerns for a great danger to health and mistrust of all planned activities to acceptance of the remediation programme and indifference about the radiological hazards. In this paper it is attempted to explain the success of getting acceptance for the programme and to discuss some of the reasons for the change in the public risk perception.

2. Difficulties in defining the public and the stakeholders

It is very difficult to identify a public attitude to radiation risk and proposed protection measures. In a society there is always a large variety of risk awareness and concerns about radiation hazards. On the one hand one can find people who deny any risk of ionising radiation, for example indicating that there were no effects visible in their families or among their acquaintances despite relatively high exposures, and on the other hand there are people who are seriously concerned about the lowest activity concentrations in the environment even if the related radiation exposure is extremely low or, from a technical point of view, negligible. Between these two extremes all imaginable positions can be found, and it is uncertain whether at least the majority of people in a society has a preconceived idea at all or whether their opinions reflect a sound technical-scientific conception. The impression that a particular position is dominating is largely influenced by the echo in the media, and vice versa the media play an important role in influencing the public opinion.

Moreover, there are many members of the public who principally mistrust the experts and all authorities, there are others who blindly rely on the advice of experts and decisions by the authorities, and there is another part of the public, hopefully not a minority, with a sound scepticism in official announcements but able and willing to adapt their attitude and to accept decisions if fully and openly informed and involved in the decision process. This part of the public is aware of the fact that we are living in a society based on the division of labour and that not everybody can be an expert in everything.

The geographic distribution of these “opinion spectra” may be variable in a country or a region, and it may also depend on the particular exposure situation how the radiation risk is perceived, e.g. many people distinguish between exposures to artificial and natural radiation even if these exposures in terms of the dose equivalent and thus the risks are identical. These differences are well illustrated by two German contributions to this Workshop: this paper and experiences presented by Dr. Huthmacher in the Panel. The remediation programme discussed in this paper is carried out in a former uranium mining area of approximately 10 000 km² where 1-2 million people are living. Only some 10 000 people are directly affected by uranium mining and milling residues. Some of these residues are located at the periphery of large cities like Dresden, Chemnitz, Gera or Zwickau. However, their inhabitants are affected only to a small extent by the residues.

Yet more difficult than the identification of a public attitude to radiation hazards is the definition of the so-called stakeholders whose involvement in decision-making processes is seen as the most important precondition to achieve public acceptance for the decisions to be taken. Stakeholders may be people directly affected by the decisions, their elected representatives, decision makers like

local, regional, state or federal authorities, professional bodies or experts, owners of sites, enterprises carrying out and institutions funding the remediation, any interested person or pressure groups of people even if not directly affected by the decisions, etc. At any rate, in view of their influence on the public opinion the media have to be regarded as stakeholders!

Furthermore since involvement in decision making cannot be restricted to defending a pre-selected option against raising objections the stakeholders should be involved in the preparatory stages of the decision making when options are still available.

In the following it will be tried to show, with the phenomenon outlined in the Introduction taken as an example, that there is no simple and even no general answer to how and to which extent the public and its stakeholders should be involved in the decision process. The success in getting adequate public acceptance in decision making for remediation actions could be accounted for as more dependent on the societal, i.e. the scientific-technical, political and social-economic context of the radiological problems to be solved, and less due to whether stakeholders are completely and formally involved in the decision process.

3. The societal context

The scientific-technical context

During the last 20 years we are facing an increasing uncertainty in our approaches to radiological protection [1]. The 1977 system of dose limitation as laid down in ICRP 26 provided a solid basis for radiation protection for practices. In addition to the practices, there are also intervention situations including abandoned contaminated areas from previous activities in which radiation protection was either totally or incompletely observed, such as former radium factories, waste rock piles and tailings from uranium mining and processing, contamination around nuclear weapon production sites etc. A further problem is natural radiation exposure increased by human activities. This includes in part real intervention situations, such as radon exposure in dwellings or abandoned contaminated areas of mining and processing of uranium and other ores, and in part practices with occupational and public exposures to increased natural radiation such as underground workplaces, water works, radon spas and numerous branches of industry, such as the processing of mineral sands, the phosphate industry or the oil and natural gas industry.

In the most recent basic ICRP recommendations in Publication 60 the system of dose limitation was extended to a system of radiation protection containing approaches for solutions to these hitherto neglected problems in radiation protection. However, it has become clear that inconsistencies from the point of view of a strict risk evaluation, which are difficult or impossible to resolve, make the implementation difficult. For example, it is scientifically undisputed that limits for practices and reference levels for intervention situations should differ. The ICRP has recently recommended generic intervention levels for prolonged exposure in the range of 10-100 mSv per year [2], taking into account among other facts the acceptable radon exposure in dwellings. These values should be applied to the existing total exposure and are therefore not source-related, but they will probably meet problems of acceptance. Indeed, at an IAEA conference in Arlington/USA in December 1999 [3] it became evident that the clean-up of abandoned contaminated areas is usually based on a dose criterion of 1 mSv per year. It seems that the public and the decision makers are unwilling or unable to deviate from the current limit for practices.

It appears that a comprehensive implementation of the radiation protection system set out in ICRP 60 has little prospect. The paradoxical situation has therefore arisen that a world-wide discussion of the starting point of a new radiation protection system has begun in parallel to the implementation of the most recent ICRP recommendations. The ICRP Chairman R. Clarke set the ball rolling with his proposal of a “controllable dose” [4]. However, reasonable radiation protection is by no means excluded under the current system! One should only pragmatically try to solve the most urgent problems first without insisting on developing a complicated radiation protection system that is logical down to the last and that covers every problem. With increasing experience, new approaches may converge.

The flexibility thus provided for the solution of complicated radiation protection problems is an advantage which may promote attempts to get public acceptance. On the other hand, the apparent inconsistencies in the present radiation protection system, which can especially be demonstrated with an undifferentiated comparison of criteria for remediation measures with protection measures in normal practices, hampers the credibility of expert judgements in the eyes of a significant part of the public and increases uncertainties.

Therefore it was important that appropriate parts of the former East German radiation protection legislation were kept in force. By means of recommendations of the German Radiological Protection Commission this legislation was flexibly applicable to the remediation of an area contaminated by natural radionuclides, and radiological criteria for the clean-up of the sites of former uranium mining and milling in East Germany could be established [5] that have been accepted by the vast majority of the affected public. The ultimate decision for a particular remediation action is laid down in the radiation protection licence for each individual remediation project.

In addition a comprehensive mining and water legislation provides a certain continuity. Most remediation projects in fact need licences not only under the radiation protection but also under the mining and water resource legislation.

The political context

The uranium production of the former Soviet, later Soviet-German Wismut Company amounted to approximately 232 000 t during 1946-1989. With this output East Germany ranged third world-wide behind the USA and Canada. Uranium mining and milling began under post war conditions in the Soviet-occupied zone, with the aim to produce as fast as possibly the uranium needed for the Soviet nuclear weapon programme. This resulted in large scale devastation at many different sites in a densely populated area. However, the population in large parts of these areas has been familiar with mining and milling of conventional ores since centuries and is proud of a long miners tradition.

Wismut worked all the time under military conditions of total secrecy and did not inform the public on its activities at all. The devastation of the area, the destruction of essential infrastructures up to total ruining of towns and damage to the landscape, access control to significant areas etc, led to growing displeasure in the public. With the time increasing anxieties arose about the radiation hazards connected with the residues of the Wismut activities. Again, all questions raised by the public were not answered. In addition, there was no control of the Wismut company by the national regulatory authorities, even while the company was obliged to meet the radiation protection regulations since the 70s [6].

After the political change in East Germany suddenly a totalitarian and closed political system turned into an open and democratic society providing full and open information, and this process was speeded up after the reunification of the two German states. A vast majority of the public enthusiastically welcomed this development.

After the reunification the German federal government was faced in the Wismut area with one of its largest ecological and economic challenges. 1990 Wismut turned at once from the production to the decommissioning phase without any preparation or preplanning. There were big concerns within the local population on possible radiation detriments because no information on radioactive contamination and resulting exposures had been passed to the public in the old political system. The new freedom was used to build-up environmental groups getting good response in the public, and the new democratic media expressed the public concerns. These concerns were significantly enhanced by some media, mostly outside the region, that were characterising the situation as a second Chernobyl or even worse. "Valleys of death" were announced. Altogether there was an urgent need for large scale remediation.

In 1991 Wismut GmbH was founded as the legal successor of the former bi-national SDAG Wismut. The German Government took over the full responsibility for Wismut GmbH and the remediation. Furthermore, the funding of the rehabilitation programme was secured within the federal budget, a very important pre-condition for any successful remediation. The duration of this rehabilitation project was estimated at 15 years and the costs at DM 13 billions. The intent is to restore the areas to an acceptable environmental level with an appropriate balance between ecological, economical and social values [7].

Radiological protection is an essential incentive and significant part of this programme, particularly from a political point of view, but other targets such as reduction of chemical pollutants (arsenic, heavy metals, hydrocarbons etc.), prevention of waste rock pile damages and mine subsidence, restoration of the damaged towns and villages and landscape and last but not least the preservation of some economic infrastructures in a time of radical social and economic changes were equally important.

The social and economic context

Together with the political changes mentioned above a tremendous economic and social restructuring took place in East Germany. The majority of industrial workplaces could not be saved because most of the industry was not competitive on the free market. The result was a high unemployment rate. Wismut GmbH however was made responsible for the huge decommissioning job which substantially contributed to social stabilisation within the region. The experienced Wismut staff was urgently needed for a successful remediation. Moreover, a lot of workplaces could be saved in the region due to contracts which Wismut GmbH let to industrial and commercial enterprises in the region.

At the same time new medium-sized and competitive industries had to be built up in East Germany, and there was an urgent need to attract investors. The public became soon aware of the fact that a stigmatisation of the area as radioactively contaminated deterred potential investors, and this contributed to a change in the public attitude to the radiation hazards. Any exaggeration of the radiological risks visibly resulted in a negative economic impact. In addition, the long mining tradition in some areas of this region led to a denying of any radiation risks in a small part of the public. The main argument is that there were no radiation effects at all visible in the family and among

the neighbours despite high exposures at home or at workplaces. This attitude is certainly linked with economic concerns and is strange in view of the fact that in this area the “Schneeberg lung disease”, i.e. radiation induced lung cancer of miners, had been detected for the first time.

Understandably, Wismut was initially faced with the mistrust in large parts of the public because it was identified with its past activities as a environmental polluter without any obligation to inform the public. The extent of the area affected by past mining and ore processing activities amounts to approximately 35 km², of which 1 500 hectares are covered by waste rock piles and 700 hectares by tailings ponds. The remediation objects are spread around two federal states and may be grouped into underground workings, mine shafts, exploratory shafts, waste rock piles, an open pit mine, building structures of mining and processing facilities to be decommissioned and demolished, areas contaminated by spread radioactive material, as well as tailings ponds and other residues from uranium processing or leaching [8,9,10]. The extent of the remediation task makes Wismut one of the largest rehabilitation projects in the world. The following numbers may give an impression of the total remediation task: close-up of 1 440 km mine workings, filling-up 1.4 Mio m³ shafts and tunnels, backfilling of an open pit with 127 Mio m³ (!), relocation of 146 Mio m³ mine dumps, contouring of mine dumps by 4.8 Mio m³, demolition of 735 000 m³ plants and structures, covering of tailings ponds by 7.6 Mio m³ material, site reclamation of 1 530 ha. Approximately 6.8 billion DM, i.e. half of the projected remediation costs, have been spent until the end of the year 2000. The progress is easily visible in the affected territories and is being acknowledged by the population in the area. The positive economical consequences clearly contributed to the change in the public opinion from mistrust to interest and acceptance.

The Wismut rehabilitation project covers only those sites which were in 1990 still under responsibility of the Wismut Company. However, in the early 60s numerous facilities and their sites were transferred from Wismut after decommissioning to communities, enterprises and other regional bodies or citizens for further use or for safekeeping. These residues were only identified, investigated and evaluated but not included in the remediation programme [11]. It is interesting to note that recent requests to include these sites into the Wismut remediation program seem to be triggered more by economic incentives than by radiological concerns.

4. Stakeholder involvement

4.1. *The general approach*

Immediately after the political change in 1990 in East Germany complete information was provided to the public about the radiological impacts in the uranium mining area. Samples including foodstuff which people had collected were measured and interpreted on site. The active participation of opposed persons and pressure groups in the on-going monitoring and evaluation work was encouraged. Countless discussions and information meetings were organised. Wismut as well as the Federal Office for Radiation Protection and the Authorities of the Federal States have been operating information centres in the region from the beginning. This was seen as a first step of stakeholder involvement, and particular emphasis was put on the continuous provision of information to the media in their role as essential stakeholders. Even special workshops on remediation concepts were organised for the media. As a result the local media, although asking critical questions, nearly unanimously support the decisions taken.

On the 1st Villigen Workshop it was shown how the affected public, i.e. usually local authorities or responsible people of the affected communities, were involved in the decision processes by Wismut and the authorities in the Federal States on a voluntary and not on a legal basis [12]. As a summary one may state that the public attitude towards Wismut remediation and the acceptance of the

remediation decisions by representatives of the local population highly depends on the local situation or the “microsocial” conditions and varies widely. There are no general rules for stakeholder involvement at all except that the attempts should be adapted to these local conditions and that total openness, willingness to discuss all tabled problems and to show to the affected population that their concerns and proposals are taken serious are of utmost importance. In this way a culture of involvement of the public in decision-making had been voluntarily developed by all authorities and Wismut.

In the German legislation a formal environmental impact assessment (“Planfeststellungs-Verfahren”) is required for projects with large impacts on the environment. The aim of this is to involve the general public and not only the directly affected persons in the decision for introducing a new practice. Attempts to establish expressively such a formal procedure for the Wismut clean-up activities instead of the voluntary efforts as discussed in this paper were rejected because all regional and local stakeholder became convinced that such a formal environmental assessment impact would result in a delay or even an obstruction of the decision making. Furthermore, fast decision making which was needed to keep the program running may have become nearly impossible. However, the most important part of the formal environmental impact assessment, i.e. the environmental impact study (“Umwelt-verträglichkeits-Prüfung”), was de facto applied as part of the preparatory work for decisions on remediation options and for the evaluation of radiological impacts for workers and the population during execution of such options.

In the following experiences in two federal states regarding complex remediation projects and the related stakeholder involvement will be discussed in detail.

4.2. *Acceptance differences with remediation projects in Saxony (Schlema and Oberrothenbach)*

Schlema

The town of Schlema located within the Schneeberg-Aue region was very well known for its radon spa which operated until the end of WW II. The central part of the town including the spa was destroyed or devastated by the rigorous mining activities which started immediately after WWII and lasted until 1990/91. Approximately 80 000 tonnes of uranium were produced during this period. Mining started at the town centre close to surface and extended to the East to a depth of more than 1 800 m. About one third of the town area was covered with mine dumps, and the central part of Oberschlema, where a multitude of individual veins of the deposit were mined almost up to the surface without keeping safety pillars, experienced subsidence up to 10 m.

Due to limitations in space for relocating mine dump material outside the town the concept suggested by Wismut for the remediation of the mine dumps is to largely keep the contaminated material in place. The dumps are contoured to provide geomechanical stabilisation and to blend into the slightly mountainous landscape. The contoured dumps are covered by 1 m of soil and then vegetated. The main subsidence area in the centre of the town was stabilised by locating the close to surface mine voids and filling them with concrete. The area since has been turned into an attractive park and a new spa has been built. Remediation at the Hammerberg mine dump which covers the northern slope of the Schlema valley is almost complete.

As a result of intensive efforts in stakeholder involvement at various levels the remediation activities which cause considerable disturbances for the population of the town by truck traffic, noise and dust have been widely accepted. Little concerns regarding radiation hazards related to mine dump

material which has not been covered yet or radon emanations from underground have been reported. On the contrary many people are interested and proud about the progress of the remediation work. The general attitude is very pragmatic and in cases of potential conflict constructive. People take walks on week ends over the mine dumps and are keen to explain to visitors what is going on in their town. Though mining almost destroyed the town mining traditions are strongly cultured and attract tourism. People are mainly interested in a non-contamination image of their town and region and are confident that the remediation measures taken exclude any immediate hazards and long-term risks. Schlema meanwhile has become a model site for a successful revitalization which is based on sustainable remediation options and a strong consensus with the public. This could be demonstrated in the course of World EXPO 2000 when the site became an external project and received wide international attention.

Oberrothenbach

The village of Oberrothenbach close to the city of Zwickau is located within a small valley the upper part of which is occupied by a very large tailings disposal facility. The tailings pond has been created by putting a 60 m high dam across the valley. The small village of Helmsdorf located up valley was evacuated and liquidated. The Helmsdorf tailings pond is part of the Crossen mill site located in the Mulde valley on the outskirts of Zwickau and covers an area of more than 200 ha and contains more than 50 million cubic metres of slimes and initially more than 10 million cubic meters of highly contaminated process water.

The remediation concept for the tailings disposal facility is to stabilise the tailings in place, contour the facility including the dams to allow surface water runoff without erosion, to cover it and vegetate it. First a water treatment plant had to be built to treat surface and seepage water in order to enable discharge. After removal of the surface waters an intermediate cover is constructed covering the exposed tailings and functioning as a working platform for the following contouring work. To complete the necessary stabilisation, contouring and final covering and vegetating will take as long as 20 to 25 years. All of the residues of the Crossen plant area as contaminated scrap iron, rubble and contaminated soils from remediation of the mill site are disposed of within the Helmsdorf facility.

The efforts in stakeholder involvement at Oberrothenbach by Wismut and the licensing authorities were and still are quite extensive. From the beginning full information on the radiological risks and the remediation concepts and options was provided and explained in public meetings. Landscape models with different post-remediation use options were developed and built and placed on public display for interested citizens to stimulate public comment and response. By resolutions of the community of Oberrothenbach suggestions and preferences were expressed which Wismut tried very hard to accommodate for as long as this was possible within reasonable technical and financial limits. The Saxonian Ministry of the Environment informally was in continuous contact with the local authorities and Wismut to achieve acceptance for individual remediation measures. Frequent meetings with inhabitants were held to react on any request for information including the consequences of the remedial actions, e.g. necessary measures for noise abatement and radiological risk reduction in connection with the construction of a pipe conveyor for transport of waste materials from the Crossen site in the Mulde valley up to the Helmsdorf site.

Despite this very active stakeholder involvement at all stages of the large Crossen/Helmsdorf remediation project the level of acceptance is much lower than at Schlema. People at Oberrothenbach keep a very critical and questioning attitude. Even subtle details are raised and there is always suspicion that information is provided incompletely, not only by the operator Wismut but also by the authorities.

The possible reasons for the difference in attitude of the public towards remediation at Schlema and Oberrothenbach are likely related to the fact that there is immediate benefit through remediation activities visible to the people of Schlema. The central town area has been restored close to its original use as a heath resort including the beautiful spa garden. The relocation of one major mine dump gave opportunity to develop a new attractive residential area for the town. Other areas where formerly uranium ore processing took place were restored and a shopping centre with ample parking sites was erected. Furthermore the living mining tradition at Schlema make people possibly more tolerant towards impacts typically related to remediation activities. On the other hand people at Oberrothenbach have to live with the fact that the upper part of their valley will be permanently occupied by the tailings and even the reshaping of the main dam will not change this. Due to the duration of remediation they have not yet recognised the potential benefits for using the remediated tailings ponds area while in the short and medium term they have to bear with impacts of remediation activities without any benefits immediately arising for them. Furthermore mining has no tradition in Oberrothenbach.

4.3 *Large scale remediation projects in the Wismut region Eastern Thuringia.*

The Wismut Region Eastern Thuringia covers an area of more than 200 km² and includes 16 towns and communities. The northern part is characterized by the Ronneburg mining field and the southern part comprises the large milling site at Seelingstädt and the tailings ponds of Culmitzsch and Trünzig. Stakeholder involvement in the remediation program for this area is taking place both by participation in the activities initiated by a “Planning Staff for the Integrated Site Development of the Wismut Region” and regarding specific sites by actions initiated by Wismut.

Planning Staff for the Integrated Site Development of the Wismut Region

After the first years of remediation the authorities in the State Thuringia came to the conclusion that involvement of the affected public according to the legal requirements such as in the mining legislation and based on the voluntarily initiated information activities was insufficient as regards content and organisation. Taking into account the enormous financial expenditures planned for the remediation it was deemed possible to gain benefit not only for the environment but also for the economic and social situation in the region. However, this would make sense only if the region as a whole would be considered instead of single sites as in a licensing procedure. That is why a “Planning Staff for the Integrated Site Development of the Wismut Region”, was founded in 1994 as a special body. Initially it was composed of representatives of the State authorities, of the affected administrative districts and communities, of expert institutions and of Wismut GmbH and met 6-8 times per year. The Planning Staff suggested to design a regional development concept combining the remediation activities with the regional economic development objectives and proposed a catalogue of concrete measures.

Some of these measures have been already successfully completed, others are being implemented. Meanwhile the Planning Staff has become a body where questions and problems concerning the economical, infrastructural and social situation of the region are discussed even if the projects are not or only indirectly connected with the Wismut remediation programme. In close and permanent co-operation with Wismut, shaping and structuring of the sites to be remediated can be chosen such that the future utilisation is possible as planned. Also aspects such as the preservation of relics as historical monuments are taken into consideration.

The activities of the Planning Staff are particularly important when large areas extending over the territory of different communities or administrative units are involved as will be demonstrated with the following specific Wismut projects.

Regional Green Belt

One example is the establishment of a regional green belt within the area affected by uranium mining and ore processing. Though the lands used for mining make up only about 10% of the total area the influence of mining on land use and development within the region was much larger. Mining has changed previous functional interrelations within the region. Villages, large wooded areas and cultural assets have fallen victim to the mining and mining related infrastructure. The objective of the concept of a regional greenbelt was to upgrade the whole region and to lay the base for a revitalisation of the region. The green belt concept was developed in close co-operation between Wismut and its conceptual planning for remediation and the local and regional planning authorities. Major targets of the concept are to increase forested areas, to secure soil protection for agricultural use, to achieve a regional biotope network and to improve the recreational potential in the vicinity of the population centres in the region. The concept was explained and discussed in many public meetings and conferences and has meanwhile achieved the quality of a publicly accepted guideline document for the structural and ecological renewal of the region. It also functions as a kind of master plan which provides guidance for decision making on individual sites.

Beerwalde Mine Dump

Uranium mining in the Ronneburg district resulted in about 200 million m³ of mine waste. These materials were placed during production next to the mines using different technologies. In their present state these materials cause radiological risks and strong environmental impacts, mainly on ground and surface waters which is enhanced by their potential to generate acid mine drainage. The remedial options are either onsite or offsite remediation. South of the motor highway the offsite option has been selected since the relocation of the waste materials can be optimally combined with the filling of the Lichtenberg open pit. North of the motor highway the optimal solution arrived at by multi-attribute analysis is to combine the three mine dumps of Beerwalde, Drosen and Korbuszen into one complex at Beerwalde with a base increased from 24 ha to 34 ha and a total volume of about 9 million m³.

Major topics of discussions with the community of Beerwalde which is largely agricultural, included the reasons for favouring the in situ option, the duration needed to transport the Drosen material to the Beerwalde site since this meant to build a haulage way for heavy transport equipment which would cut off several agricultural roads, and the final shape of the dump complex. A particular matter of concern was the final height of the pile and whether it would be visible from the village. It is noteworthy that questions like post-remediation use of the pile and long-term surveillance and maintenance were of lower interest for the community at the planning and decision making stage. Most effort by Wismut went into developing an interactive 3D-visualisation tool by which the final “product” could be demonstrated at public meetings. The general attitude of the community immediately concerned with the waste pile project near Beerwalde can be characterised as defensive to tolerant. A more positive and forward approach only developed later on when the final shape of the new pile became visible. Now members of the community have started to identify themselves with the new landmark and are interested in how to use it in future.

Central Remediation Zone Ronneburg South

This zone comprises an area of about 1 000 ha and extends over the territory of the town of Ronneburg and several other communities and administrative units. It is characterised by the large open pit Lichtenberg, the major mine sites of Schmirchau, Reust and Paitzdorf and the mine dumps which surround the open pit and those with the characteristic pyramide shape at Reust and Paitzdorf. The remediation concept proposed by Wismut for this central zone foresees the relocation of all waste rock into the open pit and thus concentrate the total contaminant inventory in one location, to demolish all contaminated structures and place the resulting contaminated materials also in the pit and to decontaminate all plant sites by removing the contaminated soils and exchanging it with uncontaminated fill. Furthermore the central zone occupies most of the underground mines which presently are flooded. Once the flooding level approaches the surface overflow of contaminated mine waters will occur at topographic low lying locations, i.e. in valleys. Therefore seepage collection systems will be installed.

Stakeholder involvement at the early conceptual stage of this major remediation project was rather limited and concentrated on questions of monitoring the emissions and impacts of this large scale remediation action. With progress in filling the open pit and removing mine waste at a rate of 10 million m³ per year the post-remediation landscape started to evolve. In 1999 Wismut prepared a guidance document and plan proposing the future shape and structure and post-remediation use of the central zone. Meanwhile the area became part of the EXPO 2000 project “Revitalisation of Reclaimed Mineland in East Thuringia”. Furthermore the 2007 national horticultural exhibition went to the towns of Gera and Ronneburg and will take place within the Gessen valley which is part of the central zone and will be affected by the necessary installation of mine water seepage collection and monitoring systems. These events and the progress in remediation recently stimulated public interest concerning many aspects of post mining respectively post remediation land use and structuring. One of the lively discussed issues was whether pyramid shaped mine dumps at Reust and Paitzdorf should be kept in place since they are visible from far away and are deemed to represent valuable land marks which would make the area more attractive. All of the licensing authorities and Wismut however could not justify to preserve these in their present state as land marks or historical monuments. By contouring and covering these piles which would have reduced their emissions into the groundwater and atmosphere their significant shape would have been lost.

4.4 *Conclusions from successful stakeholder involvement*

As a general finding of the presented examples of stakeholder involvement one may state that the affected public gets more and more interested in how the remediated sites can be used after completion of remediation. Very often relevant concerns are overriding the radiological and other environmental aspects. Therefore other authorities and local representatives in addition to those originally approached are involved in the decision making process, e.g. authorities responsible for the territorial development of industry, agriculture, forestry, tourism and culture as well as people and their representatives and professional bodies interested in and dealing with these problems.

5. Summary

After 10 years of remediation of an area seriously affected by former uranium mining and milling a satisfactory public acceptance has been achieved. The initial mistrust and refusal of any proposed measures has totally changed. The full and open information, the inclusion of the affected public in the decision making on particular remediation measures adapted to the changing local conditions, and last but not least the consideration of the growing interest in the site utilisation after

the remediation has essentially contributed to this success. However, the main reasons for the success seem to be rather the scientific-technical, the political and, above all, the social-economic context in which the remediation programme is carried out. This societal context is historically unique. Despite the overall success of stakeholder involvement and the achieved public acceptance the authors cannot present any general recipes how best to involve stakeholders in the decision-making process.

References

NEA/OECD, A Critical Review of the System of Radiation Protection, Report of the CRPPH, May 2000.

ICRP Publication 82, Protection of the Public in Situations of Prolonged Radiation Exposure, Annals of the ICRP, Vol.29, Nos.1-2, 1999.

IAEA International Symposium on Restoration of Environments with Radioactive Residues, 29 November – 3 December 1999, Arlington, Virginia, USA.

Clarke, R. Control of low level radiation exposure: time for a change?, Radiol. Prot. Vol.19, No.2, p.107-115,1999.

Kraus, W. *et al.*, Criteria for the restoration of mining residues in Germany, IAEA International Symposium on Restoration of Environments with Radioactive Residues, 29 November - 3 December 1999, Arlington, Virginia, USA. SM 359/2.2.

Mager, D.; Kraus, W. An overview of the uranium mine and mill remediation activities in Germany, Kerntechnik Vol.60, p.5-6, 1995.

Hagen, M. Significance of the large-size ecological WISMUT project and its implications for economic and regional development (in German), International Conference on Mine Rehabilitation, 11-14 July 2000, Schlema, Germany.

Hagen, M.; Jakubick, A.T. The Wismut Experience in Management of Large Scale Remediation Projects, Sixth International Conference on Radioactive Waste Management and Environmental Restoration (ICEM), Singapore, October 12-16, 1997.

Gatzweiler, R.; Meyer, J. Environmentally compatible decommissioning and remediation of uranium mines-case history WISMUT (in German), International Conference on Mine Rehabilitation, 11-14 July 2000, Schlema, Germany.

Daenecke, R. Rehabilitation of tailings management facilities at WISMUT-current state and outlook, International Conference on Mine Rehabilitation (in German), 11-14 July 2000, Schlema, Germany.

Kraus, W.; Ettenhuber, E.; Kümmel, M.; Przyborowski, S. Basic problems in evaluation of radiation exposures from mining residues, Sixth International Conference on Radioactive Waste Management and Environmental Restoration (ICEM), Singapore, October 12-16, 1997.

Kraus, W.; Staube, J.; Ettenhuber, E. The decision-making process in dealing with populations living in areas contaminated by the uranium mining residues in Eastern Germany, OECD/NEA Workshop on the Societal Aspects of Decision-Making in Complex Radiological Situations, 13-15 January 1998, Villigen, Switzerland.

EXPERIENCE WITH CITIZENS PANELS

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Consensus Conference on Radioactive Waste

In May 1999, 200 delegates attended a four-day UK Consensus Conference on radioactive waste management, which was organised by the UK Centre for Economic and Environmental Development (UK CEED) and supported by the government, industry and environmental groups. The event brought together a Citizens' Panel of fifteen people, randomly selected to represent a cross section of the British public, together with the major players in the debate. The four-day conference saw the panel cross-examine expert witnesses from organisations such as NIREX, British Nuclear Fuels Limited, the Ministry of Defence, Greenpeace and Friends of the Earth. The findings of their investigations were put together in a report containing detailed recommendations for government and industry and presented to the Minister on the final day.

What is a Consensus Conference?

A consensus conference is a sophisticated form of public participation, pioneered in Denmark, which aims to influence the policy making process by opening up a dialogue between the public, experts and politicians. It involves a citizens' panel, selected from members of the public, being fully briefed on the subject of the conference and then taking full control of the subsequent debate, including the choice of questions and selection of the expert witnesses for the conference. At the four-day conference the panel cross-examines the witnesses in public session, assesses the responses, discusses the issues raised and then retires to write its report. The report presents the views of the panel on the key policy issues and the ways in which citizens' concerns may be addressed by the policy makers. It is presented to the minister and other key players in the debate on the final day and is the subject of a press conference.

The strength of the process is the way in which it contributes the views of *informed* citizens to the policy-making process. It provides an insight into the way in which the issues are framed and prioritised by the public and in particular identifies key public concerns and methods by which they might be examined and resolved. It can also stimulate wider and better-informed public debate on the issue.

Consensus conferences are especially suited to dealing with controversial issues of public concern at a national level which are often perceived as being too complex or expert dominated. Past consensus conferences have tended to focus on issues of science and technology, but this approach is equally well suited to other issues, including environmental issues, which require careful consideration by informed members of the public. The only previous national Consensus Conference to have been held in the UK was in November 1994 on the topic of plant biotechnology.

The main features of the consensus conference on radioactive waste (“radwaste CC”) were as follows:

Ensuring independence

The initial task was to recruit an advisory committee of between eight to ten members. The committee was chosen to be balanced and objective, following clear and transparent procedures. It was appointed after consultation with several organisations including Friends of the Earth, the Natural Environment Research Council and Nirex. The Committee met five times during the year of the project.

The committee oversaw the whole process, ensuring the independence and integrity of the proceedings and safeguarding the credibility of the conference. Key tasks of the committee included defining the broad scope of the debate, selecting the method for recruiting the citizens’ panel and drawing up a list of witnesses for the citizens’ panel to call upon. For the radwaste CC, a shadow committee was also established, made up of the key interest groups not involved in the main committee but who were consulted on processes and outputs.

Selecting the witnesses

A comprehensive list of “experts” or “witnesses” was drawn up from which the citizens’ panel selected those they wished to give ‘evidence’ at the actual conference. This list was based on the knowledge and expertise of the advisory committee and on recommendations from other interest groups. The witnesses included scientific and technical experts as well as people from wider perspectives, such as social and ethical fields.

Recruiting the citizens’ panel

Since the citizens’ panel is central to the consensus conference process, fair and independent recruitment is essential. For the radwaste CC a panel of 15 people was selected to reflect a variety of socio-demographic criteria, such as gender, age, education, occupation and geographical location. Panel members were chosen on the basis of not having had any significant prior involvement with the conference topic – they took part in their capacity as citizens, not as professionals or specialists. The CC panel was too small to be a statistically representative sample of the population, but was nevertheless chosen to represent a genuine cross-section of the general public, reflecting as wide a range of views as possible.

The panel was chosen through random selection techniques undertaken by an independent market research company.

Citizens’ panel preparation

In order to be able to fulfil their role as informed citizens, the panel was given time to prepare before the actual conference. The panel members received a comprehensive information pack and attended two preparatory weekends. Throughout the whole process, it was crucial to ensure that the citizens’ panel was seen to be free of all pressures and influences that might jeopardise the independent and balanced nature of the debate.

The introductory material, commissioned by the advisory committee, outlined the essential aspects of the subject under consideration. The committee sought to ensure that the information was presented in a balanced and neutral way, since this was the first in-depth encounter with the subject for the panel members.

The two preparatory weekends took place in the two months before the actual conference. Over the course of these weekends, the panel had the opportunity to get to know each other, learn to work together and received an overview of the various technical and ethical issues concerned. The panel then identified the key questions to be addressed at the conference and selected the witnesses it wished to hear from.

Facilitating the process

Throughout the preparatory weekends and during the conference, an independent facilitator was present to support the panel through the process. The facilitator was responsible for monitoring group dynamics, ensuring all panel members had their fair say, and assisting in the writing of the final report. The facilitator had no influence on the deliberations of the panel or the content of the report.

The Consensus Conference

The consensus conference itself was the forum at which the citizens' panel was able to put its chosen questions to the selected witnesses, discuss the topic in-depth and produce a final statement on its conclusions. These conclusions, along with the witnesses' presentations, were incorporated into the final report which formed the key document for policy makers

Why Radioactive Waste?

The idea of holding a national radwaste CC in the UK originally came from UK CEED, an independent not-for-profit foundation. UK CEED was concerned that, following the rejection of the rock characterisation facility (RCF) at a public enquiry in 1998, the government was left without a legitimate policy on this vital issue. Furthermore, one of the most important lessons learnt from the public enquiry process was the extent to which the government had failed to engage in public consultation as part of the policy making process. The radwaste CC aimed to address these key challenges by:

- contributing the views of informed citizens to the policy-making process for radioactive waste management;
- gaining an appreciation of the way in which the issues are framed and prioritised by the public;
- identifying key issues of concern as seen by the public and to recommend a process by which they might be examined and resolved;
- expanding the availability of reliable and high quality information to the public;
- stimulating wider and better informed public debate on the issue.

The radwaste CC was not:

- a replacement for the normal democratic decision-making processes – it was intended to enhance the existing structures;
- about making detailed technical judgements on the treatment of radioactive waste or the merits of alternative repository sites;
- intended to give a view that is representative of the whole UK population;
- a public relations exercise on behalf of the nuclear industry or the anti-nuclear groups.

UK CEED was responsible for securing funding for the radwaste CC, the majority of which came from public sources – through a Public Understanding Grant from the Office of Science and Technology and from the Natural Environment Research Council. The remainder of the funding was provided by NIREX, the company responsible for implementing national policy on disposal of intermediate level radioactive waste in the UK.

Observations

It was generally acknowledged that the radwaste CC was an extremely successful project. Key observations from the project include:

- The Panel worked extremely hard and took its work very seriously.
- The Panel took control of the process from early on and retained full independence of action.
- The choice of witnesses proved controversial.
- The report was written and published to a very tight time-scale.
- The report was widely praised.
- The conference was “plugged in” to the official decision-making processes and the report has proved influential in industry and government circles.
- The panel has been kept in touch with developments and has been reconvened on one occasion.

STAKEHOLDER PRE-INVOLVEMENT IN THE POST ACCIDENT MANAGEMENT OF RURAL AREAS : A GOVERNMENT PERSPECTIVE

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Abstract

In 1995 NRPB published an assessment of the applicability of a range of agricultural countermeasures for use in the UK. The study recommended that, for the purposes of contingency planning, a working group should be set up to bring together key groups that would be involved in intervention in rural areas following a nuclear accident. This idea was taken forward by Government and in 1997 the Agriculture and Food Countermeasures Working Group was established. Participation is at a senior level by those involved in making policy decisions. The original membership has been expanded, and of the 22 representatives, 11 are currently from non-Government Organisations. The Group has met on five occasions and has successfully addressed all of its four terms of reference. From 2001 it will form the UK node of a European network of similar stakeholder groups being set up in Finland, France, Belgium and Greece.

1. Introduction

A project (Nisbet, 1995) was undertaken by NRPB on behalf of the Ministry of Agriculture, Fisheries and Food (MAFF) to evaluate the applicability of all available agricultural countermeasures for use in the UK. This study was the first to consider applicability on the basis of more than radioecological effectiveness and technical feasibility. Criteria for practicability were developed which also included the capacity, cost, impact and acceptability of implementing the countermeasure. The collection of expert opinion from a wide range of organisations formed an essential part of this evaluation. However, the consultations highlighted a divergence of opinion between experts on many of the criteria discussed. As a consequence it was impossible to propose a coherent strategy for the UK should rural areas become contaminated with radionuclides following a nuclear accident. A recommendation was made to MAFF that for the purpose of pre-accident planning, a working group comprising all the relevant stakeholders should be set up to develop strategies for the post-accident management of rural areas. This idea was taken forward in 1996 at a more senior level within the Ministry where there was overwhelming support for the setting up of the new group.

2. How the Group was set up

Representatives from MAFF and NRPB drafted terms of reference for the new group and compiled a list of the key stakeholder organisations that would be invited to participate. Chairmanship was to be provided by MAFF,¹ and the technical secretariat by NRPB and MAFF.³⁶

3 Terms of Reference

The draft Terms Of Reference (TOR) were discussed and clarified at the first meeting and minor amendments were made. The current TORs are:

- To establish lines of communication between those organisations who, in the event of a nuclear accident, would be involved in decisions on the need for intervention in agricultural systems in the medium to long term, and in their implementation.
- To provide a forum for the dissemination of relevant information on agricultural countermeasures.
- To debate and judge the practicability of various countermeasure options, as part of pre-accident planning, and to distil the implications for government and the agriculture and food industries; and to identify where further work is required.
- To provide the core of a working group that, in the event of an accident affecting agriculture in the UK, could be convened to provide an input to decisions on countermeasure strategy.

4 Membership

Selection of members was based on the following four criteria:

- Adequate representation of the interests and concerns of each stakeholder type.
- Reasonable balance between Government Organisations (GO) and Non-Government Organisations (NGO).

1. Since April 2000 responsibility for food safety has transferred from MAFF to the Food Standards Agency (FSA). Consequently, Chairmanship and part of the technical secretariat now come from FSA.

- Participation from individuals with responsibility for input to policy type decisions and with a broad knowledge of the issues.
- Willingness to participate.

A list of the organisations currently represented on the Group and the role of each participant in their organisation is given in Table 1. The composition of the Group continues to evolve, and of the 22 representatives, 11 are currently from non-Government Organisations. Participation is at senior level and members attend meetings at their organisation's expense. The initial high level of enthusiasm and commitment shown by members has been maintained throughout.

5. Meetings

The Group has convened five times since its inception in 1997. A wide range of issues relating to the post accident management of rural areas has been discussed, including disposal options for contaminated milk and crops. Where appropriate, scenarios have been used to focus discussion. The interval between meetings is about 10 months. This provides members with sufficient time for any matters arising to be adequately discussed at all levels within their respective organisations, before being reported back to the Group. It also enables significant progress to be made on relevant research topics between meetings.

6 Achievements

The Group has successfully addressed each of its four Terms of Reference. Firstly, it has established communication links between those organisations that had not hitherto collectively considered the implications of contamination of the food-chain. This provides an opportunity for each participant to gain an understanding of the constraints under which other organisations would be operating in the event of a nuclear accident. From 2001, communication links are being further extended into Europe through the development of a network of similar stakeholder groups in Finland, France, Belgium and Greece (The FARMING² Network).

Secondly, members of the Group are kept up to date on remediation issues through the distribution by the technical secretariat of recent, relevant published scientific papers, published scientific reports and unpublished state-of-the-art progress reports. This information is then available for wider dissemination within each stakeholder organisation, where appropriate. Future publicity on remediation strategies will be promoted through the FARMING web site, which will be set-up later this year.

Thirdly, the Group has successfully debated the practicability of a wide range of remediation options and, despite a diversity of opinion, a consensus view has generally been reached on many issues. As a result, findings from the group have been taken forward by both Government and Industry. Government has, for example, been prepared to consider the legislative implications of options such as disposal of contaminated milk to sea or to land. The water industry has also made a valuable contribution by identifying a number of long sea out-falls potentially suitable for the disposal of large volumes of contaminated milk. In addition, the Group has successfully identified gaps in the current knowledge base which are being addressed either through the work of active sub-groups or by the commissioning of funded research.

2. FARMING (Food and Agriculture Restoration Management Involving Networked Groups) is a European Commission 5th Framework Programme thematic network, co-ordinated by AF Nisbet.

The Group continues to accrue a good working knowledge of remediation issues and has been successful in promoting mutual trust and respect between its Members. Consequently, there has been enthusiasm for the setting up of various sub-groups to take forward specific issues and to develop policy where appropriate. For example, a sub-group has been established to develop an emergency monitoring programme for individual farms in, or close to affected areas, to determine whether milk is above or below a given intervention level. This will make use of an existing sampling programme for micro-biological contaminants. In the event of an accident, the implementation of such a programme could have a significant effect on the amount of milk that would be designated as waste. Another sub-group has recently been convened to establish a national plan for the management of milk considered unfit for human consumption (Baldwyn, this issue). It is the intention that in the event of a future nuclear accident this plan can be implemented without delay. In this way, the UK Group acts not only as a forum for discussion but also as a platform for taking forward plans for dealing with contaminated foods. As many of the options being developed are applicable to non-nuclear contaminants the impact of the UK Group is potentially far reaching. From a Government perspective, the new links that have been established with all the major stakeholders will promote the level of authoritative advice it can give to Ministers and the credibility of information communicated to members of the public.

7 Conclusions

The setting-up of the UK Working Group on Agriculture and Food Countermeasures provides a good example of how research findings can be translated into practice. Stakeholder involvement in determining practicable options for the post accident management of rural areas has enabled complex issues to be resolved and accountable policies and plans to be developed under stable conditions. Stimulating discussion, informed debate, and measurable progress has maintained the interest of the membership. The Group has attracted widespread interest/support, as many of the strategies discussed are applicable to non-nuclear contaminants.

References

Nisbet, A.F. (1995) Evaluation of the applicability of agricultural countermeasures for use in the UK. NRPB-M551, Chilton.

Table 1. Membership

Membership	Organisation	Role
Government Central	Food Standards Agency (3) National Radiological Protection Board Meat and Livestock Commission	Head Radiological Safety Department, Head Emergencies Branch Head of Assessments Division Technical director
Local	Local authority	Chief Environment, Engineering and Transportation Officer
Territorial	Ministry of Agriculture, Fisheries & Food Scottish Executive for Rural Affairs Dept National Assembly for Wales Agriculture Dept Department for Agriculture in Northern Ireland Environment Agency Scottish Environment Protection Agency	Regional Director: Lead on Emergencies Emergency liaison officer Environmental Science Adviser Head of Food Science Division Leader Radioactive Substances Regulation Head of policy co-ordination - Radioactive Substances
Non Government	Water Industry Milk Transporters Dairy Industry Federation Food and Drink Federation British Retail Consortium National Farmers Union National Federation of Consumer Groups Greenpeace Centre for Ecology and Hydrology Royal Agricultural College	Chairman Water UK Emergency Planning Group General Manager Quality Assurance (National Supplies Manager) Technical Director Chair of Scientific and Regulatory Affairs Secretariat. Also Executive in Regulatory and Consumer Affairs Environmental Policy Adviser (Policy Director) (Chairman) Senior Scientist Head of Radioecology section Professor of Agricultural Systems

Text in parentheses represent retiring members of the Group

**STAKEHOLDER PRE-INVOLVEMENT IN THE POST ACCIDENT MANAGEMENT
OF RURAL AREAS: A USERS PERSPECTIVE**

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Abstract

Disasters can be identified in advance whether they be generic or site specific. The Agriculture and Food Countermeasures Group identified the consequences of a nuclear disaster and sought to identify viable options for the disposal of contaminated milk. However, a viable option does not take the working of the group to a satisfactory conclusion. The end product is the National Emergency Plan to deal with the disposal and, therefore, come the day, the Plan can be activated without question or delay.

Introduction

Disasters, crises and emergencies can be identified in advance as either an asset or site specific event or a generic event. Radiation emergencies clearly fall into both categories as the event will almost certainly start at a site, but will be generic in its impact because, depending on the weather, the area affected cannot be assessed until the event has happened. It is all very well going this far, but it requires a drive and a vision to do something about the potential emergency in order to ensure a managed and positive response to the real event.

Agriculture and Food Countermeasures Group

In the UK, the Agriculture and Food Countermeasures Group brings together representatives of Central Government Departments and Agencies, Local Authorities, the water and agriculture industries, the food retail trade, milk transporters and agriculture specialists. Through its work, the Group has been able to develop a better understanding of the overall impact of a radiation emergency on agriculture and, in particular, cows whose continual production of milk makes the disposal of contaminated milk an urgent and potentially huge problem. While the work of the Group has concentrated on a radiation emergency, any disposal route can apply to all milk unfit for human consumption.

In its deliberations the Group has identified three possible disposal routes:

1. The use of long sea outfalls from sewage treatment works.
2. The use of land spreading.
3. Aerobic and Anaerobic digestion.

Of the possibilities, options 1 and 2 have been proved viable while a report into option 3 is due at the end of January 2001. Until this report is produced, it is not possible to consider prioritising the disposal routes.

It is at this point that the true worth of the Group can be identified, because to the delight of an Emergency Planner, they saw that the work does not stop with the proven viability but must be developed into a full plan involving all the relevant organisations from the public and private sectors. It should be noted that much criticism would come from the media and other interested parties if, following an event, it was disclosed that such viable options had been identified but nothing done about it. The Group, therefore, can be identified clearly to one with a vision and a drive to produce the full planning response to an identified emergency which allows all the legal aspects to be covered and, therefore, come the day the plan can be activated without question. It is also clear that any disposal of waste to the environment is sensitive and, therefore, must be authorised by the national Government who take the responsibility.

The national plan

In the UK, licensed nuclear sites are required to have emergency plans in place, but these do not generally deal with the practicalities of handling large quantities of waste foods such as milk. The Agriculture and Foods Countermeasures Group is currently developing an outline system to handle this type of problem. This system is referred to in the remainder of this paper as the National Plan. The National Plan in principle must be generic because, until the event, the area affected and hence the amount of milk to be disposed of cannot be assessed. However this does not stop the detailed planning

taking place at the disposal sites and the transport plan because the final plan must reflect the practicalities of the operational disposal once the decision route has been both decided and authorised. This plan, therefore, will be directed at two levels:

Part 1: The National Incident Team (Generic).

Part 2: Use of Long Sea Outfalls (Specific)

Part 3: Other Viable Options (Specific).

Part 1: National incident team

The National Incident Team would be convened once the emergency has been declared. It would consist of five core members from:

Food Standards Agency (Chair)

- Ministry of Agriculture, Fisheries and Food
- Environment Agency
- National Radiological Protection Board
- National Farmers Union

They would be supported by:

- The Water Industry
- Milk Marque (the transporters of milk)

The roles and responsibilities of this team are:

- Identify the area affected.
- Liaise with the Off Site Control Centre (set up to locally manage a nuclear incident).
- Interpret RIMNET and any other information. (RIMNET is a system of gathering and communicating radiological information).
- Obtain local intelligence on the scale of the problem.
- Liaise with lead Government Department.
- Obtain direction and authorisation for disposal.
- Decide method of disposal.

This will result in the implementation of the specific plans for disposal.

Part 2: Use of long sea outfalls

Confirmation of Long Sea Outfall

While the viability report identified the location of the long sea outfalls, it is now necessary for them to be evaluated so that in any given case the best practicable environmental option can be selected. In this way a consent to discharge waste milk to sea could be fully justified on technical and other grounds. Predictive modelling will be carried out by the Environment Agency with the appropriate water company to confirm the suitability for use which will result in a definitive list of sites for detailed planning purposes.

Transportation of Milk to Pipelines

Milk Marque operates two types of milk distribution tanker, the smaller type with a capacity of up to 13 000 litres will carry contaminated milk from the farm before transferring to the larger 25 000 litre non-food grade vehicles, available in any part of the country, for movement to the discharge point. The use of such vehicles would be on the proviso that neither the milk nor any derivatives were destined for human consumption. The logistics of all tanker requirements and movements form a key part of the detailed transportation plan.

Operation of the Long Sea Outfall

The final part of the plan is the management of the disposal site. While in simple terms it requires: the identification of a rendez-vous point; a route to the disposal point; method of disposal including any resources needed; and an exit route, there is a need to ensure that the logistics of gaining site entry in potentially remote areas not readily accessible by large goods vehicles is also considered.

Part 3: Other viable options

The development of a practical plan must, therefore, cover a wide range of factors. These include legal aspects such as obtaining consents to discharge from particular sea outfalls or to a given area of land, and the logistics of collecting and transporting large volumes of waste milk to a disposal point. Consequently, many of the organisations represented on the AFCG will be important stakeholders in the development and implementation of the National Plan. Therefore, as other viable options are identified and approved, the methodology for their use will also be developed into a plan which will form further parts to the whole plan. Thus, all the options will be planned in detail and contained in the one national document.

Conclusions

The identification of the options for the disposal of milk unfit for human consumption and the development of a National Plan for implementing the disposal has only been possible through the team working of the multi-stakeholders Agriculture and Food Countermeasures Group. It has been successful because sound communication links were in place and there was stakeholder “buy in” and drive to deal with the whole scenario.

I commend the working of this Group to all nations.

BNFL EXPERIENCE OF PUBLIC ENGAGEMENT: EXPECTATIONS FOR RISK POLICIES

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Abstract

BNFL operates a range of nuclear facilities covering fuel fabrication, power plants, reprocessing operations and decommissioning activities. The paper explores the company's experiences in public communication and stakeholder involvement relating to nuclear and radiation issues. These range from the early establishment of Local Liaison Committees linked to each of the sites, through the introduction of public visitor centres at sites, the extensive involvement in formal consultation exercises, to the more recent involvement of a wide range of stakeholders in a process of dialogue to aid the decision making of the company on environmental affairs. In these activities there are some common themes which the company and the wider nuclear industry believes should be consistently brought to the attention of stakeholders and decision makers in order to support a balanced consideration of these issues. How, and indeed whether (and to what extent) these aspects are then factored into the overall decision process is subject to a changing dynamic within the developing expectations of society for a more transparent involvement in technological issues.

Introduction

It is important in today's climate to set radiological and nuclear technical issues in a broader social, political and environmental context. Understanding the technical issues remains vitally important for progress in the nuclear industry, but we can no longer assume that we are the only experts on issues relating to things nuclear. Neither can we discount the opinions and research of groups outside the industry. Non-governmental organisations, NGOs, can have a strong influence on shaping opinion on technical issues. On an even broader level, public opinion – or at least *perceived* public opinion – can have tremendous effects on a project.

Monsanto found this out to their discomfort. The controversy over genetically modified food has familiar echoes to many of us in the nuclear industry, and there is a common issue – the failure of industry to understand and respond to the depth of feeling within the public at large to the implementation of a technical programme which was not of their making and from which they perceive little benefit. Obviously there are lessons to be drawn from this situation in communicating our plans and its benefits. However we must also look deeper than this for lessons on how we form our plans and create informed decision making.

In previous decades, decisions would have been made solely by the industry, government and regulators, largely on a technical basis. This approach has been caricatured as “Decide, Announce and Defend”. Opinions on nuclear issues always seem to be strongly held and therefore issues surrounding the industry always create heated discussion – some of this based on facts, some on social factors and sometimes on emotion. All are able to influence decision making. Sometimes this extends to the decision to cancel a project – in these cases perhaps we have moved to “Decide, Announce, Defend, Abandon”.

Excluding some stakeholders from the decision making process can make things *seem* more straightforward and allow the “hard” issues to be addressed (and this is an old mis-perception by the nuclear industry). Including the full range of stakeholders in the process can have unpredictable and sometimes surprising results, which may not always be convenient or to our liking.

Stakeholders

So if dialogue, involvement and consensus are the way forward, who are the stakeholders who should be involved in this process? And can there be “one process”, or are there many interweaving strands of “involvement”? Experience has shown that it is necessary to engage in a wide range of parallel exercises, each aimed at a different focus. However, in pursuing these strands it is important to ensure consistency of direction and information, and a common high standard of integrity.

BNFL has over many years sought to be more open in our dealings with the public. This was borne out of necessity. A number of high profile incidents in the early 1980s, including the 1983 Sellafield beach closure, created a climate in which BNFL was regarded as “secretive, dishonest and not to be trusted”. The Company's “open door policy” was the result. We invited members of the general public to visit BNFL sites, in particular Sellafield. This was backed by a massive advertising campaign. The concept was that even though many members of the UK general public would not visit Sellafield, the mere fact that they had been invited and were able to visit conveyed a positive impression to the public that BNFL had nothing to hide. The programme has nonetheless been very successful in attracting the public to Sellafield. To date, some 2 million people have visited the site since the Sellafield visitors centre was opened in 1988.

As part of its everyday business, BNFL has a wide range of internal and external stakeholders who have an interest in our operations and activities. This is naturally part of the “global village” in which all industries have to operate. We have Local Liaison Committees covering all of our sites, enabling our local communities to have first hand contact on issues of mutual interest such as employment considerations, emergency planning, safety and environmental issues, with the opportunity to find out more about our operations. These committees bring together political representatives of the local community, the local authorities (including health, police and emergency services) and the regulatory bodies. Committee proceedings take place in public.

BNFL also participates in consultation exercises arising from the UK regulatory processes and in public debates arising from the normal “business as usual” relationship we have with those who are opposed to our activities.

The BNFL Stakeholder Dialogue

In 1998 BNFL decided to embark on a process of Stakeholder Dialogue, designed to help inform BNFL’s environmental decision making. It was decided that owing to the particularly sensitive nature of our business we needed to take external advice. We sought the advice of an independent facilitation charity called The Environment Council. As a result of their intervention, it was decided, after some internal soul-searching, to set up a meeting between BNFL and a wide range of stakeholders. The Environment Council believes that by bringing the right people together and ensuring the integrity of the process, the resulting decisions or solutions will be more creative and sustainable and will thus contribute towards an improved environment for all. The process is based upon a set of Ground Rules which are developed and agreed by all participants, and which include the maintenance of confidentiality until all parties agree that information should be released into the public domain under the auspices of the Environment Council.

This was a massive step for the company. We were going to sit down in a room full of people, many of whom had been trying to close down the company for many years. The fear was that we were giving away control of our own destiny. It was also a massive step for many of the stakeholders; they were going to be seen to sup with the devil! The first meeting was held in September 1998. This meeting was the first time in the UK nuclear industry that such a diverse group came together in a room to discuss the very issues that had kept them apart for so long. The stakeholder groups included:

- BNFL
- Unions that represent BNFL employees
- NGOs (international, national and local), primarily covering ‘green’ and disarmament issues
- Local Councillors and local authority officers
- Regulators and advisory bodies
- UK Government officials
- EU Commission officials
- Representatives from the UK Nuclear Industry

In identifying a list of issues and concerns which could be addressed in further meetings, “Reprocessing” and “Trust” headed the list of issues. A representative Task Group was established to consider how the dialogue might move forwards. Early on, it was decided that “Trust” could not be addressed as a specific issue. Rather, participants would have to see if Trust could be developed through attempting to work together.

The Task Group recommended that the dialogue first address the issues of Waste and Discharges. It was thought these areas offered the best potential for finding some areas of agreement, however limited. There was also the opportunity to input into the UK Government's reviews of waste management and discharge strategies. As such a dialogue process was unprecedented in the UK, Waste and Discharges offered the best opportunity for learning about the strengths and weaknesses of working together before attempting to address more contentious issues like Reprocessing and Plutonium.

The Wastes and Discharges groups produced Interim Reports on their findings which were discussed at the Main Group plenary meeting in November 1999 and subsequently published by the Environment Council in February 2000. To reflect the discussions of the Main Group, the two reports are described as "work in progress" interim reports and carefully outline where participants have agreed or disagreed. Copies of the reports are available on the Environment Council's web site (www.the-environment-council.org.uk). The reports have been utilised by BNFL in compiling inputs into the UK's National Discharge strategy, the recent Radioactive Waste Management Advisory Committee (RWMAC) inquiry into the waste management implications of reprocessing operations, and also led to a meeting between representatives from the Waste Group and Environment Minister, Michael Meacher. In November 1999, two new groups were established to consider the more contentious topics of Spent Fuel Management Options and Plutonium.

The stakeholder process has changed the paradigm of "business as usual" in the UK. The attacks by the NGOs through the media have not seemed as vociferous as previously experienced. There has been the extension of networks and relationships in the Working Groups which does lead to the building of "Trust", one of the key issues raised at the initial November 1998 meeting. Any information provided during the process by BNFL to the Working Groups does not contain commercially sensitive material, but the process has enabled many misunderstandings and misconceptions (on the part of the NGOs in particular) to be addressed. These misunderstandings in the past would likely have been thrashed out through adversarial exchanges in the press.

BNFL's recent difficulties and poor business performance has coloured some NGO perspectives towards the view that the Company is in dire straits and that continued NGO participation in the process may have little reward. It would also be naïve not to recognise that some participants may have a low expectation of the process and may use it more as a way of gathering information rather than as a real dialogue. The NGOs also have nationally agreed policy stances which determine their views. There is also the "personal risk" experienced in that NGO participants need to bring their constituents along with the process. The NGOs have traditionally relied upon controversy and the attendant publicity this brings to make financial gain through increased membership support. The dialogue process is "behind closed doors" until outputs are endorsed by all parties, and NGO individual representatives and their stakeholders are concerned that their involvement is seen to have value and therefore that their constituents will endorse their continued participation.

There is the constant call for BNFL to "demonstrate" that the stakeholder process is being reflected in informing our decision-making processes. This is not to suggest that the process acts as a "shadow Executive" but that we reflect on giving cognisance to the process when making announcements or submissions which could have been impacted by earlier deliberations or which could impact upon "work in progress" being undertaken by Stakeholder Working Groups. The process has led to a blurring of the boundaries of company/NGO interactions between "business as usual" and the dialogue process. This is inevitable as the Working Groups consider the contentious topics of Spent Fuel Management and Plutonium Options.

Stakeholder dialogue has not solved the industry’s “perception” problems – and probably never will. Indeed, one of the key “agreements” is the agreement to differ. What has been extremely helpful is that we have started to find some common ground, agree common data and only then focus on genuine differences.

Key Issues in the Debate on Risk

When engaging in discussions with stakeholders in the wide range of interactions discussed above there are several common themes that the nuclear industry will seek to ensure are included in the ongoing deliberations and debates.

It is very important not to lose sight of the concept of *radiation dose*. Pressure from some stakeholders tends to focus on parameters such as *activity* (Bq) discharged or environmental *concentration* (Bq kg⁻¹). However, the ICRP has developed a comprehensive framework for radiation protection which allows us to convert from activity (etc) into dose, risk and harm, which we believe to be the more fundamental and logical concepts for decision taking. There are currently no similar unifying theories which apply to other forms of detriment (eg discharges of non-radioactive species ranging from mercury and organotins to carbon dioxide) – hence the public is unfamiliar with (and possibly suspicious of) the more integrated approach inherent in *radiation dose*.

For example, within the Discharges Working Group of the BNFL Stakeholder Dialogue the group reviewed potential decision-making parameters and ranked their order of importance. This was a relatively simple and non-scientific process, but nonetheless allowed the group to identify the priorities for detailed consideration. The outcome was as follows:

Parameter	Relative Weight
Critical Group dose	5
Activity (Bq)	3
Activity concentration (Bq kg ⁻¹)	3
Half life (persistence)	3
Collective dose	1

The principal conclusions of the Group were developed in terms of the impact of future Sellafield discharges on critical group dose, with an anticipated dose reduction profile being widely acknowledged as a good “first step” towards implementation of the Oskar Sintra aspirational statement.

The concept of radiation dose should be used to demonstrate the impact of the nuclear industry within the context of radiation exposures and risks from other natural and man-made activities. It is recognised that a wide range of issues influence the perception and acceptability to the public of any form of risk, and it is not appropriate to argue the acceptability of the industry purely on the basis of simplistic dose comparisons. However, it is important to ensure that awareness of this context is kept within the consciousness of stakeholders and decision makers.

The nuclear industry, as for any other industry, will seek to ensure a reasonable balance in terms of Value For Money when considering the benefits and detriments of risk reduction measures. This field of judgement should extend across the widest possible base of industrial and societal activities, certainly encompassing the energy industry, including the current debate on global warming. We support the identification of the Best Practicable Environmental Option (BPEO) which

takes account of a scientific assessment of all relevant environmental effects. The overall objective is to seek to avoid the disproportionate use of society's resources being deployed on ameliorating trivial harm and to ensure that *all* relevant environmental factors are introduced into the decision process. However, it is recognised that in seeking to achieve this goal the issue must encompass stakeholder perceptions and not rely solely on objective scientific inputs. Nonetheless, in doing this it is the duty of the nuclear industry to ensure that all stakeholders are aware of the full context of the decisions to be taken.

It is important that the industry listens to and understands the concerns and perceptions of interested parties, and attempts to work with stakeholders in directing appropriate attention on areas which will make the greatest impact on people's "contentment" as well as reducing objective risk. In particular the industry is aware of the importance of securing "trouble free operation" as perhaps the major contribution it can make to the future acceptance of nuclear power.

Conclusions

Addressing the key technical issues will remain the solid foundation of dealing with the nuclear issue. But building on these technical foundations will rely strongly on how those affected are involved in the decision-making process. It is no longer acceptable for so-called "boffins" to use the excuse that people will not understand.

Neither is it acceptable to talk about the need for "better education" of the public. They are affected and they have a right to an opinion. In this increasingly open, wired and campaign oriented world, the public can and will inform themselves. The responsibility lies on those who have the technical knowledge to be proactive in ensuring that stakeholders understand and grasp the issues, have the full context of the situation, are not misinformed and are included in transparent decision making.

Taking the step towards involving all stakeholders – even those who seem fundamentally opposed to ideas being put forward – is a difficult first step. It requires courage to react positively to views we may not agree with and an openness to accepting the opinions and insights of others. Ultimately, dialogue and consensus building is essential for the future of the nuclear industry and vital for the continued growth of trust between all those who hold a stake in the industry.

**OPENING AND OPERATING A NUCLEAR DISPOSAL FACILITY:
LESSONS LEARNED IN PUBLIC OUTREACH**

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Abstract

Addressing the issue of nuclear waste is no small task for professional communicators. Communications need to strike the right balance between presenting scientific facts and responding to public issues, describing risks without creating unnecessary anxiety, and listening and addressing public concerns. The U.S. Department of Energy's (DOE) Carlsbad Field Office (CBFO), which operates the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, has more than 25 years of experience in communicating about deep geologic (2 150 feet) disposal of nuclear waste. While a single formula for success is unrealistic, the CBFO has identified 14 steps in its stakeholder outreach program that together provide a model for similar projects dealing with controversial issues. Bottom line, the lesson is to listen, learn and adapt.

Background

The need for the WIPP can be traced back to the Manhattan Project of World War II in the 1940s. The United States government produced the first significant quantities of transuranic material while developing its nuclear weapons program. Although the government has idled its plutonium-producing reactors and warhead manufacturing plants, transuranic waste continues to be generated as the DOE cleans up former nuclear weapons facilities. The resulting problem is what to do with radioactive transuranic waste that continues to be generated and is in temporary storage across the country.

In 1957, the U.S. National Academy of Sciences first suggested salt beds for disposing of radioactive waste. After a follow-up NAS report in 1970, the Atomic Energy Commission, predecessor to the DOE, favoured a site near Lyons, Kansas. The site had 250 million year-old salt beds, a low probability of an earthquake, and a simple, flat bedding structure. In 1972, the Atomic Energy Commission abandoned the Lyons site because of concerns about well drill holes near the site, risks of salt dissolution, and political opposition. At this point the focus began to shift to southeast New Mexico. A site near Carlsbad, New Mexico shared many of the favourable characteristics and few of the concerns that led to the decision to abandon the Lyons, Kansas site. In fact, Carlsbad area leaders actively pursued the project as a means to diversify the economic base of the region.

The 2 150 foot-deep waste repository ultimately became a reality, but not without challenges. Despite favourable scientific and local political conditions, roadblocks remained along the path to opening the WIPP. The first-of-its-kind repository is often referred to as the most regulated parcel of desert in the world. With no previous example to follow, the CBFO successfully complied with stringent certifying and permitting processes stipulated by the U.S. Environmental Protection Agency and the state of New Mexico.

The challenge

The communication challenge was daunting, not only in the WIPP's host state, but also at 23 sites across the country that were preparing waste to ship to the WIPP. Although the Carlsbad community was generally very supportive of the project, anti-WIPP sentiment was strong in northern New Mexico and among some stakeholders along waste transportation routes. Specifically, stakeholder issues included:

- **Safety and health of nearby residents and workers.** Safety and health is a two-edged sword. Workers and residents near both the WIPP site and the transuranic waste sites wanted the CBFO to ensure that their health and safety would be protected. Thus, some stakeholders near the transuranic waste sites were very supportive of removing the waste from their environment, while others, in the more distant areas of New Mexico, opposed bringing waste into the state.
- **Protection of the environment.** Environmental protection is also a two-edged sword. Areas around some transuranic waste sites had been contaminated to a greater or lesser degree over the years, and those sites have a long history of campaigning to clean up their environment. Likewise, northern New Mexico residents opposed the importation of waste into the state in part because they had seen contamination at the DOE sites, including a nearby DOE national laboratory. Meanwhile, although the local community actively supported the project, they also wanted the DOE to ensure their environment would be protected.

- **Transportation of the waste from the sites to the WIPP.** Transporting the waste through “bystander communities” was a problem that sprawled across 30 states and 10 Indian tribes and pueblos. Many of these communities were not trained or equipped to respond to a nuclear waste accident, and some residents were fearful of exposure from the passing trucks.
- **Continuation of the nuclear cycle.** Some stakeholders opposed opening the WIPP because they saw it as one component of perpetuating the use of nuclear power and potentially another build-up of nuclear weapons. Continue to confound waste disposal at the back end of the nuclear fuel cycle, the reasoning goes, and eventually it will obstruct reactor operations at the front end.
- **Lack of environmental radiation protection standards.** Until 1994, a specific set of federal regulatory guidelines had not been established for the WIPP. After the U.S. Environmental Protection Agency implemented these stringent standards, official and public confidence in the safety of and support for the facility climbed measurably.

Combined, these challenges resulted in an eleven-year delay in the opening of the WIPP. The positive result, however, is that when the facility opened in 1999, stakeholders had had numerous opportunities to learn about and comment on it; scientists and oversight groups had examined, studied, evaluated, and approved the performance potential of the repository; regulators had crafted a strong regulatory framework to direct management of the waste; and lawmakers had written stringent laws to respond to public concerns. The project was firmly rooted in the regulations and law after having dotted every “i” and crossed every “t.”

Fourteen steps to effective communication

Good science, strict compliance with laws and regulations, and the ability to communicate effectively are all essential to a successful project. But perhaps the most undervalued component is good communication, because no matter how good your science is, or how compliant your procedures are, they all go for naught if people don’t believe in your science. Reflecting on its communications successes and failures, the CBFO has identified 14 steps considered integral to its continued communication effort.

Form a Dynamic Team

The CBFO Office of Public Affairs leads a dynamic team of communicators from multiple organisations, supplemented by other technical staff, as needed. The Westinghouse Waste Isolation Division and the CBFO Technical Assistance Contractor provide daily communications resources to the effort. DOE Headquarters also provides support and is an active partner on the team.

Despite the multiple organisations, the team works together without barriers that typically emanate from contractor corporate identity. The most striking example of this is in implementation of the emergency response Joint Information Center (JIC). The JIC is activated during emergencies to provide accurate and timely information to the public. Upon activation, all other outreach activities cease, and every communicator on the project has a role to play. Ongoing staff training and practice drills have prepared the team to work efficiently. Although the JIC has not been activated for any serious WIPP emergencies, it was activated after a tragic natural gas pipeline explosion near Carlsbad that killed 12 people, including a WIPP employee on a nearby outing with her family. The JIC supported public information activities of the New Mexico State Police, U.S. National Transportation

Safety Board, and El Paso Natural Gas Company for several days. The team functioned extremely well, and from the outside no easy distinction could be made between federal and contractor employees.

Undertake careful planning

A fundamental question to ask when planning public outreach is “What does success look like?” This approach requires the communicator to conceptualise the big picture or vision, develop goals and actions to achieve the vision, and track activities that lead to the accomplishment of each goal. An example is the CBFO’s *Stakeholder Outreach Plan*. The stated goal is to facilitate operation of the WIPP through effective two-way communication. The plan includes eight strategies for achieving the goal, each of which has a corresponding list of actions to be taken and performance measures to evaluate success.

The CBFO has used this high-level planning document to guide its long-term efforts. In addition, it has developed specific, detailed strategies for successfully conducting smaller events. Planning and communication among team members is also important for these activities to ensure all necessary details are addressed. The CBFO approaches complex public events at the WIPP by establishing task-specific planning matrices that the core team works from to co-ordinate the entire activity. For example, during planning for the WIPP Grand Opening celebration in April 1999, the CBFO hosted the Secretary of Energy, two U.S. Senators, an U.S. Representative, and several hundred other invited guests including public officials, employees, and members of the public. The team established and regularly updated the detailed planning matrix, or table, which documented each activity, timing requirements, status, and staff assignments. During the weeks prior to the event, the team began each day with a review of tasks accomplished and remaining, and identification of new issues requiring resolution.

Even smaller efforts can benefit from careful planning. Any new communications activity at the CBFO typically begins with a proposal to address the activity’s purpose, intended audiences, messages, activities, assignments and timeline.

Develop effective messages

Many public relations programs operate on the premise that if you repeat information often enough, people will “get” the message. For weighty issues such as siting a nuclear waste disposal facility, communicators must find the points where public concerns intersect with the agency's vision and direction. That is, messages must be both understandable and focused so that the vision and direction are clear – while responding directly to stakeholder concerns. This means that *communication channels must be two-way streets*. Essentially, the objective is to both convey the message and receive and act upon stakeholder input. If a message supports your vision but doesn’t respond to stakeholder interests, it most likely will fall on deaf ears and opportunities to reach stakeholders will be lost. Likewise, if the agency doesn’t listen, existing barriers may remain, and even be reinforced. The CBFO defines stakeholders as anyone who has an interest in or might be affected by their plans and actions.

The communications team developed the following messages that met the two-way test:

- **Get the waste off the hill** validated the DOE’s goal of removing transuranic waste from New Mexico’s Los Alamos National Laboratory to the WIPP, while concurrently supporting the local community’s desire to begin moving this waste out of their neighbourhood as quickly as possible.

- **Reduce the risk** supported the DOE’s vision of cleaning up waste storage sites around the country, thus eliminating the low-probability risk to people living near those facilities, while reinforcing the site community goals of moving the waste “out of their backyard.”
- **Benefit to the nation** conveyed the DOE’s intention of safely moving waste from temporary aboveground storage to permanent disposal nearly half a mile underground at WIPP, which responded to stakeholder desires to protect public health by removing this waste from the accessible environment.

Identify audiences

Identifying your organisation’s many audiences is the first essential step toward understanding and addressing the goals and concerns stakeholders may have regarding a project. The next essential step is taking the time to *listen* to the specific stakeholder concerns of each audience. Find out what stakeholders already know about the project, what they want to know, how best to get the information to them, what concerns them, and how they might want to be involved in future decisions. Often, communicators assume that they know what stakeholders with opposing views want (i.e., more media coverage for their cause and themselves, clogging of the nuclear energy cycle, preventing further use of nuclear energy). These assumptions can become barriers to listening to stakeholder concerns and goals, and to perpetuating the belief that the agency doesn’t listen and doesn’t want to hear from its stakeholders.

At the WIPP, a complex array of specific audiences closely follows activities of the CBFO. These audiences include regulators, oversight groups, elected and appointed government and tribal officials, governmental associations, media, special interest groups, employees, local and state-wide residents, citizens along transportation routes, stakeholders neighboring DOE waste storage sites, and the international nuclear waste community. Combined, these audiences are considered CBFO’s stakeholders, but when speaking or writing about specific issues, the office seeks wherever possible to address each particular audiences’ information needs.

Establish partnerships

No one achieves long-term success alone. The CBFO is fortunate to have established partnerships with communities, sites, states, tribes, and government consortia across the country. Some of these partnerships began many years ago, such as the one with the City of Carlsbad, which encouraged the federal government to locate the project in the vicinity of Carlsbad. Community leaders continue to support the WIPP by serving as project advocates, proactively keeping lines of communication open with each new Secretary of Energy and with New Mexico’s congressional delegates and state elected and appointed officials. Community leadership is also actively involved in WIPP’s public meetings and hearings to voice the interests of local citizens.

However, mutual agreement is not necessarily a foregone conclusion. In the mid-1990s, community leaders expressed concern about an appreciable cut in the WIPP’s programmatic budget. They expressed dissatisfaction to the local CBFO manager, who said he had done all he could to change the funding decision. Not willing to take no for an answer, the leaders took their case to Washington, D.C. and got the budget cut reversed. More recently, they have disagreed with the DOE on the amount of regional economic development support that should be required of the WIPP’s new management contract. Despite these differences, the community and the CBFO continue to work together closely to keep the project on track and an important part of the local economy.

The WIPP project also has established successful partnerships with states, tribes, transuranic waste sites, government consortia, and congressional delegates from host states to DOE waste sites (e.g., Colorado and Idaho). Here are some examples.

- **The New Mexico Governor’s Task Force on Radioactive Waste.** The CBFO has worked closely with the task force coordinator to create meeting and informational exhibit opportunities in most communities along the New Mexico transportation corridors.
- **Transuranic waste sites.** The CBFO has established both technical and public affairs partnerships with DOE staff and contractors at the transuranic waste sites. The partnerships help the CBFO communicate more effectively with stakeholders at other sites and with transuranic waste managers responsible for preparing, characterising, and shipping their waste to the WIPP.
- **State government associations.** The CBFO has partnered closely with both the Western Governors’ Association and the Southern States Energy Board to plan and co-ordinate the transportation and communications programs along the designated transportation routes. The plans include extensive training of emergency responders and key hospital personnel, provision for specialized equipment, and joint information and outreach initiatives to the public.
- **Native American Tribes.** CBFO has signed cooperative agreements with four tribal governments to date stipulating federal funding for emergency response preparations, including technical assistance and training. WIPP waste shipments will eventually cross the boundaries of ten different tribes.

Encourage Third-Party Voices

Everyone has heard the saying, “consider the source.” Each of us intuitively knows that some information sources are more credible than others are, and that some are not very credible at all. The same information presented by two different sources can have dramatically different perspectives. For example, the DOE has put extensive effort, thought, and study into developing its national transportation program and is confident that it is well maintained and safe. It has shipped hazardous and radioactive materials around the country for many years with virtually no impact to the environment. Yet, many stakeholders continue express doubt about the CBFO’s ability to ship transuranic waste safely.

In contrast, a 1989 report prepared by the U.S. National Academy of Sciences noted, “The system proposed for transportation of transuranic waste to WIPP is safer than that employed for any other hazardous material in the United States today and will reduce risk to very low levels.” This nationally recognised organisation of the country’s top scientists makes this point much more effectively – and credibly – than the DOE can.

Another third-party voice on the WIPP has been the Washington, D.C.-based Environmental Health Centre, a division of the private-sector National Safety Council. This independent organisation has evaluated and published several informational backgrounders about safety of the WIPP and its transportation system. The Environmental Health Centre’s voice brings stakeholders the scrutiny and perspective of another autonomous perspective, which also has broadened the WIPP’s suitability to the public.

Credible third-party perspectives can take a variety of forms, including scientific peer reviews, community testimonials, newspaper editorials, and statements from professional organisations and knowledgeable government associations, such as the Western Governors' Association.

A requirement in fostering objective third party points-of-view is to treat the relationship with arms-length, hands-off respect. That is, the third party cannot be expected – and should not be asked – to follow a “party line.” Mutually ensuring that any project information is accurate is essential. However, stepping over the line of independent perspective undermines the credibility of both the proponent and the third party.

Inform people inside and outside of the organisation

The CBFO places very high value on making useful information about the WIPP available to the public. In prior years, the DOE was often less open about its operational activities. The “old way” of doing business has changed, and openness is now recognised as essential. Readily available, trustworthy information is the first step toward successful communications.

CBFO does not expect all stakeholders to necessarily agree with its viewpoint. Well-meaning people can have honest disagreements. But the more accurate information that is available, the more likely common areas of agreement can be found and the sooner work can begin on resolving areas of disagreement. Informing people is accomplished through many different avenues, ranging from news releases to newsletters and from tours to public meetings.

Information needs to be tailored to the interests of key stakeholders, such as partnership organisations, regulators, and oversight groups, but one group often gets overlooked – employees. Employees make up one of the most important stakeholder groups, because 1) employees are keenly interested in keeping the facility operating smoothly and safely and 2) informed employees can be very effective ambassadors to others in the community and beyond.

One tool that has been particularly effective at the WIPP has been the daily internal electronic newsletter, called *WIPPToday*, that the management and operating contractor publishes on the project's Intranet. The publication is timely and lively, and employees know they will find the latest information there. The contractor sends updates by e-mail on any major developments. In addition to being quick, *WIPPToday* involves no printing, copying, or paper costs.

The CBFO also has used another electronic newsletter, *WIPP Watch*, to inform its more distant stakeholder-partners about late-breaking news. The CBFO used this publication in the final months leading to opening, when rumours and incorrect information about court rulings and regulatory decisions could have confused or even unhinged co-operative efforts. These e-mail publications allow the CBFO to tell its story quickly, without having to be concerned about misinterpretation and perhaps even distortion.

Involve the Public

The next important step is stakeholder involvement. These days, the law requires and people expect public involvement in the decisions that their government makes on their behalf.

The purpose of involvement is to ensure that other opinions and ideas are considered in the decision-making process. Those opinions and ideas may be contrary to the project's purpose or perspective, but thoughtful public comment can identify new ways to address issues that may have not been considered before. For instance, early models of a shipping container for the WIPP were revised when an oversight group raised concerns about whether the design would be able to remain leak-tight in an accident. What resulted was the TRUPACT-II, a robust shipping container certified for DOE use by the U.S. Nuclear Regulatory Commission.

In 1995, the CBFO sought public involvement through a series of meetings on the System Prioritisation Method, a computerised model used to evaluate performance requirements of the WIPP prior to compliance certification. Through this effort, the number of essential technical experiments was pared from 23 areas of study to 8. Public involvement was also key to the issuance of favourable records of decision on the Supplement Environmental Impact Statement in 1990 and the Supplemental Environmental Impact Statement II in 1997. The CBFO held scoping meetings at the beginning of each document-development process to determine what the analysis should include, and to seek comment directly on the draft documents before final decisions were determined.

Most recently, the CBFO has held several public meetings on various proposed modifications to the WIPP's hazardous waste facility permit issued by the state of New Mexico. After receiving numerous public suggestions on one proposed modification, the CBFO withdrew its request, made substantive changes responding to the stakeholder advice, and has plans to submit a revised modification request.

Develop tools for success

WIPP communicators have an array of tools to meet a variety of needs. Below are some communication tools that have been successful at the WIPP.

- **Disposal Decision Plan (DDP):** Although this one-page project schedule looked intimidating at first glance, it became the road map to opening the WIPP. As a catalogue of the major milestones to be achieved prior to opening of the WIPP, the DDP presented a capsulated view of the CBFO's vision, road map and timeline for where it was headed. Internally and externally, people referred to it often. CBFO periodically updated and redistributed the plan to reflect new programmatic realities. The DDP called for 48 public meetings over a four-year period.
- **Santa Fe Information and Outreach Office:** For many years, stakeholders in northern New Mexico seemed to be the most opposed to the WIPP, despite the fact that the Los Alamos National Laboratory, which is in their part of the state, would benefit by sending waste to the WIPP. The CBFO's solution was to go directly to the people: it opened and staffed a WIPP information and outreach office in downtown Santa Fe. WIPP staff is readily accessible for exhibit events and group presentations, and residents can stop in any time and get accurate, timely information about the WIPP project. The CBFO credits this office with a significant reduction of opposition to the WIPP, as noted in recent independent polling data by the University of New Mexico.
- **Tour Program, Speakers Bureau, Exhibits, and the Road Show:** For many, seeing is believing, and people have marvelled after taking a guided tour of the WIPP at the level of public safety and environmental protection it offers. A special exhibit, called the Road Show, is an actual WIPP truck and trailer complete with demonstration-only

TRUPACT-II shipping containers. The truck drivers answer questions about the containers, the DOE's satellite tracking system and the safety procedures they must follow. CBFO also makes qualified speakers available to any group that requests a presentation about the WIPP or National Transuranic Waste Program.

- **Publications:** Regular publications are a key tool for keeping people informed. The CBFO distributes monthly calendars for stakeholders that include information and involvement opportunities. Each month, a feature item highlights the latest activities at the WIPP of interest to stakeholders. The CBFO also publishes a quarterly stakeholder newsletter, *TRU Progress*, which provides more in-depth information about recent events and upcoming activities.

An array of fact sheets focuses on particular meetings or topics, some on routine information, some on milestones achieved, and some on specific events. For example, shortly after the opening of the WIPP, the CBFO discovered a spot of contamination on the outside of one of the TRUPACT-IIs bringing waste to the WIPP. After investigation, it ascertained that the contamination came from naturally occurring radioactive material (NORM). CBFO prepared a fact sheet on this event and the source of radiation, noting that it was cleaned up by simply swiping the outside of the shipping container.

In addition, the CBFO uses special publications effectively. When the CBFO submitted its 80 000-page WIPP Compliance Certification Application to the U.S. Environmental Protection Agency, it was searching for a way to present the information to stakeholders. The solution was a *Citizens' Guide to the Waste Isolation Pilot Plant Compliance Certification Application*. The 40-page guide described highlights of the application in non-technical language. After the opening of the WIPP, the CBFO prepared a special publication to provide historical documentation of the decades-long journey. Titled *Pioneering Nuclear Waste Disposal*, this publication also used non-technical language to convey complex issues to the general public.

The CBFO sent these publications to its entire stakeholder mailing list (about 3 000 recipients) and also posted them on the WIPP Home Page. The Internet is rapidly becoming a primary source of information for stakeholders, but printed copies are also available upon request through a toll-free call to the WIPP Information Centre for those who do not have Internet access.

- **Media relations:** Effective media interaction depends on building considerate, trustworthy, and professional relationships with editorial boards and reporters. The CBFO operates on the premise that good relations begin with sensitivity to media deadlines – when news collecting stops and the cameras and presses must roll. The CBFO also regularly provides photos, graphics, and useful information about the project to make reporters' work easier.

Thinking ahead can lay the groundwork for effective coverage. For example, the CBFO hosted a WIPP Media Day for reporters from national television networks and regional publications in advance of the WIPP's opening. In addition to providing comprehensive media packets, the CBFO offered presentations and demonstrated waste-handling processes so that reporters could ask questions, take photos, capture video footage, and most important, understand the facility before it opened.

A second way to demonstrate sensitivity is to recognize the basic needs reporters have in reporting their stories – and nowadays, that could include assistance with phone jacks and downlinks for transmitting big stories. The CBFO has discovered that sensitivity also requires an understanding that news may not always be reported the way it wants and when it wants it. If an organization's efforts are effective, it should have an opportunity to present its position, even if a story doesn't go its way.

Building trust, the second important component of good media relations, requires telling the truth and nothing but the truth, and to be forthcoming with facts that the organization may not be comfortable communicating. Reporters who feel that an organization is "spinning" the news will be much harder on it than if its representatives had been open to begin with. An organization is not required to reveal classified information, but it should beware of placing that label on information that would create embarrassment if it were revealed, as opposed to compromising security. If the information is only embarrassing, good communicators will step forward and take whatever criticism comes their way.

Train for success

Success is no accident. Careful planning is one thing, but practising what one plans is quite another. The CBFO has provided WIPP communicators with ongoing training through which they have practised the skills required to be successful. For example, communications staff participate in emergency response exercises several times per year and are graded annually to ensure readiness in the event of an emergency.

One example of successful preparation was activation of the JIC in August 2000 after a natural gas pipeline exploded near Carlsbad, New Mexico (cited earlier). The JIC provided emergency communications support to the New Mexico State Police, the El Paso Natural Gas Company, and the federal National Transportation Safety Board. Good communications were critical, as there was interest by a very large extended family related to the victims, plus local, regional, and national media. The CBFO support to these organisations helped them carry out their communications activities flawlessly and sensitively.

In addition to training staff, the CBFO also has undertaken a comprehensive emergency response training program along transportation corridors throughout the U.S. To date, more than 17 000 people have been trained in 16 states and nine Indian tribes.

Evaluate effectiveness

Evaluating the effectiveness of communications is essential if communicators are to know whether they were productive or just busy. Each outreach activity or event should have a feedback mechanism built in. The CBFO has conducted surveys about several programs, such as the quarterly newsletter and the monthly calendar. But formal surveys are not the only means of obtaining feedback. For example, each page of the WIPP Web site is set up to encourage stakeholders to e-mail the WIPP Information Centre. In fiscal year 2000, the Information Centre fielded more than 200 requests for information by e-mail. That represents about 200 people who might be able to tell the CBFO if their information needs were met and how to make access to information easier.

Make your organisation flexible

In today's rapidly changing world, organisations must remain flexible and nimble to respond to changing circumstances. Although careful planning is important, plans should not become a straight jacket to restrict creativity and new solutions. In fact, a good plan is adaptable, allows for the unexpected, and has the tools to deal with unanticipated events.

Such tools might be minor, such as calling for a simple change in the planned traffic patterns in an exhibit area to allow better access. Or they might be significant, such as the opening of the CBFO's Santa Fe information and outreach office to directly interact with concerned area stakeholders. In any case, proponents must continually 1) ask themselves how things might be done better; and 2) listen to colleagues, stakeholders, and their own intuition to identify ways to improve on their "best."

Learn from success and failure

Instituting a "lessons learned" mechanism should be an ongoing effort to foster continuous improvement and to avoid making the same mistake twice. Handled well, lessons learned encourage thoughtful observation and communications that work more effectively. Below are some of the lessons learned to date at the CBFO.

- **Involve people in decisions early and often.** The CBFO conferred successfully with the City of Santa Fe over a period of several months to work out a mutually acceptable agreement about temporarily shipping waste through the city prior to the completion of a highway project bypassing the city. Without this constructive involvement, such an agreement would not have been possible.
- **Have a plan that focuses and galvanises team effort.** Of all the CBFO documents prepared during preparations for opening the WIPP, the Disposal Decision Plan was probably the most-used information product. Many managers and staff carried it in their pockets. The CBFO updated it whenever change necessitated and provided the revisions to regulators, oversight groups, officials, and other stakeholders. It left no mystery as to the next steps anticipated and was the heart of the CBFO's openness on the WIPP.
- **Establish regular communications with stakeholders.** Don't wait until something's wrong. Shortly after the establishment of the then-Carlsbad Area Office, the manager initiated an ongoing public dialogue on the merits of the WIPP. That worthwhile process ultimately was critical to approval for opening the first-of-its-kind repository.
- **Remember internal "ambassadors" and working partners.** The internal electronic newsletter WIPPtoday provides employees with an ongoing source of information both to bolster their own comfort level regarding the current status of the WIPP and to help them relay correct information to the friends, family, and neighbours. Working partners – in this case the transuranic waste site public affairs teams, the government consortia, and the local governments – became strong advocates in the campaign to open the WIPP.
- **Respond to the people with the most concerns.** Throughout the process of certifying and opening the WIPP, the residents of northern New Mexico expressed the greatest concern about the repository. In response, the CBFO established and staffed the public

outreach office in Santa Fe. This initiative laid the groundwork for more readily accessible information about the WIPP and ultimately contributed to altering local public perceptions of the WIPP, according to polls conducted by the University of New Mexico Centre for Public Policy.

- **Make publications reader-friendly.** Translate technical language into readable, easy-to-understand formats, and use interesting graphics and colour to present clear, unambiguous messages. The CBFO earned praise and thanks from regulators and stakeholders for its Citizens' Guide to the Waste Isolation Pilot Plant Compliance Certification Application, an easy-to-read 40-page booklet that summarised the 80,000-page technical request for WIPP certification made to the U.S. Environmental Protection Agency.
- **Recognise the importance of personal interactions.** Despite the speed and convenience of the Internet and e-mail, nothing replaces person-to-person communications. Holding informational meetings for stakeholders and communicating directly by telephone both demonstrate that you care about their concerns. In November 2000, the CBFO met with a group of stakeholders who had wanted to attend an internal workshop for key state regulators from around the country. The meeting was not intended as a public meeting, but representatives of the CBFO met with concerned stakeholders to report on results of the meeting and to hear their issues. Despite strong feelings about the issues, the meeting was cordial and candid, providing an opportunity for the stakeholders to express their concerns directly to the CBFO.
- **Become a partner on the technical team.** All too often, communicators are brought in at the end of a planning process and asked (in some cases) to "make a silk purse out of a sow's ear." Communications and involvement planning must be integral to the entire planning process. The CBFO has demonstrated that it embraces this concept by assigning communications staff to the project technical teams as they plan a range of initiatives to "fill the pipeline" to the WIPP.

Look to the Future

One of the most useful practices communicators can adopt is to pause from what they're doing and think about the future. What's on the horizon? How does what they're doing now affect what they'll be doing in the future? Who needs to be involved in decisions early? Answers to these questions can help communicators be successful.

The WIPP has several challenges looming on the horizon, including:

- **Receipt and disposal of remote-handled transuranic waste.** The initial transport of remote-handled transuranic waste for disposal at the WIPP is planned for 2002. Public and media interest will be high.
- **Rail shipments of waste.** Based on a recommendation of the National Academy of Sciences, the CBFO is evaluating the use of shipments by rail using specially built ATMX cars.
- **Central waste analysis confirmation.** The CBFO is developing plans to conduct test-sample confirming analysis of the waste set for disposal at the WIPP, which will accelerate the cleanup of 18 small quantity sites waste storage sites around the nation. This time- and cost-saving initiative will require extensive public interaction.

- **Underground experiments.** In addition to offering WIPP as an international repository demonstration and training facility, scientific experiments in the WIPP underground not be related to waste disposal are also being considered. These include astrophysics and other particle physics experiments that will benefit from the WIPP's deep geologic configuration. This new initiative is an important expansion of CBFO's primary mission of transuranic waste disposal.

Each of these issues will have unique challenges when communicating with stakeholders. The CBFO, its contractors, and their partners are actively involved in the planning for all these initiatives.

Conclusion

In the end, what do communications have to do with opening and operating a nuclear disposal facility? Everything. On its technical merits alone, the WIPP very well could have begun operations in 1988 as was originally scheduled. The challenge, however, is that many people have an inherent fear of anything nuclear. To respond to this concern, a framework of stringent regulations and procedures were put into place that extended the facility's pre-disposal period for many years.

In the meantime, professional communicators shared information with – and sought input from – the public, regulators, elected officials and others until finally every regulation had been met and every legal challenge to opening the WIPP had been exhausted. Polling data conducted by the University of New Mexico show that public support of the WIPP since 1997 has increased, especially when the survey question was revised to indicate that the WIPP was already open. In this case, 52% were in favour of the WIPP, while those opposed declined from 50% to 38%.

The work of professional communicators at the WIPP is far from complete. In the last year, the National Academy of Sciences issued an interim report that recommends review and revision of waste management procedures, with reduction of risk and cost as the guiding principles. As the WIPP project continues to operate, develop, and improve, the need for effective communications will continue. Over the years the communication tools the CBFO uses may change, but people will still want to know what's going on, what changes are being made, who's making sure work is being done safely, how all of this affects them, and to whom they can express their concerns.

**FROM IVORY TOWER TO CASTLE:
HOW SCIENTISTS ARE HELPING THEIR LOCAL COMMUNITIES
THROUGH SOLVING CRIME**

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In the early 1940s, a large parcel of Tennessee farmland was appropriated by the U.S. Government, and on the land several facilities instrumental to the success of the secret Manhattan project were built. Almost overnight, small communities near Knoxville, Tennessee, became part of a massive restricted government reservation. Families were forced to relocate, and former family farms sprouted large buildings filled with equipment used for isotope separation. Into what was left of the communities moved a vast cadre of outsiders whose task was to produce the enriched uranium for the wartime effort. This new town became known as Oak Ridge, named for the oak trees abundant on the town's ridges, and few vestiges of the old communities were preserved.

From that secret, abrupt, and forceful beginning, 60 years later Oak Ridge is a town of about 27 000 residents, many of whom continue to work at the government-owned facilities: the BWXT Y-12 National Security Complex (formerly the Oak Ridge Y-12 Plant), the Oak Ridge National Laboratory (ORNL), and the East Tennessee Technology Park [formerly the Oak Ridge Gaseous Diffusion Plant (ORGDP)]. In many ways, Oak Ridge is still a town of outsiders compared with the rest of the region. It enjoys a much higher *per capita* income, with nationally ranked schools. Its business continues to be science and technology, while much of the rest of the region has an agricultural-based economy. Oak Ridgers have a very high percentage of doctoral degrees and come from all over the world. Many still hold security clearances and cannot discuss their work except in generalities. Because of the need for handling hazardous and nuclear materials, none of the facilities are open to the general public except for highly orchestrated tours, and there are many areas that are closed except to trained workers with a security clearance. As a result of this history and these differences, Oak Ridgers, have been perceived as "those scientists in their ivory tower," meaning that the workers were considered to be aloof and out of touch.

The legacy of Oak Ridge has always been based on its nuclear-related business. During World War II, all three facilities were involved initially in isotope separation technology development. Over time, their functions changed so that the ORGDP's main role was uranium enrichment, the Y-12 produced parts for nuclear warheads, and ORNL performed research and development on atomic energy, isotope enrichment and other nuclear-related areas. At one time, ORNL itself operated five nuclear reactors on its premises. As the Atomic Energy Commission evolved and eventually became the U.S. Department of Energy, so, too, did ORNL change from being primarily nuclear-oriented to being a multipurpose, multidisciplinary national laboratory supporting a variety of missions and sponsors.

In about 1990, Oak Ridge created an office to apply ORNL's R&D capabilities to provide short-term solutions to problems of national importance such as drug smuggling. As these activities became more lucrative for the criminal, the criminal started adopting high-technology ways to evade

capture. As a result, it was apparent that it would take high-technology solutions to stay ahead of the drug smuggler and terrorists. What better place for government agencies to seek high-technology solutions than a national laboratory where significant taxpayer dollars have already been used to hire the best minds and supply the best equipment? ORNL scientists, however, had been accustomed to spending years on research supporting a major task or program. Could they think on a more short-term basis and actually build an operating device in just a couple of years to support an immediate operational need?

In an early project for the U.S. Department of Agriculture, ORNL was asked to determine whether a mass spectrometry technique they had developed for environmental monitoring could be useful for locating marijuana plants. Under this project, three Oak Ridge personnel accompanied U.S. Forest Service law enforcement personnel into Kentucky's Daniel Boone National Forest to find illegal marijuana plantings and to measure the odour nearby using custom-built air-sampling devices. The devices were then coupled to the mass spectrometers to see whether the distinctive odour of marijuana could be detected by the instruments; it could. The success of this small effort, along with the teaming with law enforcement personnel, was really the genesis of a much broader effort to support law enforcement culminating in the creation of the Oak Ridge Centre for Applied Science and Technology for Law Enforcement (CASTLE).

CASTLE was established in 1995 solely to use the resources within Oak Ridge to help local, state, and federal law enforcement personnel solve crimes. It included several functions, which will be described in more detail below:

- Casework support
- Short-term feasibility tasks
- Technical advice & assistance to operations

Casework was the cornerstone of the CASTLE program. First, it was through solving crimes that we could show that Oak Ridge scientists and technologies were relevant to our community. Second, through working on cases, it was easier to determine generic problems and seek R&D funding for solutions. Third, it was important to build a network of supporters so that longer-term R&D projects would be endorsed by the supporters to potential sponsors. What made our casework support unique, however, was not only the application of world-class researchers and equipment to support law enforcement, but the fact that these capabilities were offered *at no cost* to the perpetually needy law enforcement community.

With regard to casework, there were several ground-rules established early on. First, the request for assistance had to be made by law enforcement personnel, preferably through the sheriff or chief of police of that jurisdiction. Second, we declined or referred cases that could be readily supported by the state, Federal Bureau of Investigation (FBI), or by private sector companies. Third, we established a procedure for handling evidence, consistent with standard chain-of-custody evidence handling procedures (written documentation, locked rooms and cabinets, etc.). Fourth, our legal counsel concurred in our ability to testify, as needed, as expert witnesses.

When we implemented the program, one of our first steps was to involve law enforcement personnel from across the region in a workshop. The purpose of the workshop was to introduce the law enforcement personnel to Oak Ridge and the capabilities of the national laboratory. We also solicited from them ideas regarding their problems and ways that they thought we might help. More than 30 law enforcement personnel attended the workshop in May 1995. From that workshop, we built internal and external networks. With the external network of law enforcement personnel, we kept in touch by e-mail and letter. They received an informal "CASTLE Bulletin" at least once per month, describing current cases, opportunities for grants, complementary ongoing research, etc. The internal network was a group of scientists and engineers intensely interested in helping law enforcement and

eager to volunteer to work on cases. When a case request came in to the CASTLE co-ordinator, it was distilled, summarised, and sent immediately to the internal network soliciting ideas on how best to approach the problem. Then, a team was assembled as needed to provide a quick solution. In some cases, the solution was provided in as little as half a day.

In addition to the workshop and bulletins, several CASTLE team members traveled the region to spread the word of the program to police and sheriff's departments. They shared an introductory briefing about the CASTLE program, gave examples of casework performed, answered questions and provided contact information. The chief crime laboratory personnel of the states of West Virginia, Kentucky, Tennessee, Mississippi, and Florida were also briefed. The CASTLE program continues to be an invited topic at workshops and seminars for law enforcement personnel throughout the south-eastern U.S. A video was produced and widely disseminated to law enforcement personnel to promote the program. In addition, Oak Ridge exhibited or briefed the CASTLE program at several regional and national law enforcement meetings, including the American Academy of Forensic Sciences (AAFS), International Association of Chiefs of Police (IACP), American Correctional Association (ACA), American Society of Crime Laboratory Directors (ASCLAD), and National Sheriffs Association (NSA).

Over the course of 5 years, Oak Ridge scientists worked on more than 150 cases for state, local, and federal law enforcement. Some were very high-profile cases, including the Unabomber investigation, the hair analysis from President Zachary Taylor's exhumed body, and others. Many cases involved murder investigations, but there were also a number of robberies and other crimes. In each case, our objective was to provide a piece of the puzzle that no one else had been able to provide and to do so as quickly as possible. Sometimes the research equipment made a quick solution possible, but many more times the solution was reached because we just thought about the case in a different way and had a different approach. Following are a few examples:

- One of our first cases involved a hate crime. An African-American family moved into a predominantly white neighbourhood and was immediately harassed, culminating with the burning of a cross in their yard. The Sheriff's department began video surveillance by placing time-lapse cameras on the house, aimed at the street. Shortly thereafter, a tree that had been planted by the family's neighbours as a gesture of support was deliberately destroyed by a vehicle driving through the yard late at night. The video was retrieved from the camera, but unfortunately the equipment was not suited for low light levels and only revealed two headlights and some reflections from a street light. Oak Ridge CASTLE was asked to examine the video for any useful information that might be obtained and, if possible, to determine specifically what type of vehicle was used for this malicious act. Because the video recording was so dark, there was minimal useful information obtained by standard video enhancement techniques. However, a graphic artist at ORNL thought of a possible way to identify the vehicle, using brochures gathered from car dealers. She scanned the images from the brochures and scaled and rotated them so that the headlights of each vehicle appeared in the same position as those in the video. She was able to determine that the vehicle had a high probability of being a late model Dodge Dakota 2x4 pickup truck. No other vehicle, sedan, van, or other light truck fit the headlights and streetlight reflections in the video. We later learned that the main suspect in the crime was a juvenile who regularly drove his parents' Dodge Dakota 2x4 pickup truck. With this information from the graphic artist, the Sheriff's Department was able to confront the juvenile and his parents.
- In another case, an emergency call reporting a raging fire was received on Sunday morning. The sole resident of the house, a young woman, was injured in the fire. She was transported to the hospital and an investigation began immediately because of a

number of unusual circumstances. Her neighbour, a member of the Sheriff's Department, was on his way to church about 10 minutes before the call was received, and he had noticed no smoke or fire. The burn pattern on the woman was very unusual. She was burned on her arms and shoulders, but not where her night-gown had been. The gown was virtually intact. When questioned, she was unable to name a possible cause of the fire, and it appeared the fire was deliberately set. She lived 3 weeks before pneumonia caused her fire-damaged lungs to fail. After her death, her family remained convinced that she was murdered and asked that the investigation continue. The medical examiner subsequently ruled her death a homicide. Initially, Oak Ridge was asked if there were advanced analytical techniques that could be used to examine the burned tissue to determine what accelerant might be present. The plan was to exhume the body. After careful consideration, it was felt that any evidence would be already destroyed by the decomposition process. As the investigation proceeded, it showed that the young woman led a double life. By day she was a well-respected school teacher, but at night, she allegedly had a number of married lovers and had been blackmailing them for her silence. One of the possible suspects remarked to an informant that if he were to kill someone, he would do so using an automobile airbag. He worked at a facility that manufactures and installs airbags. After contacting universities and others for assistance, the police contacted Oak Ridge CASTLE personnel to ask, "If you were going to kill someone with an airbag, how would you do it?" They hoped that the answer would be consistent with the physical evidence. Oak Ridge scientists were able to provide a technical path using chemicals common to the airbag industry that would create a friction-sensitive explosive device hot enough to flash-burn the young woman. With this information, the police were able to identify the murderer with compelling evidence of motive, opportunity, and technical knowledge.

- In a third case, a convenience store worker was shot to death in the store's storage room. The suspect admitted shooting the clerk but claimed he did so as the result of a fight with the clerk and that the weapon had discharged accidentally during the struggle. The storage room is, unfortunately, not under video surveillance, although the rest of the store is. In the surveillance tape, the suspect is shown entering the store and the clerk is in the back corner. But what happens next is very hard to discern. Like many tapes from surveillance cameras, the resolution is poor and the images are difficult to see. The police department and the district attorney's office asked Oak Ridge to review the tape to see if there was anything that might refute the suspect's story. When Oak Ridge reviewed the tape carefully, frame by frame, it appeared that there was a tiny flash of light for a brief instance near what appeared to be a weapon in the suspect's hand. But was it a muzzle blast? And, if so, could that be proved? Oak Ridge asked the police department to fire a weapon in the same convenience store at the same location at the same time of day. By comparing that tape with the original evidence and doing extensive calculations, Oak Ridge engineers were able to prove that it was a muzzle blast and that there could not be any other source for the flash of light. As a result, it was clear that the shot had been deliberate and that there had been no struggle in the back room. When the District Attorney's office showed the Oak Ridge evidence to the suspect's attorney, the evidence was so compelling the attorney advised his client to plead guilty to first degree murder to receive a sentence of life imprisonment without parole instead of the death penalty. A police detective said in a kudos letter to Oak Ridge, "I am convinced the decision to plea was a direct result of CASTLE's support." Estimates are that Tennessee taxpayers saved over \$100 000 by avoiding a trial for this case.

In some CASTLE tasks, Oak Ridge scientists were asked to perform short-term research to support law enforcement requests. One such instance arose from a case involving the rape and murder of a 3-year-old child. A family friend confessed to the crime while under the influence of alcohol but later recanted his confession. In the process of gathering physical evidence, the detective on the case dusted the suspect's vehicle for fingerprints. Because of the confession, the police knew the girl had been in the suspect's car, but the detective could find no fingerprints from the child. The prints had "disappeared." As a result of this discovery, he performed some tests of his own. He asked children and adults to handle glass soda bottles, then he put some in the cool basement of his home and some in the trunk of his vehicle. Periodically, he would take them out and look for fingerprints. He found that the higher the temperature, the faster the children's fingerprints would disappear, while those of adults stayed around for much longer periods of time. He came to Oak Ridge to find a cause for the disappearance. Oak Ridge chemists embarked on a study to determine the chemical composition of fingerprints and to understand how the fingerprints of children differ from those of adults. By having children and adults touch a glass slide, then performing a solvent wash and analysing the residue through gas chromatography/mass spectrometry, it was determined that children have a much higher concentration of the lower-molecular-weight volatile fatty acids in their fingerprint residue than adults do. At puberty, the composition changes markedly. As a result, the children's fingerprints tend to evaporate rapidly, particularly as the temperature increases. Consider the differences between gasoline and motor oil. The two are very similar in that they are petroleum-based hydrocarbon materials but very different in other ways, particularly evaporation. In comparison, children's and adults' fingerprints contain many of the same compounds, but the amount of certain constituents varies such that the children's prints evaporate much more quickly.

While performing this research, the chemists observed something else of interest. Not only could one look at a mass spectrum and instantly and visually determine that it was a child's or an adult's, but there were several adults tested frequently whose spectra could be determined immediately as "Bob's" or "Jane's," simply by the distribution of the peaks. Upon analysis, the peaks in "Bob's" fingerprints identified him as a smoker. The consistent, distinguishing spectral peak was a derivative of nicotine. "Jane" could be identified by a peak that turned out to be an oestrogen derivative. This discovery led to some interesting speculation. Could enough information be gained from analysing the chemical composition of fingerprints to narrow the suspects in a crime, perhaps, to a "white male, smoker, alcoholic, in his 40s"?

Further, could this be a new technique for non-invasive drug testing that would supplant the undesirable urinalysis and other methods used for employment screening, corrections, military service and other situations? Oak Ridge, with funding from the Department of Energy, began a long-term research project to try to answer these questions. Now, several years later, the results are very encouraging. In a recent test, for example, 14 inmates in a correctional facility were tested for cocaine use. Fingerprint residue samples from all 14 were submitted to Oak Ridge in a blind test. The test revealed a positive cocaine result for one individual, which was later confirmed by the test results from the urine sample taken at the same time. While additional work remains to be done, the early results show a great deal of promise. The Oak Ridge test would allow an individual to merely handle a glass pebble. Within a short period of time, the results could be available. This would be much more palatable to people who are undergoing drug screening or who have to test the current samples. It would eliminate the degradation of urinating into a glass container in front of witnesses, and it would eliminate any possible biohazard from the laboratory analysis.

In another instance where casework led to a research project, the work on the convenience store homicide described above also resulted in a 3-year R&D effort to improve law enforcement's ability to use video surveillance. The videos retrieved from crimes in banks and convenience stores, for example, tend to be very poor quality. The machines are not well maintained, may be of poor

quality to begin with, may be old and not suited for all lighting conditions, and the tapes are often used over and over again. As a result, there are many factors that degrade the image from what the camera actually sees, including the optics, noise, and other factors. Video enhancement experts try to compensate for these shortcomings by interpolating pixels and other techniques to try to interpret the image. Oak Ridge's approach is to reconstruct, rather than enhance, the image. By using complex mathematical algorithms, Oak Ridge is reducing the effects of these degrading factors and incorporating the package into a user-friendly PC-based platform that offers complete, automatic logging for courtroom defence challenges. This system was developed with guidance from key video experts from the FBI; U.S. Secret Service; and the Bureau of Alcohol, Tobacco, and Firearms and will be available commercially in about a year.

Because of the expertise at Oak Ridge, which is unbiased toward any particular commercial product, it has been common for state, federal, and local law enforcement personnel to ask for technical advice or for other types of assistance. For example, the Tennessee Bureau of Investigation was attempting to do video surveillance of a suspected marijuana grower, but their equipment was not suitable for low-light applications, was vulnerable to rain, and could be observed readily. They asked Oak Ridge for advice on state-of-the-art equipment when it came time to purchase replacement equipment. In another instance, one of our staff members was asked to accompany the FBI on the raid of a house where it was suspected the occupants had been dealing in nuclear-related equipment, perhaps used for the production of special nuclear material. Our expert was able to examine sales and shipping documents and determine instantly that the equipment being dealt did not have legitimate non-nuclear purposes, which led to the suspect's arrest.

As mentioned previously, some of the work on the CASTLE program resulted in longer-term research projects that will eventually provide new solutions to law enforcement problems. But many more times, the only benefit Oak Ridge received was a heartfelt thank you from a police or sheriff's department. From the standpoint of our scientists, many of whom essentially donated their time, the satisfaction gained from helping solve a crime and "put away a bad guy" cannot be overstated. We received many, many letters from grateful police departments that deemed our work instrumental in solving cases we had been involved in. One spin-off was the implementation of a two-week summer program in 1996, which is still ongoing. It is the "SciCops" program for sixth and seventh graders, and it allows community youngsters the opportunity to work with Oak Ridge scientists and Knox County Sheriff's Department personnel in an interactive program to learn how science and technology can be used in crime investigation. During the program's 5 years, about 200 young people have been educated.

Additionally, Oak Ridge has received a considerable amount of local, national, and international publicity for supporting law enforcement. There have been a number of television features about Oak Ridge law enforcement and security-related technologies including FOX news, Cable News Network (CNN), Idea TV (the largest cable network in Brazil) and Discovery channel (including a recent segment aired in September 2000 featuring our work on developing an improved method of determining Time-Since-Death). Besides a number of local articles, Oak Ridge forensics work has been featured in publications such as the *Washington Post*, the *London Sunday Times*, *Popular Science*, and *Science Magazine*. All of this publicity has been very positive in moving Oak Ridge away from its traditional image as a nuclear laboratory into a truly multidisciplinary facility that serves community, as well as national, needs.

As a further result of the CASTLE program and similar efforts at DOE laboratories throughout the U.S., the Department of Energy committed in May 1998 to a Memorandum of Understanding with the Departments of Treasury and Justice which covers a "crime-fighting partnership" initiative. The U.S. Departments of Treasury and Justice house most of the federal law

enforcement agencies including the Federal Bureau of Investigation, National Institute of Justice (NIJ), Drug Enforcement Administration (DEA), Immigration and Naturalization Service (INS), U. S. Marshals Service, U. S. Secret Service, Bureau of Alcohol, Tobacco and Firearms (ATF), and Financial Crimes Enforcement Network (FINCEN). Under this partnership, DOE's charter is to provide preeminent science and technology that can be applied to the mitigation of crime and criminal activities through the establishment of collaborative partnerships between the DOE laboratories and the law enforcement and forensic sciences communities. One of the chief goals is to facilitate the flow of technologies produced through the partnership to law enforcement agencies at the state and local level.

For a number of reasons, the CASTLE program at Oak Ridge no longer exists as a formal program. But though the news-letters have stopped and the name is no longer used, the heart of the CASTLE program – Oak Ridge scientists helping solve crime – is still as strong as it was during the height of the CASTLE program. CASTLE has evolved into an established Oak Ridge law enforcement program, supporting forensic science, training and other law enforcement needs. And casework remains an important offering when the unique capabilities of the Oak Ridge complex are needed. The staff and management at the Oak Ridge facilities are committed to continuing to support the needs of the law enforcement community and thereby contributing to public safety throughout our community, the region and the nation.

EMERGENCY PREPAREDNESS STAKEHOLDER INVOLVEMENT: AN ITERATIVE PROCESS

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The 560 square mile Hanford Site is located in eastern Washington State and managed by the U.S. Department of Energy (DOE). Hanford's primary mission has evolved from national defense production to waste management, environmental restoration, and technology development. On May 14, 1997, a chemical explosion occurred at the Plutonium Reclamation Facility that resulted in the declaration of an Alert level emergency and activation of the emergency response organization. The event and subsequent evaluation process involved most of the stakeholders associated with the site. Lack of timely notification to the offsite organizations and medical treatment of workers were key deficiencies identified during the response. This paper will discuss how this event impacted on stakeholder involvement.

DOE at the Hanford Site had actively coordinated their emergency preparedness programs with local and state emergency response organizations for many years. When stakeholders identified issues, the resolution process was conducted primarily internal to DOE. Stakeholder involvement was for the most part limited to identifying the issue and receiving the report of the corrective actions DOE had taken. This process was used in response to an issue of particular importance to offsite agencies related to reporting non-emergency events. While the process of informing offsite agencies of emergencies on the Site had been periodically discussed and tested many times in emergency exercises, non-emergency events were not reported. The stakeholders explained that early notifications were important because, unlike other industrial hazards in the community, there is heightened sensitivity to events at a site that some members of the public immediately associate with the dangers of radiation. News of an event that would go relatively unnoticed elsewhere, may generate concern simply because it occurs on the Hanford Site. Early notifications of non-emergency events would provide information to enable authorities to advise concerned residents or enable them to prepare in case the situation escalated into an emergency. Given this request and justification from stakeholders, DOE determined the impacts of necessary changes to be fairly low and therefore modified notification procedures to meet the request. The changes were reported back to the stakeholders and appeared to be adequate and acceptable. It wasn't until an emergency occurred that the weakness in the notification process was discovered.

At 7:53 p.m. on May 14, 1997, a chemical explosion occurred in an inactive plutonium processing plant on the Hanford Site, approximately 30 miles north of the city of Richland. Facility management took immediate actions to protect their workers and assess facility conditions. It was not until 10:02 p.m. that the facility manager declared an Alert level emergency, which triggers notification to State and local authorities. These notifications were not completed until 11:22 p.m. when staff responding to the Hanford Emergency Operations Center discovered that it had not been done. Subsequent notifications and interactions with offsite agencies were provided in a prompt manner until termination of the emergency at 6:41 a.m. on May 15, 1997. However, the delay in initial emergency notification brought significant negative reaction from the stakeholders, news media, and

general public. In addition, stakeholders were concerned that the process DOE had developed to provide them advance notification, before an emergency was declared, had not worked. DOE senior management met several times with local government and state personnel and made promises to improve the process.

It was clear that responding to the level of concern that was generated by the notification failures would require a new approach to stakeholder involvement. A task team consisting of DOE, its contractors, and representatives of the offsite agencies was formed to evaluate and improve the notification process. Through their membership in the task team, offsite agency involvement was expanded beyond their traditional role. They were not simply identifying a problem, but also participating in determining the resolution. In this case, the team identified that the emergency notification procedures were adequate, but identified corrective actions to ensure the process would be implemented properly. However, in the area of non-emergency notifications, this multi-agency team spent several months developing an entirely new system to enable DOE to meet offsite information needs.

The process used to address notification issues following the PRF event was very different from what had been used in the past. Having the stakeholders participate as team members in identifying the issues and solutions made the process laborious and certainly lengthier than if it had been worked internally. However, the benefits became apparent during the first few task team meetings. In trying to help identify solutions, offsite team members began to recognize the challenges DOE and its contractors faced in trying to be responsive to offsite agency needs that are not always consistent or well defined. DOE and contractors gained a better understanding of why stakeholders were concerned and were asking for changes. It became clear that this level of short-term offsite involvement would translate into long-term ownership. Offsite participants not only accepted part of the responsibility to ensure that the non-emergency notification criteria developed met their needs, but also agreed to be responsible to identify revisions when needed.

An opportunity to demonstrate the improvements made in the notification process came in January 1998, when picric acid, a potentially explosive material, was discovered in a crawl space under a building located in the Hanford 300 Area. As in the PRF event, an Alert level emergency was declared, but in this instance, the notification to the offsite agencies was timely and received positive feedback from the local agencies. Since then, when offsite agencies are concerned about not being notified of some type of occurrence at Hanford, they most often find the cause is in an omission in the criteria they helped to develop. Stakeholder expressions of frustration can quickly be turned into a more productive discussion of how all parties can work together to change the criteria language to ensure inclusion of such events in the future.

Another example of changes in stakeholder interface resulting from the event at PRF was in medical response. The PRF event resulted in potential chemical and radiological exposure of several workers. Because there were no physical injuries in the event, the workers did not receive immediate medical evaluation from the site occupational health staff. As details of the event unfolded, the potential for exposure to both radiological and chemical hazards became apparent. As the workers needs were recognized, they were directed to report to the local hospital. A site contractor physician reported to the local hospital to augment emergency room staff by providing site-specific consultation. The local hospital emergency room doctor examined the workers but found no indication of exposure to hazardous materials and released them. Subsequently, the workers felt that their treatment at the event scene onsite was less than adequate. Additionally, their concerns indicated that the local hospital treatment in the emergency room was also less than adequate. This created a negative public image for the hospital as well as the Hanford Site emergency medical capability. Repercussions of the workers concerns ultimately lead to changes in the way exposure are handled onsite.

Prior to the PRF event, the primary interface with local hospitals was in the area of the handling a radiologically contaminated patient. Hanford medical staff interfaced with hospital staff periodically and a Memorandum of Understanding was maintained that confirmed the hospital's intention to accept radiologically contaminated patients from Hanford. The hospital had also participated in annual emergency exercises usually involving an injured and/or radiologically contaminated worker. This amount of interface had been seen as adequate until the PRF event. What had not been anticipated and discussed with the hospital, were Hanford-specific needs. Just as the public has sensitivities about Hanford events, Hanford workers may also have sensitivities about hazards to which they may be exposed. These sensitivities, heightened by onscene treatment that was seen as less than adequate, spilled into the hospital environment, where the hospital treated the workers as they would any patient. Also, it was clear that the potential for chemical contamination had not been thoroughly discussed with hospital officials.

While DOE and contractors worked to resolve the issues related to onscene medical treatment, the Site Medical Contractor began working with the local hospitals to increase awareness of Hanford hazards and needs. What was needed went beyond an MOU documenting agreement to accept Hanford patients, but rather a Hanford-specific exposure treatment protocol that clearly defines the required actions. This information, termed the Hanford Protocol, was provided to each of the local hospitals. The Site Medical Contractor also instituted a regular meeting with hospital staff to educate them on the variety of chemical hazards workers at Hanford may encounter. To ensure that the hospital has access to information they may need when receiving a Hanford patient, a Medical Liaison position was added to the Hanford Emergency Response Organization. The Medical Liaison reports to the hospital and provides consultation, support, and follow-up information to the worker during an exposure event. These efforts provide an ongoing opportunity to maintain a positive interface with the local hospitals.

Emergency management is an iterative process subject to continual improvement. This is particularly true in terms of coordination with stakeholders. Emergency management professionals are used to the continual cycle of development, testing and revision but may not always appreciate that this same cycle must be used with stakeholders. Just as emergency procedures are periodically revised, the methods and frequency of interface with local and state emergency officials will be revised. In many cases, involvement is the way to gain acceptance and the only means to achieve reasonable assurance of effectiveness. While the level of stakeholder involvement described in these two examples may not be necessary in all areas of emergency management, it was the only path to success for these high-profile issues.

**THE DEPARTMENT OF ENERGY'S ENVIRONMENTAL MONITORING SUPPORT
FOR RONGELAP RESETTLEMENT IN THE MARSHALL ISLANDS:
A PARTNERSHIP FOR THE FUTURE**

T.R. Bell

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The Department of Energy (DOE) initiated a dedicated program in 1974 to determine residual levels of contamination remaining in the Northern Marshall Islands from the 66 Pacific atmospheric nuclear weapons tests. The United States atmospheric nuclear weapons test code-named "Castle BRAVO," conducted at the Bikini atoll in 1954, inadvertently deposited radioactive fallout on 253 residents of the Rongelap and Utrik atolls. The Rongelap people were evacuated 3 days after Castle Bravo, but not before they received significant fallout doses. Although the Rongelap people resettled on Rongelap Island from June 1957 until May 1985, the Rongelap community self-exiled themselves at that time for fear of what they believed to be rising levels of ^{137}Cs in their local food supplies. Since that time, the U.S. government has worked with the Rongelap people in a partnership to address environmental concerns and provide environmental monitoring, dose assessment data and information and mitigation strategy alternatives. DOE has been an instrumental partner in agreements, town meetings, interactions at the level of the local atoll government councils as well as the government of the Republic of the Marshall Islands have been needed to do this successfully.

Past History

For 25 years, Lawrence Livermore National Laboratory (LLNL) has conducted detailed environmental monitoring and agricultural research studies to provide measurement data and assessments to characterize current radiological conditions at the Bikini, Enewetak, Rongelap, and Utrik atolls. Since enactment of the Compact of Free Association in 1986, the U.S. government has expended more than \$45 000 000 toward this goal.

LLNL has joined together with other scientists and scientific organizations from around the globe to forge an international team of experts with the expressed purpose to answer questions about radiation contamination in the Marshall Islands.

In addition, DOE conducted an aerial radiological and photographic survey of eleven atolls and two islands within the Northern Marshall Islands as well, which was published in November 1978. The programs have been designed and executed to provide the needed environmental monitoring and dose assessment data that the people of these atolls could use to make informed decisions on their own resettlement initiatives.

The environmental monitoring process, conducted by LLNL consists of field sample collection and laboratory analysis of terrestrial foods, marine foods, soil, and water. To date, some 2 260 terrestrial food samples, 8 500 marine food samples, 7 500 soil samples, 600 animal muscle

tissue samples, 100 clam samples, 80 water samples, and 85 lagoon sediment samples have been collected and analysed by LLNL. About 45% of these samples were taken from in and around the Bikini, Enewetak, Rongelap, and Utrik atolls to identify and quantify exposure pathways for plutonium ($^{239} + ^{240}\text{Pu}$), americium (^{241}Am), cesium (^{137}Cs), and strontium (^{90}Sr). The other 55% of these samples came from other atolls, such as Taka, Bikar, Rongerik, Ailinginae, Likiep, Jemo Island, Mejit Island, Ailuk, Wotho, and Ujelang. Also, agricultural research studies centred on Bikini Island have provided important insight into possible mitigation strategies that help reduce the uptake of radionuclides in locally grown food products.

This paper, however, will focus on the successful efforts of DOE, other U.S. federal agencies, as well as national and international scientific groups to assist the Rongelap people. A plan that funds and begins to make their dream of returning to their island home of Rongelap an upcoming reality is now in process. This paper will also explore how public confidence was engendered in the process of communicating and developing the necessary environmental monitoring support the Rongelapese leaders and community members needed to start resettlement.

In response to U.S. Congressional hearings on November 16, 1989, and May 4, 1990, a committee of renown scientists, chaired by Henry I. Kohn, Ph.D., was convened to provide insight and recommendations on potential resettlement of Rongelap atoll. Data from LLNL's environmental monitoring program was reviewed and became the basis for the committee's findings.

From 1992-1994, DOE funded a study by the National Research Council of the National Academy of Science to evaluate the appropriateness of analytical techniques, ingestion and inhalation models, and proposed remedial actions to support resettlement of the Rongelap atoll. The study entitled "Radiological Assessments for Resettlement of Rongelap in the Republic of the Marshall Islands" was published in 1994.

In 1994, the Rongelap local government asked a distinguished international panel of experts (known as the Scientific Management Team) to determine compliance with agreed limits for total annual dose-rate on Rongelap Island and actinide contamination of soils on Rongelap islands and neighbouring islands. Their report, entitled "Summary of First Phase", was published in 1996.

By 1997, the Rongelapese had gained enough U.S. and international favourable endorsement for resettlement that they made the decision they were serious about resettling Rongelap Island. The Rongelapese advised the U. S. Congress that they were ready to move back to Rongelap Island but needed U.S. funding to make this dream a reality.

The U.S. Congress was favourably impressed with their positive approach to resettlement and authorised 45 million dollars over a five-year period to make resettlement a reality. As the lead agency for funding from the U.S., the Department of Interior signed an MOU in 1998 that provided the mechanism to begin the initial phase of resettlement that is to be completed by the year 2003.

Present Program

In June 1999, DOE signed an MOU that offered a partnership approach to radiological monitoring and dose assessment that offers DOE's technical expertise in these areas to assist the Rongelapese in achieving their goals. The purpose of this MOU is to establish a framework for co-operation among the Parties to foster the timely and effective co-ordination of DOE's environmental monitoring support activities with the Rongelap Local Government Council (RALGOV's) phased resettlement of Rongelap Island.

Due to the close communications, sometimes on a daily or weekly basis, relations with the Rongelap people are better today than they have ever been. This makes possible a forged partnership that is working to achieve goals established by the Rongelap people.

With respect to Rongelap, LLNL's long-term efforts have led to important conclusions and recommendations. Based on 25 years of environmental sampling data, analysis, and research at Rongelap, it has been concluded that:

The Rongelap people can resettle without concern of radiological exposure if they 1) scrape the village areas and 2) apply potassium fertilizer to food growing areas. This mitigation technique is referred to as the Acombined option@. The Rongelap/RMI/DOE Environmental Monitoring Memorandum of Understanding being implemented at Rongelap today is based on this principal.

One of the first successes of this support occurred in November 1999. A whole body counter was installed on Rongelap Island and construction workers preparing Rongelap for resettlement received whole body counts. Rongelap technicians, trained at the Lawrence Livermore National Laboratory, helped set-up, calibrate and operate the whole body counter and provide information on results in Marshallese. This new whole body counting asset now provides a year-around capability at Rongelap. In this partnership, the technicians from Rongelap do the daily maintenance, calibration checks, the whole body counting and transmit by facsimile to LLNL the daily/weekly/monthly protocol logs to ensure proper calibration and maintenance is being done. DOE helped set up the whole body counter and plans to maintain the whole body counting system, provide required protocols, and manage the resulting database. Similar joint efforts have been developed for plutonium urinalysis testing for construction workers currently working to develop infrastructure on Rongelap to assess their potential for $^{239+240}\text{Pu}$ inhalation during their construction activities. DOE is paying one-half of these technicians' salaries.

Future Plans

To assist RALGOV to achieve the objectives of its resettlement program, DOE will undertake the following activities, as set forth in the recommendations of the "Department of Energy Environmental Monitoring Support Plan for Rongelap Resettlement Activities" (referred to as the "DOE Support Plan").

An important part of the DOE Support Plan involves technical assistance in doing soil remediation as follows: recommend depth of soil excavation and removal in the proposed housing and village area of Rongelap Island; conduct sampling and analysis of surface soils in the housing and village area, following scraping of the area and before application of coral fill, to determine concentrations of $^{239+240}\text{Pu}$, ^{241}Am , and other radionuclides attributable to the U.S. nuclear testing program; recommend amount, rate, and frequency of application of potassium chloride (KCl) fertilizer to agricultural areas; conduct *in situ* gamma spectrometry (ISGS) to confirm effectiveness of soil removal in the housing and village area; observe application of KCl; collect and analyze samples of food crops after application of KCl; and conduct ISGS after application of coral fill.

In addition the DOE Support Plan also offers the following technical assistance: sample and analysis of well water; maintain close communications; conducting resuspension studies to determine aerial distribution of $^{239+240}\text{Pu}$ plutonium; and place thermoluminescent dosimeters (TLDs) in and around buildings in the housing and village area after resettlement, for the one-time measurement of external gamma levels.

As demonstrated above, a U.S. as well as an international support effort, has resulted in successfully providing the necessary information and essential environmental characterisation data, as well as an understanding of potential dose scenarios and recommended mitigation strategies. Communications, agreements, and facilitated support efforts have provided the assurance that a working partnership can make resettlement on Rongelap Island an achievable goal.

The U.S. nuclear weapons test “Castle Bravo” contaminated Rongelap Island with radioactive fallout fission products, the most significant being ¹³⁷cesium. Indigenous people were evacuated. Now, after over 25 years of research the U.S. and Rongelap people have a plan to safely allow the Rongelap people their dream of returning to their island. The DOE Radiological Support Plan, effected by a Memorandum of Understanding with the Rongelap Atoll Local Government Council calls for recommended soil sampling and disposal, food crop practices and controls, Rongelap effected whole body counting and Pu urinalysis screening (with DOE technical assistance), the installation of radiation monitoring equipment, and a continuing program of monitoring and analysis. The Rongelap people’s confidence was engendered by a process of communicating through numerous encounters, the nature of the hazards and by tapping the expertise of national and international experts. The resulting, recommended mitigation strategies and developing environmental monitoring support for the Rongelap people are now realised to be effective in ensuring that village areas have minimal levels that pose little potential for exposure from residual contaminants and help to reduce the uptake of residual ¹³⁷cesium in food to negligible levels.

EMERGENCY PLANNING ZONE REDUCTION

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This paper describes the process used by a large industrial Department of Energy (DOE) site to communicate changing hazards to its stakeholders and instill the confidence necessary to implement the resulting emergency planning changes. Over the last decade as the site's missions have shifted from full-scale production to a greater emphasis on environmental restoration and waste management, the off-site threat from its operations has substantially decreased. The challenge was to clearly communicate the reduced hazards, instill confidence in the technical analysis that documented the hazard reduction, and obtain stakeholder buy-in on the path forward to change the emergency management program. The most significant change to the emergency management program was the proposed reduction of the site's Emergency Planning Zone (EPZ). As the EPZ is defined as an area for which planning is needed to protect the public in the event of an accident, the process became politically challenging. An overview of how the site initially approached this problem and then learned to more substantially involve the state and local emergency preparedness agencies and the local Citizens Advisory Board will be presented.

The site was part of the DOE nuclear weapons complex and was established to produce and recover nuclear materials (primarily tritium and plutonium) for the national defence. To accomplish this mission, many facilities were constructed including heavy water production reactors, tritium processing facilities, chemical separations plants, a fuel and target fabrication plant, a heavy water extraction plant, research and development laboratories, waste management facilities, and associated support operations. The site encompasses approximately 300 square miles, only ten percent of which is occupied by these facilities. The areas adjacent to the site are largely agricultural with a relatively low population density. The site was in full-scale production and operations through 1983. Since that time, missions have continued to evolve and include tritium production, special nuclear material storage, legacy material cleanup, environmental restoration and waste management activities. All nuclear reactors have been shut down with no plans for restart. Although there are significant nuclear and chemical hazards associated with current site operations, the overall magnitude of the threat has been substantially reduced.

After the 1979 incident at Three Mile Island, Federal guidance was issued to improve emergency preparedness for commercial nuclear power reactors. This guidance included the establishment of a ten-mile radius plume exposure pathway EPZ. The EPZ size was established to encompass the area where projected doses from accidents would not exceed Protective Action Guide levels and to provide substantial reduction in early severe health effects in the event of a worst case accident. DOE adopted similar guidelines for their nuclear facilities and in 1983, the site co-ordinated with the surrounding states to establish an EPZ. The EPZ was based on a ten-mile radius from each of its five operating reactors since reactor hazards bounded all other site operations.

Over the ensuing decade, DOE issued additional emergency preparedness requirements and guidance that resulted in a robust emergency management program at the site. The cornerstone of these emergency management program requirements was the emergency preparedness hazards

assessment (EPA). The extent of emergency planning and preparedness at each facility directly corresponds to the type and scope of hazards present and the consequences of potential accidents. Thus, analyses in the EPA form the technical basis for each facility emergency management programme.

In December 1996, the last of twenty EPAs for the hazardous material facilities located on the site were completed. Based on an evaluation of the EPAs, a comprehensive report was developed that documented a technically defensible, consolidated site EPZ. The report concluded that hazards from the site's operations no longer supported an EPZ beyond the site boundary. Considering this positive information, site personnel conducted a meeting with the two affected states to share the results of the report and provide copies of the supporting documentation (i.e., the twenty EPAs) for review. The site also shared its schedule for implementing the resulting changes to its emergency management program. The review of thousands of pages of technical documents to validate the EPZ technical basis and a short site implementation schedule were cause for considerable consternation by the states. In addition, DOE had recently informed the states that their existing emergency preparedness grant budgets would be reduced due to the declining site budget. Although untrue, it was the states' opinion that these two events were linked, and DOE was trying to eliminate the EPZ to provide a technical basis for reducing their grant funding. These political overtones significantly complicated the site's relationship with the states and the task of trying to reduce the EPZ.

The site had always enjoyed support from the surrounding community and a good, if not cautious, working relationship with the states. This event and the resulting political issues caused a sizeable rift in that relationship and a loss of the site's credibility. Upon realising that this had occurred, the site postponed the reduction of the EPZ and committed to work closely with the states to ensure their understanding and acceptance of the technical basis prior to any EPZ changes. The first steps were to allow the states all the necessary time and support to review the EPAs. The site established routine meetings, which included the EPAs analysts, to review the generic EPA methodology and the specific analysis for each of the facility EPAs. State technical questions were answered and formally documented to provide a baseline for future discussions. When the states requested additional technical analyses to enhance their planning and preparedness, the site consented and created a mutually agreeable schedule to accomplish the tasks. The site also elected to involve the local Citizens Advisory Board (CAB), an independent panel of citizens, to provide advice and recommendations to DOE on this issue. A briefing was conducted on the EPZ issue and the work being done with state officials to satisfactorily resolve their technical concerns. The CAB was very interested in the project and requested periodic follow-up briefings, including state input and rebuttal, to ensure satisfactory progress was being made.

It has been nearly four years since the initial EPZ meeting with the states and no EPZ reduction has yet been implemented. However, during this period the site focused on building a more open, long-term relationship with the emergency preparedness community. Establishing quarterly meetings with the stakeholders was a major priority. These meetings include tours of the various hazardous material facilities, an open forum for discussion of issues, and presentations on new site missions and activities of interest to the emergency preparedness community. The quarterly meetings have been a resounding success for providing information about the site and removing an air of suspicion about site operations. To keep the states up-to-date on the current facility hazards, a quarterly review of EPA revisions was also instituted. The reviews are conducted with emergency management staff and EPA analysts so any programmatic and technical questions or issues can be resolved. Copies of the EPAs are provided on CD-ROM to allow this information to be readily available to state personnel on a day-to-day basis and in the event of an emergency.

Although this process cost the site considerably in terms of a damaged reputation and the resources expended to work through these issues, it was invaluable to gain an understanding of the states' perspective. The site may never have fully realised that extensively involving the states in the planning process would have resulted in a better emergency management program. As a result of this process, the site has a more open relationship with the emergency preparedness community and the community has a better understanding of the site and its hazards. The site has committed to continuing all openness initiatives and developing additional ways to improve communication and co-ordination.

Soon the additional technical analyses will be completed and the site will revisit the EPZ issue with the states. This new relationship will be put to the test and determine if these initiatives were truly effective.

COURTESY NOTIFICATION PROCESS

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This paper describes the improvements that have been implemented to enhance communications of a large Department of Energy site with state and local agencies. Through an aggressive off-site communications program, and with constant feedback from stakeholders, the site has established a clear line of communication that provides off-site agencies with timely and accurate information regarding its activities. This paper will discuss the implementation of the courtesy notification process, which takes into consideration the potential for media or public interest, and quarterly facility tours and briefings. This paper will include a historical timeline of events and incidents that have resulted in establishing the Off-site Communications Process and the demonstrated success in opening lines of communication with these off-site agencies.

Over the years, the state and local stakeholders developed a perception that the Savannah River Site (SRS) was not providing them with timely and pertinent information regarding incidents that may have a potential to affect the surrounding areas. Beginning in 1994, in an attempt to dispel this perception and to develop our communication links, SRS initiated a Courtesy Notification process. This process addresses events that might not otherwise reach a threshold that would trigger off-site notification to state and local agencies. The Courtesy Notification process is implemented by the SRS Emergency Duty Officer (EDO) for any incident that has, or had the potential to affect the environment or would be of general public interest. If the event meets establish criteria, as agreed upon by the stakeholders, the EDO automatically makes the required notifications. If there is uncertainty, a conference call is convened with key personnel including the affected facility manager, DOE facility representative, Emergency Services manager, media relations, and the Off-site Liaison. Following the initial Courtesy Notification, the Off-site Liaison contacts the state and county officials to identify programmatic issues, suggest improvements, or recommend changes during the event.

On June 25, 1997, the Receiving Basin for Off-site Fuels (RBOF) received an alarm that resulted in precautionary protective actions for employees in a two-mile radius. Courtesy notifications to off-site agencies were delayed for approximately three hours. As a result, the Emergency Services Department (ESD) conducted a joint meeting on July 29, 1997 for South Carolina and Georgia emergency preparedness officials to discuss the Savannah River Site Courtesy Notification Process. A review of the lessons learned and corrective actions taken as a result of the June event was also conducted.

As a result of this joint meeting with state and local officials, ESD implemented changes that have improved the communication process with off-site agencies. These changes have also served to strengthen relationships with the agencies involved. Some of the improvements include:

1. Briefings for SRS Operations Centre Emergency Duty Officers
2. Courtesy Notification process briefing for Facility Managers

3. Implementation of revised SRS Operations Centre procedure requiring use of fax transmission of courtesy notification message in addition to verbal or telephonic notification.
4. Off-site liaisons briefed directly by SRS Operations Centre Emergency Duty Officer.
5. Increased number of “routine” contacts including monthly personal visits
6. Quarterly Meetings for off-site officials to discuss pending issues and tour site facilities.
7. States/counties notified at time of alarm, time of “all clear”, and official event close-out.
8. Clarified Westinghouse Savannah River Company (WSRC) point of contact for technical information for Emergency Duty Officers.

In addition, ESD has involved state and county emergency planning officials from South Carolina and Georgia in developing a Path Forward for SRS Emergency Preparedness through meetings to obtain input from the respective agencies. An integral part of this path forward is the states review and understanding of facility Emergency Preparedness Hazard Assessment (EPHA) documents. ESD transmits revised EPHAs to the states and counties for review and provides technical briefings to assist the states and counties in interpreting the data.

Issues identified by the off-site agencies included timeliness of the Notification, non-emergent events with potential media or public interest and appropriate contacts for follow-up information. To address these concerns, SRS issued a new standing order for the Emergency Duty Officers (EDOs) that emphasises timeliness, provided additional training for the EDOs, and initiated a new procedure in which the Emergency Services Department Off-site Liaison conducts personal follow-up communications with the off-site agencies. Additionally, contact cards containing phone/pager numbers of key DOE & WSRC personnel were provided to the off-site officials to be utilised as needed.

The result of this improved Courtesy Notification process is an increased confidence level by state and local stakeholders that the Savannah River Site is providing them with timely and pertinent information regarding incidents that may have a potential to affect the surrounding areas.

STAKEHOLDERS INVOLVEMENT IN EMERGENCY PREPAREDNESS

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Abstract

The management of a nuclear crisis involves many actors apart from the radiation protection and nuclear safety experts. More than stakeholders involvement, what is at stake is a better co-operation and mutual understanding amongst the various actors. This mutual understanding requires that a minimal common nuclear risk culture exists.

Presently, in France, the representation of the nuclear risk is split into two clear-cut misconceptions: risk denial or catastrophe, with almost nothing in between.

In order to contribute to building progressively a common nuclear risk culture, the information about the risk and its management needs to be discussed and criticised by various actors, including non institutional actors who play an important role for the diffusion of the risk culture.

Hence, IPSN decided in year 2000 to elaborate a specific feature allowing information and debate on the nuclear risk and its short and long terms management.

It will take the form of a CD-ROM, which is currently elaborated by a task group taking into account:

- the “social expectancies”, as they have been identified by a sociologist,
- the available documents about the nuclear risk, the crisis and its management, which were analysed. The analysis shows that there is a need for a new type of feature.

The feature contains first a common bulk whichs addresses all types of nuclear accidents and then, specific developments for each type of accidents occurring in different nuclear installations.

Specialists in CD-ROM design are involved in the project. It is very important to design the structure of the CD-ROM in such a way as it presents the technical information in an understandable manner for non-specialists.

This CD-ROM, which should be widely distributed and will serve as a support for debates, may contribute to building up progressively a common risk culture. It should help to aim at a better mutual understanding between experts and lay people whose points of view about the nuclear risk management need to be properly taken into account. This should tend to improve the risk management strategies, short and long terms.

From stakeholder involvement to players co-operation

Stakeholder involvement aims at opening the decision making process to players who are left aside up until now. When decisions have to be taken involving radiological protection or nuclear safety, experts such as design engineers, safety and protection specialists play an essential role in these decisions. As an example, the authorisation of radioactive discharges from nuclear installations is, in many countries such as France, driven mainly by technical considerations. Local communities and environment protection organisations often consider that public enquiries are far from being the appropriate means to insure their involvement in the decision making process.

In the case of emergency response, the decision making process involves many players who are not technicians, but who nonetheless have a major role to play: in France these are the “Préfet”, the emergency and civil defence services, the police, the “gendarmerie” and elected representatives, advised by the safety and radiological protection authorities and expert appraisal organisations.

What is at stake is not how to involve non technician stakeholders but how to achieve a good co-operation and mutual understanding between players whose backgrounds and professional experience can be very different.

To play satisfactorily their role, non technician players need to share with the technicians a minimum of common interpretation on what the nuclear risk really is, what is the rationale of the short and long terms counter measures aimed at protecting the public and remediating the contaminated environment. The local communities also require such common interpretation because a proper implementation of the counter-measures rely to some extent upon their co-operation.

Conversely, to advise correctly the local authorities, the experts need to understand the criteria on which the local authorities and communities base their decisions: what are the relevant psychosociological factors, what is the required logistical support, what are the local communities concerns?

Current interpretation of the nuclear risk

How close are we from a minimal common culture of the nuclear risk and its mitigation?

In France, the analysis made by a sociologist when stable iodine was being distributed on four pilot sites in 1997 and 1998 shows that the most common interpretation of the nuclear risk is one of the two extremes: either it is ignored and never thought about or it takes the form of an “end of the world” disaster. This binary interpretation suggests that the public has no clear view of what a nuclear accident involves, how it happens, what are the consequences and how they can be reduced. It is important to note that this interpretation is not limited to the local communities exposed to the risk, it is also shared by some of the players who are involved in emergency response. These players have (fortunately) no experience of nuclear accidents and their competence is built on other types of risk (road accident, chemical plant explosion, fire, ...). Then, there is not one group of players that knows and manages and another group of laymen who do not know and are affected by the consequences of the nuclear accident.

Towards a common culture of the nuclear risk

In view of sharing a common interpretation (or culture) of the nuclear risk, it is necessary to provide an information which can be discussed and criticised by the players, in their diversity: a top down type of information will not be considered as credible. There is a need for a debate, allowing the

expression of various points of view: opponents and proponents are to be given opportunity to exchange contradictory arguments. Information cannot be disseminated and accepted unless it is given, interpreted and relayed by players who are credible for the local communities.

Creation of an information/debate medium

The French Institute for Nuclear Safety and Protection (IPSN) initiated a work in the beginning of year 2000, aiming at providing an information/debate medium. This medium is intended for the “préfectures”, the elected representatives, the local information commissions, the associations and the local communities. This medium is intended to be “supported” by people commenting it but it is designed to be as much as possible self-sufficient.

In order to prepare the medium, three work directions were set:

- analysis of public expectations,
- analysis of the media already available in France and abroad,
- development of a CD-ROM medium.

The analysis of public expectations as regards nuclear accidents is based on the above-mentioned sociologist study and on the IPSN Barometer of opinion on risks and safety. Several items appeared to be relevant:

- In case of an accident, what to do immediately and during the following days?
- In case of an accident, who people should contact in order to get appropriate answers?
- What is the effectiveness of taking stable iodine and what are the cases when it cannot be taken?
- What is the effectiveness of sheltering and how long could it last ? The question of picking children up at school appear to oppose the points of view of the emergency response managers and the parents of the children.
- The organisation and the duration of an evacuation deserve explanations.

The analysis of the available media was carried out by a political science specialist. It appears that no media exist presenting the desired characteristics, i.e.: the information on the accidents, their effects and their management in the short and long terms has to be comprehensive, brief and accurate.

The medium which appears to be the most appropriate is a CD-ROM. It will comprise a section common to all types of nuclear accidents and subsections on accidents which could occur in particular types of facilities (reprocessing plants, nuclear power plants, ...) or transport systems. The common section covers several items:

- general information on radiological risks,
- general information on all types of accident likely to occur,
- exposure of the environment and the public in the event of releases,
- health and medical aspects of accidents,
- public protection countermeasures in the event of an accident,
- post-accident management.

The design of the CD ROM is currently carried out with a specialist in CD-ROM and WEB media. The aim is to “mediatise” technical information to make it available to the players involved, while avoiding oversimplifying and distorting it. This implies to structure and express the information in a quite different way as is used in a usual type of presentation (report, book).

Conclusion

This medium should help to gradually build up a shared interpretation or culture of the nuclear risk. The medium should promote debates benefiting to all the players: the facts that all aspects of nuclear risk management are dealt with together should help replying to some of the most commonly asked questions. The reactions provoked by the medium should help to lead a better understanding by the technical experts of the psychological and sociological considerations which would play an important role in any real nuclear crisis.

COMPARISON OF CHEMICAL AND RADIOLOGICAL RISK ASSESSMENT AND MANAGEMENT IN A PERSPECTIVE OF SUSTAINABLE DEVELOPMENT

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Abstract

The development towards improved health in the world has been associated with increased pressures on the environment. To cope with these and promote development, strategies to develop social, economic and environmental sustainability have been developed following the United Nations Conference on Environment and Development in Rio 1992. The OECD has established an Initiative for Sustainable Development, and will in the spring of 2001 discuss an Environmental Outlook and a Strategy. The objectives of the Environmental Outlook and Strategy are:

- (i) to generate an economy-based “vision” of environmental conditions in 2020 (the Outlook); and
- (ii) to review (and recommend) practical policy options for moving that outlook in a more “environmentally-friendly” direction (the Strategy).

In discussions around the Environmental strategy, five objectives have been proposed to enhance environmental policies in the context of sustainable development. The human practices involving radiation and chemicals should concur with these objectives. The purposes of radiation protection and chemical safety are to ensure that protection of health and the environment is given sufficient weight when the balance is sought between the social, economic and environmental dimensions of sustainable development. This paper examines to what extent such balance is addressed in about 60 examples of principles and implementation, structured according to the five draft objectives.

To give a couple of examples, in radiation protection, control of new practices from the beginning is distinguished from intervention in existing situations. In both radiation protection and chemical safety, control of practices as well as interventions is used, but radiation protection has come much further in controlling practices, with e.g. due regard taken to the long-term capacity of sinks to absorb pollution. For nuclear power, costs of environmental pollution, waste management and accidents are to a high degree internalised, partly following pressure from the radiation protection community. Important facets of chemical safety include attempts at systematically dealing with effects on other organisms than man. Among the findings, in particular, the broad importance of reproductive disturbances is interesting as a lead to potential radiation effects on the environment. A convention to regulate export of hazardous substances has no counterpart for radioactive substances.

The five draft objectives only deal in passing with the complexities of decision-making, including the management of uncertainties. Modern radiation protection and chemical safety are often highly complex. Reduction of such complexity to simpler rules of thumb, which can be applied by a wide range of stakeholders, will be increasingly important.

Introduction

Over the last century, several trends in society have a bearing on the management of health and environmental risks. The examples below based on Swedish experiences should be recognisable in most countries which have made the transition from poverty to relative affluence:

Health:

The mean life expectancy has doubled, and the modern spectrum of disease is dominated by psychiatric diseases.

Environment:

Problems in unhealthy home and working environments have been replaced by those due to widely dispersed pollution from energy use including transport, chemicals production and biotechnology. Agriculture, which has always caused loss of diversity, now also leads to pollution. Use of some natural resources is at unsustainable levels. Many types of pressures are increasing, and actions within a couple of generations are necessary to prevent large-scale loss of productivity.

Politics:

Welfare systems within national states constituted the primary means to indirectly combat health risks. As these systems were established and resources for new systems declined, political interest turned to more direct risks to health and later also to the environment (Sjöberg, af Wåhlberg and Kvist 1998). Simultaneously, many developing nations and nations in transition are still struggling with establishing a basic standard of living which promotes survival.

Research:

Environmental problems have led to questioning of the value of research and technological progress. Research has become specialised and hard to understand. A new category of “experts” has emerged as translators between politicians and researchers, acting outside of their narrow field of competence.

The result is thus improved health, increasing pressures on the environment, political interest in health and the environment, and new knowledge which is difficult to interpret. In this ambience, sustainability issues have arisen.

Towards an OECD environmental strategy

Since the 1987 report of the World Commission on Environment and Development (the Brundtland Report), all OECD governments and the vast majority of the world’s governments have agreed officially that there is an urgent need for policies to promote more sustainable forms of development. “Sustainable development” meant progress, globally and in both industrial and developing nations, that “meets the needs of the present without compromising the ability of future generations to meet their own needs”. To that end Agenda 21, endorsed by world leaders at the 1992 UN Conference on Environment and Development, encompassed a series of common goals and measures, including economic, social and political aspects.

The special session on sustainable development of the United Nations General Assembly in 1997 (UNGASS) specifically requested the OECD countries (www.oecd.org) to take the lead in the development towards a more sustainable future. The OECD has established an Initiative for

Sustainable Development. A point of departure is that economic, social and environmental developments are strongly linked, and are all important for the well-being of the current and future generations. In natural science, the concept of sustainability characterises the management of a natural resource in a manner consistent with the preservation of its reproductive capacity. In the social sciences, sustainability implies a focus on considerations broader than economic growth and material welfare alone. Here the concept embraces equity concerns and social cohesion, as well as the need to address threats to global “commons”. It emphasises the links between the dimensions of sustainability and the need for achieving balance between and among them when they conflict.

But environmental and social dimensions often lose out to shorter term economic considerations, while environmental and social policies are sometimes formulated without due regard to their economic consequences. A key aim of the initiative is to work towards establishing principles for policy-making which better integrate these different concerns regarding economic development over the medium and longer term. The OECD is also elaborating upon four specific projects on:

- climate change;
- the impact of support measures, taxes and resource pricing;
- technology and sustainable development; and
- performance measurement using indicators.

Environment and economy: outlook and strategy

With particular reference to the environmental dimension, an Environmental Outlook and a Strategy are developed. The background is that in the early 1960s, environmental problems were largely seen as local pollution problems, and preventing pollution was only a cost. Today concern has shifted to effects upon larger natural systems such as climate, major global ecosystems, and evolution itself. However, the economic value of the environment is also beginning to be realised. The economic value of the services provided by ecological systems has been estimated to be about twice the global gross national product. Most of this ecosystem value is “outside the market”.

The economic and ecological systems must be co-ordinated. Economic activities may be degrading valuable ecosystems, posing threats to human beings and human economies. Moreover, degraded ecosystems threaten markets, e.g. in the case of accelerating desertification, depleted fisheries, deforestation, and loss of topsoil. Integration of economy and ecology may serve to allow humankind to use ecological services most effectively in economic and financial systems and to use economic and financial instruments most effectively to safeguard ecosystems. Unless the workings of the natural and the market systems are harmonised, economic progress will be neither sound nor sustainable.

The OECD is setting out to contribute to such a development by elaborating and promoting a shared framework of strategic policy to integrate market systems and crucial ecological systems, respecting the development of human capital in the process. A new Environmental Strategy will be considered by OECD Environment Ministers at their meeting in May 2001. It will be based upon the first OECD Environmental Outlook to be published in April 2001. This Outlook examines drivers of environmental change, recent and projected pressures on the environment and the resulting projected changes in the state of the environment to 2020. The objectives of the Environmental Outlook and Strategy are:

- (i) to generate an economy-based “vision” of environmental conditions in 2020 (the Outlook); and
- (ii) to review (and recommend) practical policy options for moving that outlook in a more “environmentally-friendly” direction (the Strategy).

In discussions in progress in the Environment Policy Committee of the OECD, five objectives have been proposed to enhance environmental policies in the context of sustainable development:

- A. Maintaining the integrity of ecosystems through the efficient management of natural resources.
- B. De-coupling environmental pressures from growth in economic sectors.
- C. Improving information for decision making: measuring progress through indicators.
- D. The social and environmental interface: enhancing human health, the quality of life, environmental justice and democracy.
- E. Global environmental interdependence: improving governance and co-operation.

The human practices involving radiation and chemicals should concur with these objectives. The purposes of radiation protection and chemical safety are to ensure that protection of health and the environment is given sufficient weight when the balance is sought between the social, economic and environmental dimensions of sustainable development. It is the purpose of this paper to examine to what extent such balance is addressed in the principles, which form the bases of radiation protection and chemical safety. Before this examination, some basic protection principles are addressed. Thereafter, some general trends of governance are discussed with examples taken from chemical safety and radiation protection.

Basic principles of radiation protection

Ionising radiation

The discoveries of radioactivity and x-rays more than a hundred years ago rapidly led to uses which were entailed by radiation injury. Protective measures were taken and have since 1928 been recommended by the International Commission on Radiological Protection, ICRP (www.icrp.org). Until now, 84 publications with radiation protection recommendations and data have been published by the ICRP. Recommendations on radiation measurement methods and data have since 1925 been issued by the International Commission on Radiation Units and Measurements, Inc., ICRU (www.icru.org) in 63 publications. These international recommendations have been adhered to by governments to a large extent, and incorporated in national legislation. They have been the basis for ensuing more detailed recommendations and rules, also from international organisations such as the World Health Organisation WHO, the International Atomic Energy Agency IAEA and the OECD Nuclear Energy Agency NEA. The most basic recommendations concern (in abbreviated form) (ICRP 1991):

- The justification of a practice: No practice should be adopted unless it produces sufficient benefit to the exposed individual or to society to offset the radiation detriment it causes.
- The optimisation of protection: The magnitude of the individual doses, the number of people exposed, and the likelihood of incurring exposures where these are not certain to be received, should all be kept as low as reasonably achievable, economic and social factors being taken into account.
- Individual dose and risk limitation: The exposure of individuals resulting from the combination of all the relevant practices should be subject to dose limits.

Global compilations of data on ionising radiation levels and effects have since its formation in 1955 been made by the United Nations Scientific Committee on the Effects of Atomic Radiation, UNSCEAR (no website, latest report UNCEAR 2000). Generally speaking, knowledge about health

effects is good and control measures have been quite effective, so artificial radiation exposures are generally small in relation to background levels. For densely ionising radiation, such as alpha radiation from radon in air, quite a bit is known about effects on experimental systems including many mammals, but effects on man are still fragmentarily known, particularly in complex environments.

Non-ionising electromagnetic radiation

Some global recommendations on non-ionising electromagnetic radiation have been given by international organisations such as ILO and WHO but they do not have the corresponding status and broad penetration as those for ionising radiation. Knowledge about effects of optical radiation including that from lasers is generally good and occupational exposures are generally kept below levels which cause human injury. Exposures to ultraviolet radiation from sunlight tend to be high with an associated rise in skin cancer frequency. Knowledge about the effects of low-level non-optical electromagnetic radiation is sketchy and the levels are sometimes orders of magnitude above natural levels. Whether such exposures may be harmful is the subject of intense research.

Basic principles of chemical safety

Historical development

Poisonous substances have been used since millennia and appear in recorded history at least since the Papyrus Ebers from 1500 BC. The first legal acts on chemicals in many countries dealt with homicide and suicide using toxic substances. Legislation to control hazardous chemicals slowly evolved in laws on pharmaceuticals, occupational safety, food quality, and clean air and water (Lönngren 1995). An international code for the standardisation of certain pharmaceutical products was agreed in 1902, international control of narcotics was discussed since 1909, the International Labour Organisation ILO was established in 1919 and its General Conference that year adopted the first safety recommendations. The years following the end of the Second World War saw the birth of the United Nations organisations Food and Agriculture Organisation FAO, World Health Organisation WHO, and Economic Commission for Europe UNECE, as well as the Organisation for European Economic Co-operation which was later to develop into the Organisation for Economic Co-operation and Development OECD. International work on the safety of pesticides was initiated in 1948, of industrial chemicals in 1950 and of food additives in 1955.

In 1959 the “Minimata disease” in Japan was alleged to be caused by fish and shellfish containing organic mercury, and in 1962 the book “Silent spring” by Rachel Carson on pesticide effects was published in the USA. The Council of the European Communities in 1967 adopted a directive on classification, packaging and labelling of dangerous substances. By now, chemicals were clearly seen to pose problems for the environment in its broad sense, and international safety work proliferated. Actually, there were so many international organisations involved in chemical safety that co-ordination became a problem. In 1994, an Intergovernmental Forum on Chemical Safety IFCS (www.ifcs.ch) was established to co-ordinate and prioritise global work on chemical safety according to the chemicals chapter of Agenda 21 (Chapter 19: “Environmentally Sound Management of Toxic Chemicals Including Prevention of Illegal International Traffic in Toxic and Dangerous Products”). The same year, the Inter-Organisation Programme for the Sound Management of Chemicals was created (<http://www.who.int/iomc/>). It is now composed of seven international organisations working with chemical safety (UNEP, ILO, FAO, WHO, UNIDO, UNITAR, OECD), with number eight (IMO) waiting in the lobby. Special aspects of pharmaceuticals, narcotic drugs, cosmetics, and food additives are dealt with by other organisations.

Exposures and effects

Despite these advances, protection against chemicals in the environment is still in the transition stage from post-effect mitigation to prevention of injury. In Europe, a few thousand chemical substances have been reviewed before being allowed for marketing, whereas tens of thousands exist in the market, often without any publicly available knowledge about their properties with respect to health and environmental effects. For chemicals with known data, roughly one-half are hazardous to some extent. For instance, a recent study of 100 randomly chosen chemical substances showed that 22% were mutagenic (Zeiger and Margolin 2000) in a simple Salmonella test; a lower percentage would satisfy more complex criteria for mutagenicity. Good data are available for some groups of chemicals used in small volumes, such as pesticides, pharmaceuticals and to some extent cosmetics.

Chemicals have been released to the environment in quantities sufficient to cause injury, which has led to attempts at mitigation, which are still ongoing. The overview of potential effects is reasonably good for extremely large-volume chemicals such as ozone depleting and acidifying substances, and greenhouse gases, where the average global mobilisation or release is of the same order of magnitude as the natural one (European Environment Agency 1999a). The potential effects often concern both man and other organisms. For less abundant hazardous chemicals, there are chemical-by-chemical reviews of levels and effects of varying scope and depth (European Environment Agency 1999b). For instance, there are three internationally widely accepted sources of assessments which together cover less than a thousand substances:

- the Environmental Health Criteria documents (EHCs);
- the Concise International Chemical Assessment Documents (CICADs) from the World Health Organization (WHO)/United Nations Environment Program (UNEP)/International Labour Organization (ILO) International Programme on Chemical Safety (IPCS);
- the Screening Information Data Sets (SIDs) International Assessment Reports (SIARs) from the Organization of Economic Co-operation and Development (OECD) programme.

To take some examples on levels, the metals cadmium, copper, lead, mercury and tin are mobilised or released in about an order of magnitude higher volumes than the natural mobilisation rates. The extremely hazardous dioxins and polychlorinated biphenyls had maximum environmental levels around 1970 which was roughly tenfold the natural levels. Such changes are a cause of concern, and for instance recent research from three independent groups indicates cognitive and activity disturbances in children associated with the frequently occurring ambient levels of polychlorinated biphenyls (Jacobson and Jacobson 1996, Patandin *et al.* 1999, Stewart *et al.* 2000). In addition to effects on man, effects on other organisms have been observed. These are often reproductive effects, such as thinning of eggshells in prey birds and declining reproduction rates in seals.

Current principles of chemical safety

A general overview of chemical risk assessment is given by van Leeuwen and Hermens (1995). The most basic principles in chemical safety concern:

- The creation of health and safety information on chemical substances and preparations according to prescribes methods for testing, classification and labelling.
- The dissemination of such information to users.

- The precautionary principle stating that protective action may be taken even when scientific knowledge about hazards or risks is lacking.
- The substitution of inherently hazardous chemicals by less hazardous ones.
- The safe handling of chemicals in the workplace and elsewhere.

Such principles were agreed in Agenda 21 and compliance with them is subject to extensive global work. Their application in different countries is quite variable in its details. For instance several different systems are in use for classification and labelling of chemicals, and a variety of interpretations of the precautionary principle exist (Stirling 1999; Jordan and O’Riordan 1999). For such reasons, this presentation does not claim to be exhaustive or generally valid, but rather to present approaches to chemical safety which are often used.

Alternative systems for decision-making involving public interests

As mentioned above, the purposes of radiation protection and chemical safety are to ensure that protection of health and the environment are given sufficient weight when the balance is sought between the social, economic and environmental dimensions of sustainable development. In order to survive scrutiny and gain acceptance for a reasonable length of time, balancing in this sense requires: (i) knowledge about what is in the balance, or an agreement on how to handle lack of knowledge; (ii) broadly agreed value judgements for the weighting of different components in the balance; (iii) coherence between decisions applying to different situations.

Such balancing may be a complex and arduous task, often impossible if taken literally. It requires expression of the interests at stake and possibilities of dialogue involving these interests. Increasing globalisation and availability of information are strongly influencing the playing field.

To elucidate options for managing complexity, two basic approaches for decision making have been described in the science of government: the synoptic and the incrementalistic (Lindblom 1959). These have been applied by Bengtsson (1988) to decisions concerning protection against genotoxic agents. In the synoptic approach, the decision maker is faced with all relevant aspects and a systematic trade-off is sought. In the incrementalistic approach, the decision maker starts from the present situation and moves on to consider how alterations may be made at the margin. The synoptic approach can be used in quite simple cases, whereas more complex situations call for incrementalism.

In either approach, decisions can be centralised or decentralised. What seems to be emerging now is also an a-centralisation where the link to the centre is quite weak. These concepts – synoptic, incremental and a-central – will be discussed below.

The synoptic approach to decision making

The word synoptic means “affording a general view of a whole” or “manifesting or characterised by comprehensiveness or breadth of view” (Webster's dictionary). In a synoptic approach, all consequences of all possible decisions are analysed, costs and risks balanced against benefits and an alternative chosen. This approach has been advocated by the International Commission on Radiological Protection, ICRP, in its recommendations on the regulation of ionising radiation (ICRP 1991). It is also to some extent used in the assessment of the inherent hazards of existing

chemicals in Europe and failed (CEC 1998), providing strong incentives for reform. Several general weaknesses can be identified with the synoptic approach (Braybrooke and Lindblom 1963). It is not adapted to:

1. Man's limited problem solving capacities (no analysis rises to a greater level of completeness than is possible for a single analyst or a group of analysts).
2. The inadequacy of information.
3. The costliness of analysis.
4. Failures in constructing a satisfactory evaluative method (whether a rational deductive system, a social welfare function, or some other).
5. The closeness of observed relationships between facts and values in policy making.
6. The openness of the system of variables with which it contends.
7. The analyst's need for strategic sequences of analytical moves.
8. The diverse forms in which policy problems actually arise.

It is generally recognised that the decisions supported by a synoptic model must be reconsidered from time to time in the light of new conditions, acknowledging imperfections such as the listed ones. The example elaborated by Bengtsson (1988) on trans-boundary releases of radioactive substances illustrates e.g. that the system builds on an arbitrary limitation of individual risk to that from ionising radiation - individual risks from all sources should be addressed in a synoptic approach, and that the discussion is limited to the expert's domains despite the obvious value judgments it contains. However, the approach also involves significant achievements:

- It attempts to manage the overall effects of all sources now and in the future.
- It provides guidelines that have been accepted by experts in countries with very different economic, social and cultural background.
- The recommendations are practically applicable and have been followed in a number of countries.

The incrementalistic approach to decision making

An incremental approach provides an alternative to the synoptic one. An increment is a positive or negative change in the value of one or more of a set of variables. The idea of incrementalism was first coherently expressed by Charles Lindblom (1959). He states that in dealing with complex policy problems decision makers do not, cannot and should not try to be comprehensive. Instead they have developed a set of practices to simplify calculations. Together these practices constitute "disjointed incrementalism". The idea is for policy makers and analysts to take as their starting point not the whole range of hypothetical possibilities but the existing situation, and then move on to consider how alterations may be made at the margin. In a reassessment, Lindblom (1979) discusses further concepts, such as greater analytical preoccupation with ills to be remedied than with positive goals to be sought, and fragmentation of analytical work to many (partisan) participants in policy making.

Lindblom also discusses a "strategic analysis" which denotes any calculated or thoughtfully chosen set of concepts to simplify complex policy problems, that is, to short-cut the conventionally comprehensive "scientific" analysis.

A similar alternative to the synoptic model is the garbage can model. According to this model, problems, solutions, participants and suitable opportunities for political decisions meet by chance or through an intervenor – the analogy is that this meeting takes place as if the deciding factors met by chance in a revolving garbage can.

Incrementalism avoids several of the eight objections raised above, at least in part. It:

- adapts to man's limited intellect (1);
- reduces his demand for information (2);
- accounts for the high cost of analysis (3);
- adapts to the fact that public policy problems are often "highly fluid" and that ends are adjusted to means and not the other way around as most conventional views of problem solving hold (8).

In addition, incrementalism:

- involves continuous redefinition of the policy problem itself;
- integrates the parts of a problem not entirely – sometimes not at all – by intellectual accomplishment but as a result of a set of specialised social or political processes.

The idea of incrementalism has been criticised for having a limited validity and for having a built-in conservative bias. Lindblom responds (1979) that of course the validity is limited, but still incremental analysis can be applied for most public policy areas in the Soviet Union and the USA. The critics are challenged to present an alternative analysis with a wider applicability. But incremental politics is not, in principle, slow moving. Incremental change patterns are, under ordinary circumstances, the fastest method of change available. Incremental steps can be made quickly because they are only incremental. They do not rock the boat, do not stir up great antagonisms and paralysing schisms as do proposals for more drastic change.

Central, de-central and a-central decision making

The broader the interests to be respected in the decision making, the more difficult is it by definition to reach a decision which can be tolerated in the long term. The requirements i – iii for knowledge agreed values and coherence are more difficult to match, simply because in a broader range of interests there is a greater variety to cater for. The decision makers must therefore agree on a suitable level at which the decision is to take place. Systems for strongly centralised decisions have failed to survive both in politics in the former communist states, and in the market in too centralised organisations. Regulatory reform is one of the main programs of the OECD (1997), with expansion of market incentives and goal-based approaches to improve environmental quality.

Since long, there have been attempts at finding decentralised decision mechanisms, where the basic power rests at the centre but clearly defined responsibilities have been delegated.

What seems to be emerging now, in a mixture of politically and market oriented decision making, is an a-centralisation. In the European Union, there is some support for the principle of subsidiarity, implying that the Union should only become involved in matters where such involvement brings added value, for instance to truly facilitate movement of capital, goods, services and people. There is considerable debate as to where the limits of subsidiarity should be drawn, and the amount of Union legislation is staggering with increasing difficulties of finding resources for the work in the European Commission, which is the administrative body.

In an increasingly complex world with interwoven dependencies, co-ordination becomes ever more costly, time-consuming and impractical. Governments will be unable to rule over details. There are obvious risks that trans-national networks of experts in reality will be the deciding bodies when e.g. the national rules are becoming regionalised or globalised. This implies an a-centralisation, that is, the link to the central power is lost (Jacobsson 1997). An alternative way out will be to centralise objectives and priorities but leave implementation to a-centralised action (Paterson 1997). This is consistent with the discussions around the OECD Environmental Strategy, and with a trend

towards increased use of market-based mechanisms (Wallström 2000). The balancing between social, economic and environmental factors for sustainable development must thus also include selecting a blend of the means to reach the targets, with suitable measures of controllability and a-centralisation. A list of possible policy instruments is given in the table on the next page (based on Sterner 2001).

In order to maintain some legitimacy within the a-centralisation and thus make it a complement to traditional representative democracy, diversity among the stakeholders is essential. To the extent that experts are exerting the a-centralisation, legitimacy requires:

- clear and not too wide objectives;
- formal delegation of responsibility in broad terms;
- mechanism for appeal of a-centralised decisions;
- mechanism to scrutinise professionalism, e.g. peer review;
- transparency and willingness to dialogue.

Potential policy instruments and sample applications

Based on Sterner 2001 with permission from the author. Detailed explanations are given in that reference. New examples can be found on World Bank websites <http://www-esd.worldbank.org/eei/> and <http://www.worldbank.org/nipr/commun.htm>

Field of application	Natural resource management			Pollution Control	
	Water	Fisheries	Agriculture	Air pollution	Water pollution
Policy Instrument	Forestry	Minerals	Biodiversity	Solid waste	Hazardous waste
Direct Provision	Provision of Parks			Waste management	
Detailed Regulation	Zoning. Regulation of fishing: (dates, equipment etc). Bans on ivory trade to protect biodiversity			Catalytic converters, traffic regulations etc. Ban on chemicals	
Flexible Regulation	Water quality standards			Fuel quality.Café	
Tradable quotas or rights	Individually Tradable Fishing quotas. Transferable rights for land development, forestry or agriculture.			Emission permits	
Taxes, fees or charges	Water tariffs. Park fees. Fishing licences, stumpage fees			Waste fees. Congestion (road) pricing, gas taxes. Indust. pollution fees	
Subsidies & subsidy reduction	Water. Fisheries. Reduction in agricultural subsidies			Energy taxes. Reduced energy subsidies	
Deposit refund schemes	Reforestation deposits or performance bonds in forestry in Costa Rica, Indonesia and Malaysia			Waste management. Sulphur, used vehicles. Vehicle Inspection	
Refunded emission payments				NOx abatement Sweden	
Creation of Property rights	Private national parks. Property rights and deforestation				
Common Property Resources	CPR management				
Legal mechanisms, liability	Liability bonds mining or hazardous waste				
Voluntary Agreements	Forest products			Toxic chemicals	
Information provision, Labels	Labeling of food, forest products			PROPER and other labelling schemes	
International treaties	International treaties for protection of ozone layer, seas, climate...				
Macroeconomic policies	Environmental effects of policy reform and economic policy in general				

Managing lack of knowledge, complexity and diversity of values

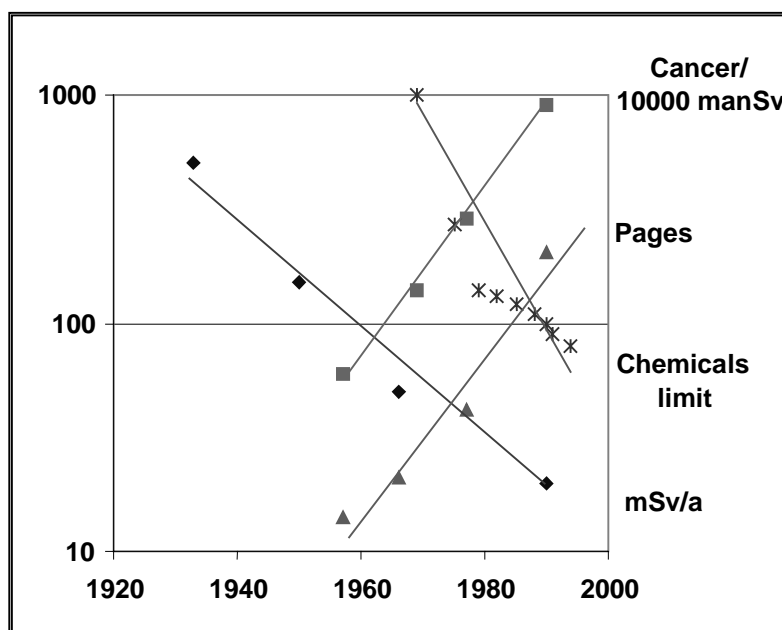
The OECD strategy deals sparsely with some factors that strongly influence the possibility of implementation: lack of knowledge, complexity, and diversity of values.

Lack of knowledge

For radiation as well as for chemicals, there is always a lack of knowledge affecting decisions. When it comes to health effects, recommendations for protection against ionising radiation have been given for many decades, based on i.e. assumed risks for attracting cancer. Figure 1 summarises for radiation the dose limit for occupational exposure, the cancer risk estimates and the volume of the ICRP basic recommendations measured in pages (adapted from Bengtsson 1990). The three quantities in the figure have not been defined identically from one recommendation to the next, but despite such uncertainties the trends are obvious.

The longest history is available for occupational exposure limitation. The dose limit has been steadily reduced, with an apparent half-life of about 13 years. A corresponding reduction has been seen for the US ACGIH exposure limits for occupational exposure to chemicals, with a half-life of about 25 years (Hansson 1998). For carcinogens in Sweden, the half-life has been about 10-20 years, as seen in Figure 1.

Figure 1. **Development with time of international radiation protection and Swedish chemical carcinogen recommendations. The data are not strictly comparable from time to time since they are differently expressed. Occupational radiation dose limits (rhombs, mSv/year) have been given since 1934 although with varying motives. The first authoritative radiation cancer risk estimate was given by UNSCEAR in 1958 in cooperation with ICRP (www.icrp.org) (squares, cases of cancer per 10 000 mansievert; the first estimate was an upper limit). The volume of ICRP radiation protection recommendations is also given (triangles, pages of basic recommendations). The development of the occupational exposure limit for chemical carcinogens in Sweden is also given (crosses, relative numbers normalised to 1000 in 1969; from Hansson 1998).**



In the last few decades, the cancer risk has been a major factor behind the dose limit. The cancer risk was first discussed by UNSCEAR in 1958, with quantitative data given only for leukemia, and then by ICRP from 1965 (Publication 8) onwards. It is logical that the reduction of the dose limit has its counterpart in increasing cancer risk estimates, where the doubling time is about 10 years. The most recent report by UNSCEAR (2000) implies a maximum estimate (cancer incidence at high dose and dose rate) almost according to a continuation of the trend.

There is a possibility of using knowledge from radiation exposures to infer the carcinogenicity of chemical substances, using the rate of DNA adducts (Granath *et al.* 1999). This has been applied also in a few practical cases.

Complexity

The increasing complexity of radiation use and protection efforts are mirrored in an increasing volume of ICRP recommendations, with a similar doubling time as the cancer risk estimate. There is no simple equivalent measure of increasing complexity for chemical safety, but three examples may be illustrative:

- the need to establish two global co-ordinating bodies (IFCS and IOMC, see above Basic principles of chemical safety, Historical development);
- in the EU chemical safety system, about 40 directives can be applied to reduce the risks from a substance that has been found to warrant risk reduction (Nordic Risk Reduction Project 2001). An EU directive typically contains 5-20 pages of text, and many have more extensive annexes;
- there are several dozens multilateral environmental agreements worldwide and another several dozens regional agreements, with roughly one-half of them pertaining to chemicals or radiation.

Diversity of values

Shared values are an important component of culture. The feeling of a loss of shared values is marked in today's society, according to Sandel 1996. It is combined with a fear that we, individually and collectively, lose control over the forces which govern our lives. In this setting, value judgements concerning risks become very important. The management of lack of knowledge is one example. Whole books have been published about the application of the precautionary principle, where the two extreme positions require corpses on the body before protective action, or action on very remote indications of risk for harming people or the environment. Another example pertains to the weighting of different components in the balance between the social, economic and environmental aspects of sustainable development, where for instance freedom often stands against public protection. The basic radiation protection principles reflect a way of adhering to such values as benevolence, efficiency and fairness. The chemical safety principles put a lot of weight on autonomy, stressing the need to make protection relevant information available, but also benevolence is clearly behind the principles. The interpretation of ethical values such as those just mentioned may differ strongly between different groups. A decision can best reflect the values of the stakeholders involved if these have the possibility to directly influence that decision.

Dealing with lack of knowledge, complexity and diversity of values

The review above shows that risk estimates are subject to substantial revision, and future increases in the risk estimates are likely. There is also much evidence of an increasing complexity in the risk management which supports the notion of expert operated a-centralised decisions (see above Central, de-central and a-central decision making). Some ways of dealing with uncertainty, complexity and diversity of values are given in the following table. A major review is given by Stirling 1999.

Radiation	Chemicals
<p>Uncertainty: The ICRP, for general cost-benefit analyses, states explicitly that in the absence of appropriate data for optimisation, a fairly arbitrary reduction factor may be applied to a limit.</p> <p>In scenario analyses, if the uncertainties are so large that it is not possible to distinguish between one option and another on the basis of collective doses, this should be stated. (IAEA 1986).</p> <p>Development of a radioactive waste disposal system should be stepwise (ICRP 1998)</p>	<p>Uncertainty: A margin of exposure in the range 10-1000 is applied to the exposure level at which no adverse effect on a human being has been observed. The factor is justified by uncertainties in extrapolation between species, enhanced individual sensitivity or synergistic effects.</p>
<p>Uncertainty: For low density ionising radiation, the no threshold linear dose-response relationship has been assumed for cancer and hereditary effects, probably meaning error on the side of precaution.</p>	<p>Uncertainty: The precautionary principle from Agenda 21 is vividly discussed as a tool for managing uncertainty, and applied for instance to support restrictions on marketing of chemicals. The chemical safety community is heavily biased towards threshold response</p>
<p>Uncertainty: For low frequency electromagnetic fields (e.g. power lines) Swedish authorities have elaborated a policy of local mitigating actions in the face of uncertainty about potential health effects (http://www.arbsky.se/press/1996/engtext.htm)</p>	<p>Uncertainty: A system for international burden-sharing for reducing the gaps in knowledge about inherent hazards from chemicals has been established and there is a discussion on closing the gap (http://www.who.int/ifcs/forum3/f3-finrepdoc/Priorities.pdf, item A3)</p>
<p>Complexity of analysis: Cost-benefit analysis may entail larger costs than justified by any potential savings of health risks from the analysis (IAEA 1988). In such a case, the analysis may be interrupted at an early stage and the assessed practice be left unregulated – it is already to be considered as being optimal. The level of detriment at which this exemption from regulation is justified corresponds to less than one case of cancer being induced per ten years of practice (a collective dose equivalent of less than 1 mansievert per year)</p>	<p>Complexity of analysis: In EU, some of the less hazardous biocides will be analysed according to a simplified procedure</p>
<p>Complexity of recommendations: Exemption levels are recommended from intervention against existing commodities and from sources within practices (ICRP 1999) at cancer risk levels around 100 and 1 cases per million population, respectively</p> <p>The present chair of the ICRP has proposed considerable simplifications in the concept used. His proposals around Controllable Dose have sparked a wide debate. (Clarke 1999)</p>	<p>Complexity of recommendations: A Threshold of Toxicological Concern has been discussed for chemical substances present in the diet, and intakes below 1.5 µg /person/d have been proposed to pose no appreciable risk (Kroes <i>et al.</i> 2000). Using a linear dose-response hypothesis, this implies a cancer risk level above 100 cases per million population for a few per cent of all carcinogenic substances</p>
<p>Complexity of exposures: Synergistic effects between radiation and other factors, e. g. chemical pollutants, has been studied to some extent</p>	<p>Complexity of exposures: Synergistic effects between various chemical pollutants have been extensively studied but the field is enormous.</p>

Radiation	Chemicals
Diversity of values: Since its Publication 81 (ICRP 1998), the ICRP (www.icrp.org) may seek wide consultation on its recommendations in progress.	Diversity of values: A major Dutch initiative on the management of chemical substances (SOMS) was set up to conclude in 2001 with negotiations between stakeholders on risk reductions (SOMS 2000)
	Diversity of values: The Intergovernmental Forum on Chemical Safety is working by dialogue among Participants including e.g. Industry NGO and Environmental NGO.

Science cannot be brought in to settle political disputes

The interplay of science and policy has been dealt with by for instance McQuaid 1999 and was recently the subject of a major US conference (<http://www.cnie.org>). Whether science has any role to play in controversial issues involving uncertainty has been challenged in works by David Collingridge and colleagues. In the book “Science speaks to power” (Collingridge and Reeve 1986), the opposite view is advanced. Science cannot be brought in to settle political disputes. On the contrary:

- science leads to bickering rather than agreement
- but this failure does not matter in policy making
- since the essential thing is to provide for correction of errors and maintain flexibility.

Collingridge and Reeve claim that no choices of policy are ever made which are sensitive to any scientific conjectures, and that no such choice ought to be sensitive to any scientific hypothesis. The reasons are that:

- policy demands interdisciplinary research that is difficult to reconcile with disciplinary rivalry
- the needs of policy can only with difficulty be catered for by science, and
- unanimity among scientists is rare and often unwelcome.

The claims forwarded are supported by discussions on two cases: whether smoking is carcinogenic or not, and potential subtle neurological impairment from lead exposure.

Another study arrives at similar conclusions with respect to the large- scale risk assessments for nuclear power (Kasperson and Kasperson 1987). Attempts at synoptic studies to evaluate the risks from nuclear power were made in the United States, Sweden, West Germany, the United Kingdom and Canada during the seventies. In follow-up studies some years later, the impact of the risk studies was evaluated. It was concluded that the risk studies have deeply and extensively influenced safety work in nuclear power, by influencing licencees and regulators. But it seems doubtful that the risk studies have been major political determinants anywhere. To take the example from the United Kingdom, established positions as pro-nuclear, pro-coal or pro-conservation have been important. “This political jockeying is far more influential in political contexts than the results of particular studies or public inquiries.” The study also seems to support the thesis above that “science leads to bickering rather than agreement”. The evaluation of the risk studies suggests that “different groups and perspectives invariably find evidence to support their claims”, and “ new risk issues often appear. Thus the characteristic net effect is to broaden the arena of debate.”

A word of caution is also in place regarding the role of researchers in a certain field who cross over to become policy analysts in a much broader field. In such cases, they have a moral obligation to declare that they are acting outside of their own field of competence.

Radiation protection and chemical safety in a perspective of sustainable development

In the following, some characteristics of the above-mentioned principles for radiation protection and chemical safety are discussed in relation to the above discussed, proposed objectives A-E for sustainable development.

A. *Maintaining the integrity of ecosystems through the efficient management of natural resources*

This objective deals with maintaining the integrity of ecosystems, staying within their capacity as sources and sinks. Measures include internalisation so that prices reflect the full external costs of natural resources.

Radiation	Chemicals
Sink capacity: For releases of carbon-14, a balance between supply to the environment and removal has been the basis for establishing upper limits for the installed capacity of nuclear power according to Swedish regulations (SSI FS 1991:5, see www.ssi.se)	Sink capacity: The concept of critical loads has been applied to find tolerable pressure on the environment. It has, however, been questioned whether there is not a sliding scale without clear threshold, requiring value judgement in establishing the critical load (Skeffington 1999)
Sink capacity: The natural flow of radioactive substances has been proposed as a yardstick for allowing much smaller long-term releases of radioactive substances to the environment (Bergman <i>et al.</i> 1987)	Sink capacity: According to the same criterion, severe restriction on the uses of several metals would be required (compare above: Basic principles of chemical safety, Exposures and effects)
	Sink capacity: Effects on other organisms than man, in particular reproductive effects, are common in the assessment of risks from chemicals but scenarios are crude
Source capacity: The radiation consequences of using up all available uranium for nuclear power have been calculated and found tolerable (NEA 2000)	Source capacity: The health and environmental consequences of continuing to mobilise substances at rates an order of magnitude higher than the natural ones have hardly been discussed. Chemical safety scenarios in technical guidance documents with the EU deal with local and regional exposures but no tools are available for dealing with the overlap from all sources in the world over long periods of time.
Internalisation of health and environmental costs: In the nuclear fuel cycle, costs for waste management (waste fee) and for potential accidents (insurance) are internalised; these are partly related to radiation protection requirements	
Internalisation of health and environmental costs: For radioactive releases, mitigating action is required to strike a balance between the internal costs of mitigation and the external costs of health and environmental effects (the ALARA principle)	

B. *De-coupling environmental pressures from growth in economic sectors*

This objective addresses consumption and production patterns. Increasing the availability of product and production process information should facilitate consumer choices. Again external costs should be internalised. Resource efficiency and too high growth in production and consumption should be addressed. Regulatory as well as voluntary measures should be applied. The sectors should integrate environmental concerns in their strategies, and particular attention should be paid to the agriculture, energy and transport sectors.

Well established measures for both radiation protection and chemical safety include licensing for the most hazardous practices, consideration of materials efficiency and waste minimisation, including reuse and recycling of materials, and more or less strict application of the Polluter Pays Principle. Mathematical modelling is extensively used both for dispersion of substances in the environment and for effects from ingested substances or incurred doses.

Radiation	Chemicals
Practice/Intervention: Control of new practices from the beginning is distinguished from intervention in existing situations, and exposure quantities accordingly defined (existing dose vs. additional dose) (ICRP 1999)	Practice/Intervention: Control of the marketing of substances that are new to the market is distinguished from control of the marketing of substances that exist in the market.
General consumption: Radioactive products for general consumption, such as smoke detectors, are extremely strictly limited (NEA 1985)	General consumption: An Integrated Product Policy is to be published by the EU in the spring of 2001 (http://europa.eu.int/comm/environment/ipp/home.htm)
Use patterns: The emphasis when deciding on restrictions is on risks, not inherent hazards. This means that expected exposures almost always form part of the background factors for decisions on protective measures.	Consumption patterns: The increasing volumes of chemicals in combination with their inherent hazards call for new strategies. There is room to complement the present direction to limit the inherently most hazardous chemicals by promoting strongly increased resource efficiency to reduce volumes significantly.
Sector integration: The role of nuclear energy in the energy sector has been thoroughly addressed (NEA 2000)	Sector integration: This is being elaborated in the EU as a high priority for sustainable development.
Product information ionising radiation: Strict rules including labelling apply for transport of radioactive materials: (http://www.iaea.org/ns/rasnet/programme/radiationsafety.htm#I.3%20Transport%20Safety) and for use of radiation in the workplace.	Product information: The safety system has as a cornerstone standardised criteria for providing information about hazards, for instance hazards to the aquatic environment, carcinogenicity or reproductive toxicity; standardised testing to establish accordance with the criteria; standardised labelling and symbols to convey judgements about test results.
Product information for lasers: The basic safety system relies on classification and labelling of lasers.	Notification to importing countries: A global convention (http://irptc.unep.ch/pic/) requires prior notification of importing countries for a few dozen hazardous substances
Choice of practice: One of three cornerstones for ionising radiation is Justification of practice: No practice should be adopted unless it produces sufficient benefit to the exposed individual or to society to offset the radiation detriment it causes.	Choice of chemical: The principle of comparative assessment is often applied: if possible, hazardous chemicals should be replaced by less hazardous ones. This leaves a lot of details in risk management to various actors involved with chemicals

Radiation	Chemicals
<p>Balancing protection and resource demand: One of three cornerstones for ionising radiation is Optimisation of protection: The magnitude of the individual doses, the number of people exposed, and the likelihood of incurring exposures where these are not certain to be received should all be kept as low as reasonably achievable, economic and social factors being taken into account. This leaves a lot of details in risk management to various actors involved with radiation.</p> <p>For the decision making, rules of thumb have been developed for the trade-off between costs of further protection and further reduction of radiation doses. The basis for the trade-off of radiation doses is the collective dose, i.e., the sum of the average doses in a population. The individual doses may also be involved in the trade-off. A monetary value, a, is assigned to the unit collective dose. If the cost of further collective dose reduction by one unit exceeds a, then the protection level is beyond the optimum. This may still have to be accepted to keep individual doses below the basic dose limits.</p>	<p>Life cycle analysis: Increasingly, the life cycle of practices is reviewed to ensure that risks from e.g. mining, oil extraction or waste management are not overlooked. This may include the study of alternative methods to obtain a given function, say the use of irradiation, natural fungi or chemical pesticides to reduce the amount of weeds in agricultural soils.</p>
<p>Voluntary commitments: The nuclear industry in applying optimisation often gives greater weight to protection than minimum requirements.</p>	<p>Voluntary commitments: The chemical industry has an extensive commitment worldwide called Responsible Care (http://www.icca-chem.org/), incorporating a responsibility also for what their customers do (Product Stewardship).</p>

C. Improving information for decision making: Measuring progress through indicators

Interim and long-term quantitative targets should be set for suitable indicators, and progress towards these targets should be monitored. Environmental information should be accessible for all citizens.

Radiation	Chemicals
<p>Indicators: Indicators have been developed to enable the aggregation of the dose to an individual from different sources (e.g. effective dose) and to a group of individuals (collective dose) (ICRP 1991).</p>	<p>Indicators: Indicators of progress are poorly developed. The total amount of pesticides sold is widely used, without risk weighting. Indices are being developed, e.g. concerning the use of pesticides (http://www.oecd.org/ehs/pest/PEST_RI.pdf). A few indicator substances are widely monitored, e.g. dioxins and polychlorinated biphenyls, in a few organisms, e.g. in marine animals.</p>
<p>Environmental quality: Objectives have been set to be compared with hypothetical future average exposures from all sources (ICRP 1991); based on harm to humans.</p>	<p>Environmental quality: Objectives are being proposed for substance levels in specific media, e.g. for water two or three dozen substances are likely to be covered (http://europa.eu.int/eur-lex/en/com/pdf/2000/en_500PC0047.pdf); based on harm to a few specific indicator organisms, mainly from local exposure scenarios.</p>

Radiation	Chemicals
<p>Environmental information: Internationally compiled state-of-the-art reports are published on sources and effects (UNSCEAR 2000). Much of the detailed basic information is also published nationally, e.g. for releases from nuclear power installations.</p>	<p>Environmental information: Internationally compiled state-of-the-art reports for specific substances often contain information on exposures and effects (see above: Basic principles of chemical safety: Exposures and effects). Making release information available is part of industry's voluntary commitment Responsible Care.</p> <p>In a few countries, and for a limited number of substances, emission registers have been established, sometimes call Pollutant release and transfer registers (PRTR, see http://www.oecd.org/ehs/prtr/index.htm). In a few countries, registers on chemical products entering the market are available, covering tens of thousands of products (lubricants, paints, glues etc) and many thousand substances (Kraft 1999)</p>

D. *The social and environmental interface: Enhancing human health, the quality of life, environmental justice and democracy*

In addition to the already extensively studied economic/environmental and economic/social interfaces, the social/environmental interface should be studied. This includes effects of environmental degradation on human health, civic society involvement in environmental issues, and the relation between environmental policies and social consequences such as employment, social inclusion and community development.

Radiation	Chemicals
<p>Effects on human health: The widely used indicators such as effective dose and collective dose are designed to protect human health (ICRP 1991). For new practices, the system has generally been effective. For intervention in already existing situations, there still remains much to be done, e.g. for radon in homes.</p> <p>The system is designed to account for:</p> <ul style="list-style-type: none"> • all exposures, in principle over all distances and all times • potential exposures which are not certain to occur • all sources, e.g. nuclear power and the use of radioactive substances in hospitals; a margin of exposure is allotted to allow for overlapping exposures • the most highly exposed individuals, represented by a hypothetical critical group. 	<p>Effects on human health: There is little overview of long-term human health effects, even those incurred from new substances which are permitted on the market. There is reason for concern about e.g. children's health (see above: Basic principles of chemical safety: Exposures and effects).</p> <p>For limited practices good health protection is ensured, such as food additives or pharmaceuticals, and some substances in occupational health.</p>

E. *Global environmental interdependence: Improving governance and co-operation.*

This objective deals with the management of environmental effects of globalisation through improved national and international environmental governance, including the incorporation of environmental concerns into international economic and financial institutions and agreements.

Corporations are encouraged to adopt higher standards of performance through non-binding instruments. Technical co-operation for policy and institutional frameworks in developing and transition countries is important.

Radiation	Chemicals
<p>Global co-operation: A peer-established body (International Commission on Radiological Protection) recommends widely accepted data and management practices for ionising radiation. See also above under Dealing with lack of knowledge, complexity and diversity of values.</p>	<p>Global co-operation: Intergovernmental bodies coordinate international work: IFCS and IOMC (see above: Basic principles of chemical safety: Historic development). See also above under Dealing with lack of knowledge, complexity and diversity of values.</p>
<p>International treaties: Many treaties at the regional or global level, e.g. on radioactive waste and nuclear safety. Often synoptic in character, e.g. agreement at the expert level on transboundary radiation exposure (IAEA 1985):</p> <ul style="list-style-type: none"> • policies and criteria for protection of populations outside national borders should be at least as stringent as those for the population within the country of release; • in any case, a minimum value (3000 USD at 1983 prices) should be applied for unit collective doses (in mansievert) appearing outside the national border. 	<p>International treaties: Many treaties at the regional or global level, e.g. on chemical waste, and limitation of transboundary releases. Generally incrementalistic in character, defining e.g. agreed percentage reductions in releases.</p>
<p>Export responsibility: Materials that could be used for production of nuclear weapons are subject to export restrictions.</p>	<p>Export responsibility: Materials that could be used for production of chemical weapons are subject to export restrictions.</p> <p>A global convention (http://irptc.unep.ch/pic/) requires prior notification of importing countries for a few dozen hazardous substances.</p>

Discussion

All-encompassing or small steps?

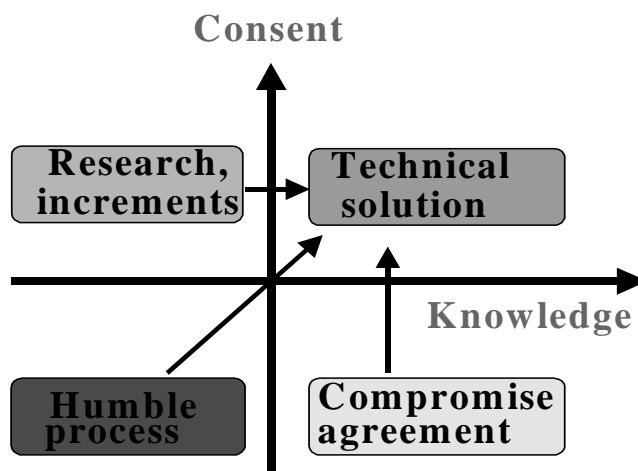
The synoptic approach dominates international recommendations on radiological protection but in the face of insurmountable complexities in the analysis, simplifications are introduced which resemble those which are deliberately accepted from the beginning in the incrementalistic approach. When the incrementalistic approach is accepted, as in the case of transboundary non-radioactive air pollution, it is sometimes in the hope that in due time a better approximation to a long-term synoptic goal will be realised.

In chemical safety, an incrementalistic approach has been necessary. Attempts at overview have been made, such as the creation of the Intergovernmental Forum on Chemical Safety and its work on global co-ordination. By this, chemical safety work fails in true prevention, and there is no system to manage the accumulated chemical exposures from all sources in a long-term perspective. A consequence is that contamination with long-lived chemicals is ubiquitous, with strong suspicions that we already see an adverse impact on children's health. Clearly, for sustainability chemical safety must assimilate the synoptic approach used for practices in radiation protection, and adopt it similarly to make it manageable.

Dealing with uncertainties

To deal with uncertainties, a clarifying matrix has been suggested by Douglas and Wildavsky (1982). They suggest that the management of risks should to a large extent depend on the knowledge about the future and the consent about the most desired prospects. Their suggested strategies are described in Figure 2.

Figure 2. **Management of uncertainty concerning knowledge and consent. See text A. to D. for explanation. Based on Douglas and Wildavsky (1982)**



- A. An engineering-like approach can be applied if there is good knowledge and complete consent, conditions which may prevail for simple problems involving limited circles of decision makers (upper right quadrant). Examples: Licensing for pesticides, for pharmaceuticals, for normal releases from nuclear power, and for sealed radiation sources in industry and hospitals; regulating radon in mines; phasing out of a few extremely hazardous chemicals, establishing handling rules.
- B. If the consent is lacking, the suggested solution is to stimulate discussions aiming at compromise solutions, or alternatively to apply coercion (lower right). Examples: Phasing out of common, well-known chemicals; defining radiation doses below regulatory concern.
- C. If instead the knowledge is lacking, research is advocated, in combination with careful step-by-step incremental decisions which permit reorientations if necessary (upper left). Surprisingly, there is unanimity in the form of little discussion about the myriad of practices employing thousands of chemicals with unknown properties. Had these practices employed radiation of similar potential levels of hazard (cancer, hereditary and reproductive injury etc.), the unanimity would likely have worked the other way round: a public outcry demanding more knowledge and further action. Examples: Classification and labelling of poorly known chemical substances, phasing out of poorly known chemicals when consequences are small; regulating endocrine disrupting substances; first introduction of microwave ovens; applying x-ray mammography screening.

- D. The most typical situation in controversies, however, is likely to be the fourth one, where the knowledge is lacking (lower left; compare the discussion above about uncertainties) and there are widely different views about the appropriate actions. Douglas and Wildavsky claim that only social consent keeps an issue out of contention. Risk taking and risk aversion, shared confidence and shared fears, are part of the dialogue on how best to organise social relations. Technological estimates of risk are not mirroring any objective truth, and other factors will govern the decisions, as illustrated above (section “Science cannot be brought in to settle political disputes”). If incrementalism is to be applied to the management of risks in this difficult situation of lacking information and lacking consent, it must be stressed that its merit is in providing processes for social interaction. This was the lesson learnt following the early work by Lindblom and Wildavsky in other contexts. Examples: Phasing out nuclear power, or chemicals when consequences are large; siting of nuclear waste repositories; applying protective measures against low frequency power lines; classification and labelling of chemicals when consequences are large; reducing radon levels in existing homes, where the controversy much deals with preferences not to take action.

Getting stakeholders involved

Finding the “social consent [that] keeps an issue out of contention” is the human undertaking since ages, and still there are no easy answers. Research in the management of practices involving risk has been extensive (Löfstedt and Frewers 1998). “Stakeholder participation” has been proposed as an important means to help reach controversial decisions. However, it has to be seen with considerable caution, as Roger E. Kasperson has eloquently explained (see special box on Risk and the Stakeholder Express). Participation in order to control changes in society may take place at many levels:

- **Central:** Elaboration of legislation in parliament and its implementation by government; in Swedish environmental law there is even some possibility for environmental organisations to appeal against judgments and decisions on permits, approvals or relaxations. To have a right of appeal an association must have conducted its operations in Sweden for at least three years and have at least 2 000 members. (See summary in http://www.kemi.se/default_eng.cfm?page=lagar_eng/default.htm)
- **Decentralised:** Elaboration of regulatory decisions by public authorities. This has been described, deliberately pointedly, by Trustnet (2000) as the Top-Down paradigm of risk governance: This is characterised by the dominant role of the Public Authorities in the risk assessment and management process as well as in the justification (usually implicit) of hazardous activities. Public Authorities govern by detailed problem oriented regulations. Aspects of the decision making process such as scientific uncertainty, objective conflicts, trade-offs, and residual risks are sometimes not disclosed to the public eye. Experts are asked to provide the Public Authorities with optimal solutions to the risk issue. Each stakeholder defends their specific interest while the Public Authorities are entrusted with the task of representing the general interest.
- **A-centralised:** Stakeholders make their own, non-regulatory interpretations of general environmental goals. Trustnet 2000 describes this in terms of The Mutual Trust paradigm of risk governance: This is characterised by a broad involvement of the stakeholders in the risk assessment and management process as well as in the justification of the hazardous activities. Public Authorities govern as much as possible by framework and process oriented regulations, including a broad participation of the concerned stakeholders. Decision-making is decentralised as much as possible to the

relevant local context. Science is no longer presented to the public as an exclusive determining factor in the decision making process. Expertise becomes pluralistic and available to all parties involved. The Mutual Trust paradigm gives room for open political processes involving the concerned stakeholders to justify the activities giving rise to social concerns in the relevant context.

With increasing complexity, a-centralised decision-making is likely to become a growing complement to the centralised and decentralised ones. As mentioned before (Central, de-central and a-central decision making), certain requisites should be met if this particular form of social involvement is to have democratic legitimacy.

There are, however, many difficulties also in attempting to find stakeholder involvement whether in centralised, decentralised or a-centralised decision making, just as democracy in general is hard to practise and easy to lose. The participatory nature of the Intergovernmental Forum on Chemical Safety was mentioned above. Its success can be exemplified by the recent conclusion of a global agreement to severely restrict the use of twelve hazardous chemicals (persistent organic pollutants, POPs) (<http://irptc.unep.ch/pops/princ5.htm>). This was preceded by reasonably good agreement between governments, industry, public interest groups and others. Success, however, rests on fragile ground. Keeping up communication at the global level is very difficult because of resource constraints – true dialogue must have person-to-person elements which are costly. Already at the national level, public interests groups are often weak and unstable. For them to set aside resources for international work is quite demanding. Priorities must be set between concrete projects such as supporting joint efforts for release limitations in a developing country, or participating in abstract co-ordination work at the global level. It is easy to imagine that funding comes easier for the more concrete co-operation projects.

Risk and the Stakeholder Express

“Currently, we are on the stakeholder-involvement express, barrelling down the rails of well-intentioned but often naïve efforts to address growing public concerns over risks, changed public expectations over the functioning of democratic institutions, and historic declines in social trust in those responsible for protecting public safety. ...implicit throughout is the notion that broad public involvement, if achieved, is the principal route to improved decision making, especially where the risks are controversial and disputed. Other outcomes that can be expected, it is claimed, are increased trust in experts and decision makers, greater consensus among publics, reductions in conflict and opposition, greater acceptance of the project or proffered solution, and ease in implementation. The list is, of course, revealing as to whose interest is really at stake in many stakeholder processes.left out, meanwhile, are those who do not yet know their interests are at stake, whose interests are diffuse or associated broadly with citizenship, who lack skills and resources to compete, or who have simply lost confidence in the political process.... and how to draw them into deliberative processes has been the enduring project of democratic theorists over the past century.

...participatory effectiveness is a learned skill that requires resources, it is cumulative and long-term in nature, it is cultural in that it requires participatory domains in the various spheres of one’s life (family, community, social networks, work, etc.). Similarly, social trust is a phenomenon built through socialization over many years into society and polity and further developed or modified as the result of unfolding encounters with authority, political processes, and outcomes of participatory experience.

...we know relatively little about which participatory interventions are likely to be successful, or even what success means, in different communities and social settings. Clearly, success is not smoothing the way for experts or proponents to achieve agency or project goals but entails deeper questions as to what the process does for a community’s or individual’s capabilities to deal with the next issue that comes along, the scope of the outcomes (positive and negative) achieved, the extent to which those stakeholders involved communicate with constituents, and how these stakeholder efforts support, rather than usurp, the established political process and elected officials.

...But perhaps it is time to put the brakes on the current stakeholder express, or to switch to the local, so that these processes become much more reflective and self-critical, that they are goal – not technique – driven, that they are rigorously evaluated by independent parties, that potential abuses (e.g., kicking controversial issues to publics) are controlled, and that they are accountable to and collaborative with those in whose name the experiments are mounted.”

Roger E. Kasperson (Excerpts from Fourth quarter 2000 issue of RISK Newsletter
<http://www.sra.org/news.htm>)

Conclusions

The human practices involving radiation and chemicals should concur with sustainable development objectives. The purposes of radiation protection and chemical safety are to ensure that protection of health and the environment is given sufficient weight when the balance is sought between the social, economic and environmental dimensions of sustainable development. This paper has examined to what extent such balance is addressed in about 60 examples of principles and implementation.

To give a couple of examples, in radiation protection, control of new practices from the beginning is distinguished from intervention in existing situations. In both radiation protection and chemical safety, control of practices as well as interventions is used, but radiation protection has come much further in controlling practices, with e.g. due regard taken to the capacity of sinks to absorb pollution. For nuclear power, costs of environmental pollution, waste management and accidents are to a high degree internalised, partly following pressure from the radiation protection community, whereas there are only limited examples of the corresponding for chemicals. Important facets of chemical safety include attempts at systematically dealing with effects on other organisms than man, and in particular, the importance of reproductive disturbances is interesting as a lead to potential radiation effects on the environment. In chemical safety, there seems to be wider acknowledgement of the importance of allowing for a diversity of value judgements in risk management. Export of "strong" chemical sources is regulated whereas the corresponding does not hold for strong radiation sources.

Modern radiation protection and chemical safety are often highly complex and require the management of uncertainties. Reduction of such complexity to simpler rules of thumb, which can be applied by a wide range of stakeholders, will be increasingly important. Securing social consent to resolve important issues of importance for social and economic aspects of sustainable development is a never-ending task. It must take due account of environmental and health aspects such as those of radiation protection and chemical safety. Their centralised and decentralised systems must increasingly be supplemented by systems which are a-centralised in character.

References

- Bengtsson, G. Integration of economic and other aspects in decisions to regulate genotoxic substances. In Proceedings Symposium on Management of risk from genotoxic substances in the environment, Stockholm 3-6 October 1988. National Chemicals Inspectorate, Solna 1988.
- Bengtsson, G. Consequences of the new ICRP recommendations in Sweden. Proceedings, Netherlands Society for Radiological Protection, 30th Anniversary Congress, 4-5 October, 1990. NVS-Publikatie nr.16, 1991.
- Bergman, C.; Boge, R. *et al.* Acceptance criteria for disposal of high level radioactive waste. In The geological disposal of high level radioactive waste (Ed. D. G. Brookins). Theophrastus publications. S.A., Athens 1987.
- Braybrooke, D. and Lindblom, C.E. A strategy of decision: Policy evaluation as a social process, pp 47-57, Free press, New York 1963.
- CEC. Commission Working Document, Report on the Operation of Directive 67/548/EEC, Directive 88/379/EEC, Regulation (EEC) 793/93 and Directive 76/769/EEC, SEC(1998)1986 final. Commission of the European Communities, Brussels 1998.

Clarke, R.E. Control of low-level radiation exposure: time for a change? *Journal of radiological protection* 19, 107-115, 1999.

Collingridge, D. and Reeve, C. *Science speaks to Power. The role of experts in policy making.* Francis Pinter (Publishers), London 1986.

Douglas, M. and Wildavsky, A. *Risk and culture.* University of California Press, Berkeley 1982.

European Environment Agency: *Environment in the European Union at the turn of the century. Environmental Assessment Report 2,* European Environment Agency, Copenhagen 1999a.

European Environment Agency: *Chemicals in the European environment: Low doses, high stakes? The EEA and UNEP annual message 2 on the state of the environment.* The European Environment Agency, Copenhagen 1999b.

Granath, F.; Vaca, C.E.; Ehrenberg, L.G. and Törnqvist, M.Å. Cancer risk estimation of genotoxic chemicals based on a target dose and a multiplicative model. *Risk Analysis* 19, 309-320, 1999.

Hansson, S.O. *Setting the limit. Occupational health standards and the limits of science,* p.25 and p.77, Oxford University Press, New York 1998.

IAEA: International Atomic Energy Agency: *Assigning a value to transboundary radiation exposure.* IAEA Safety Series No. 67. IAEA, Vienna 1985.

IAEA: International Atomic Energy Agency: *Principles for limiting releases of radioactive effluents into the environment.* IAEA Safety Series No. 77. IAEA, Vienna 1986.

IAEA: International Atomic Energy Agency: *Principles for the exemption of radiation sources and practices from regulatory control.* Safety Series No. 89. IAEA, Vienna 1988.

ICRP Publication 60, *1990 Recommendations of the International Commission on Radiological Protection.* Annals of the ICRP 21 No. 1-3, 1991.

ICRP Publication 81, *Radiation protection recommendations as applied to the disposal of long-lived solid radioactive waste.* Annals of the ICRP 28 No. 4, 1998.

ICRP Publication 82, *Protection of the public in situations of prolonged radiation exposure.* Annals of the ICRP 29 Nos. 1-2, 1999.

Jacobson, J.L. and Jacobson, S.W. Intellectual impairment in children exposed to polychlorinated biphenyls in utero. *The New England Journal of Medicine* 335 , 783-789, 1996.

Jacobsson, Bengt. *Europa och staten. Europeiseringens betydelse för svensk statsförvaltning. (Europe and government. The significance of europeisation for Swedish governmental administration).* (In Swedish). SOU 1997:30. Fritzes, Stockholm 1997.

Jordan, A. and O'Riordan, T. The precautionary principle in contemporary environmental policy and politics. In Chapter I pp. 15-35 of Carolyn Raffensperger and Joel Tickner (Eds.): *Protecting public health and the environment. Implementing the precautionary principle.* Island Press, Washington DC 1999.

Kasperson, R.E. and Kasperson, J.X. (eds.): *Nuclear risk analysis in a comparative perspective. The impact of large-scale risk assessment in five countries.* Allen and Unwin, Boston 1987.

- Kraft, J. A comparison of the Nordic product registers. Report Tema Nord 1999:586. Nordic Council of Ministers, Copenhagen 1999.
- Kroes, R.; Galli, C.; Munro, I.; Schilter, B.; Tran, L-A.; Walker, R. and Würtzen, G. Threshold of toxicological concern for chemical substances present in the diet: A practical tool for assessing the need for toxicity testing. *Food and chemical toxicology* 38, 255-312, 2000.
- Lindblom, C.E. The science of "Muddling through". *Public Administration Review* Vol. 19 p.79-88, 1959.
- Lindblom, C.E. Still muddling, not yet through. *Public Administration Review* Vol. 41 p.517-26, 1979.
- Löfstedt, Ragnar och Frewers, Lynn: Introduction to the Earthscan Reader in Risk and Modern Society, sid. 3-27. Earthscan, London 1998.
- Lönngren Rune: International approaches to chemicals control. A historical overview. ISBN 91-7932-032-5. Kemikalieinspektionen, Stockholm 1992.
- McQuaid, Jim: Policy issues arising from the judgmental nature of risk-based decision making. In *Risk Analysis: Opening the Process*. Proceedings of the 8th Conference of the Society for Risk Analysis Europe, Paris, Oct 10-14 1998. Editors: Philippe Hubert and Claire Mays. Fontenay aux Roses: IPSN, 1999.
- NEA. A guide to controlling consumer products containing radioactive substances. Nuclear energy agency, Organisation for economic co-operation and development, Paris 1985.
- NEA. Nuclear Energy in a Sustainable Development Perspective. Nuclear energy agency, Organisation for economic co-operation and development, Paris 2000.
- Nordic Risk Reduction Project: Personal communication, project leader Lolo Heijkenskjöld loloh@kemi.se, 2001.
- NRC: Science and judgment in risk assessment. Washington D.C., National Academy Press 1994.
- OECD. The OECD report on regulatory reform. Synthesis. OECD Paris 1997, reprinted 1998.
- Patandin, S.; Lanting, C.I.; Mulder, P.G.H.; Boersma, E.R.; Sauer, E.J.J. and WeisglasKuperus, N. Effects of environmental exposure to polychlorinated biphenyls and dioxin on cognitive abilities in Dutch children at 42 months of age. *The Journal of Pediatrics* 1345, 33-41, 1999.
- Paterson, John. The social governance of risk: Some indications from the field of regulatory reform. Paper presented at Trustnet Seminar, Paris 23-24 October 1997. John Paterson, Centre de Philosophie du Droit, Louvain-la-Neuve, Belgien 1997.
- Sandel, Michael J. Democracy's discontent. America in search of a public philosophy. Harvard University Press 1996.
- Sjöberg, Lennart, af Wåhlberg A och Kvist, P: The rise of risk: Risk related bills submitted to the Swedish parliament in 1964/65 and 1993/95. *Journal of Risk Research* Vol 1, 191-195, 1998.
- Skeffington, R.A. The use of critical loads in environmental policy making: A critical appraisal. *Environmental Science and Technology* 1 June, 1999, 245A-252A.

SOMS. Strategy on management of substances. CD record with all documentation, Ministry of housing, spatial planning and the environment, The Hague November 2000.

Sternier, T. The Selection and Design of Policy Instruments. A book to be published by RFF Press, Resources for the Future, Washington in collaboration with the World Bank. Forthcoming 2001.

Stewart, P.; Reihman, J.; Lonky, E.; Darvill, T and Pagano, J. Prenatal PCB exposure and neonatal behavioral assessment scale (NBAS) performance: *Neurotoxicology and Teratology* 22, 21-29, 2000.

Stirling, A. On science and precaution in the management of technological risk. Synthesis report for a project for the EC Forward Studies Unit under the auspices of the ESTO network. 55p. May 1999. Brighton: SPRU 1999 <ftp://ftp.jrc.es/pub/EURdoc/eur19056en.pdf>.

Trustnet. The TRUSTNET Framework: A New Perspective on Risk Governance. Project report EUR 19136 EN. European Communities, Luxembourg 2000.

UNSCEAR. Sources and effects of ionizing radiation : UNSCEAR 2000 report to the General Assembly, with scientific annexes / United Nations Scientific Committee on the Effects of Atomic Radiation. Vol. 1: Sources. Vol. 2: Effects. New York : United Nations, 2000.

van Leeuwen, C.J. and Hermens, J.L.M.: Risk Assessment of Chemicals: An Introduction. Kluwer Academic Publishers, Dordrecht 1995.

Wallström, M. Companies and the environment – the end of antagonism. Speech/00/474. Conference organised by MEPs Mrs. F. Grossetête and D. Bowe, Brussels 28 November 2000. Office of the European Commissioner for Environment, Commission of the European Communities, Brussels 2000.

Zeiger, E. and Margolin, B. The proportions of mutagens among chemicals in commerce. *Regulatory toxicology and pharmacology* 32, 219-225 (2000).

SESSION 4

The Evolving Role of International Expertise in Structuring the System of Radiation Protection

Chair: A. Sugier

INTRODUCTORY REMARKS

A. Sugier

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It's my pleasure to introduce our subject, "the evolving role of international expertise".

I will first say a few words about the meaning of expertise and why do we need an international consensus. Then I will stress the role of the international bodies. And finally, I will give some examples showing that, for some important issues, international bodies have failed to meet the expectations of the public.

Expertise generally means giving advice for decision making, not decision making itself,

Advice is related to two kinds of issues:

- What are the risks?
- What rules can be set up to protect the public and the environment and how can the rules be applied?

It is frequently assumed that the first stage is science and the second regulation. In fact, there is science and appreciation in both.

- In risk assessment, use is made of epidemiology and radiobiology. But these alone are not sufficient: It is necessary to extrapolate and this gives rise to debate.
- To determine the rules and how they are to be applied, it is necessary to identify the different components of the risk, and model transfer through the environment and the body. For instance you must validate the models. This also gives rise to debate.

What international bodies can provide is a broader forum of debate:

- By centralising the results of research.
- By avoiding being influenced by lobbies.

In radiological protection – our field of interest – from the very start, the tendency has been to share knowledge and draw common conclusions from it. This was not the case for nuclear safety.

As there is some level of appreciation in the expertise it is important to put in light what comes from extrapolation. Thus, the need for international bodies is evident.

Although there is some overlapping in their missions we can say that:

- the scientific aspects are the responsibility of the United Nations Scientific Committee (UNSCEAR);

- the doctrine on radiological protection has been gradually established by the International Commission for Radiological Protection (ICRP);
- practical implementation in the different fields of use of ionising radiation has essentially been developed by international agencies and organisations.

In addition, the professional societies of radiation protection grouped in an international partnership (IRPA), play a growing role in the consultation process.

In this session, I will give the floor to the three main protagonists: ICRP, UNSCEAR and IRPA.

Let me come now to the third point: the controversial issues and how they can eventually influence the evolution of the role of the international bodies. The time is well chosen, as we are at a turning point in the history of radiological protection:

- we have a century of use of radiation behind us,
- the effectiveness of the radiological protection system is evident.

However, it is also necessary to recognise a certain number of difficulties these last years.

There are three controversial issues that I would like to mention:

- prolonged exposure in contaminated lands;
- the protection of future generations in the context of the disposal of radioactive waste;
- the dispersal of very low level radioactive material in consumers goods.

In each case, all the principles of radiological protection have been seriously called into question:

- (a) Why can't the dose limit for the public be used as a criterion for the return to a normal situation after an accident?
- (b) How can we reasonably say that we can predict what will happen more than 100 years from now? Which means, how can future generations be considered to be protected against releases from waste?
- (c) What are the uncertainties associated with risk and dose factors? Is conservativeness guaranteed if a linear relationship is applied?
- (d) What has been scientifically established concerning chronic exposure to low doses? Isn't it better to seek to have a zero release, and to protect the environment choosing the B.A.T?
- (e) What do realistic exposure and critical group concepts signify? How can individuals with non-standard behaviour be protected?
- (f) Justification is not really used, even though it should be the basis of acceptance of any activity involving a risk.

How can these questions be answered? How can the system evolve without sacrificing what has made it successful?

THE ROLE OF ETHICS AND PRINCIPLES

R.H. Clarke
Chairman, ICRP

Abstract

There has been a hundred-year history of the uses of radiation in medicine and industry. Throughout that time there has also been advice on the need to protect people from the hazards associated with exposure. This paper traces the evolution of protection standards through the differing phases that are identified. These phases reflect changes both in scientific understanding of the biological effects of exposure and of the social and ethical standards to be applied. As a result, the principles used for protection have continuously evolved and are likely to continue to do so in the future.

Introduction – The Early Phase

Roentgen discovered x-rays in 1895, and in 1896 Grubbé described x-ray dermatitis of hands in the first paper to appear reporting radiation damage to the skin of the hands and fingers of the early experimental investigators. On the 12 December 1896, the American journal, *Western Electrician*, contained a paper by one Wolfram Fuchs giving the first protection advice. This was:

- (a) make the exposure as short as possible;
- (b) do not stand within 12 inches (30 cm) of the x-ray tube; and
- (c) coat the skin with Vaseline and leave an extra layer on the area most exposed.

Becquerel's identification of the phenomenon of radioactivity, also in 1896, and the Curie's separation of radium in 1898 led to it being used soon after, together with x-rays, for therapy. In the next ten years, several hundred papers were published on the tissue damage caused by radiation.

In 1913 the Deutsche Roentgen Gesellschaft issued radiological protection advice and in 1915 the British Roentgen Society recognised the hazards of x-rays in a warning statement. Several countries were actively reviewing standards for safety by the start of the First World War, but it was not until 1925 that the International Congress of Radiology was formed and first met to consider establishing protection standards. This Congress established the "International x-ray and Radium Protection Committee" in 1928, which evolved into the present International Commission on Radiological Protection (ICRP).

The early recommendations were concerned with avoiding threshold (deterministic) effects, initially in a qualitative manner. A system of measurement or dosimetry was needed before protection could be quantified and dose limits could be defined. In 1934 recommendations were made implying the concept of a safe threshold (ICRP, 1934):

"Under satisfactory working conditions a person in normal health can tolerate exposure to x-rays to an extent of about 0.2 roentgens per day."

This would be about ten times the present annual dose limit. The tolerance idea continued for the next two decades so that in 1951 the statement (ICRP, 1951) is still found that:

"The figure of 2 r per week seems very close to the probable threshold for adverse effects."

This led to a proposed limit of 0.3 r per week for low-LET radiation. In considering neutrons and alpha-particles, it was stated that

"Anaemia and bone damage appear to have a threshold at 1 μ Ci Ra-226."

Conclusions from the early phase, 1900-1960

For the first 60 years after the discovery of ionising radiation, the ethical position was to avoid deterministic effects in occupational exposures and the principle of radiological protection was to keep INDIVIDUALS below the relevant THRESHOLDS. Low doses of radiation were deemed beneficial, largely because the uses of radiation were for medical purposes, and radioactive consumer products abounded.

Carcinogenic Effects – The Middle Phase

A change in philosophy was brought about by new biological information that began to emerge in the mid-1950s. There was the epidemiological evidence of excess malignancies amongst American radiologists, and the first indication of an excess of leukaemia cases in the survivors of the atomic bombings at Hiroshima and Nagasaki. Previously there had been only deterministic effects, where the severity of the effect is directly proportional to the size of the dose, and above a certain threshold dose the effect is almost certain to appear. Now there were **Stochastic Effects** where the probability of the effect, not the severity, is proportional to the size of the dose.

The threshold was rejected. The problem had become one of limiting the probability of harm and much of what has subsequently developed related to the estimation of that probability of harm and the decision on what level of implied risk is acceptable or, more importantly, unacceptable. In the 1955 recommendations ICRP first began to address this question of acceptability (ICRP, 1955). It was said that since no radiation level higher than natural background can be regarded as absolutely safe, the problem is to choose a practical level that, in the light of present knowledge, involves a negligible risk. Maximum permissible doses should be set so as to involve a risk which is small compared with other hazards in life' and

“In view of the incomplete evidence on which the (risk) values are based coupled with the knowledge that some effects are irreversible and cumulative... it is strongly recommended that every effort be made to reduce exposure to all types of ionising radiation to the **lowest possible level.**”

There was then a prolonged debate over how to deal with the acceptability of the risks. In Publication 1 (ICRP, 1959), the words “lowest possible” were succeeded by “**as low as practicable**” and by 1966 had become “**as low as is readily achievable**” (ICRP, 1966). The Commission used these words so as to include social and economic considerations. Other considerations, such as ethical ones, were not excluded by this wording, but the Commission considered them included in the adjective “social”. In Publication 22 (ICRP, 1973), the adverb “**readily**” was replaced by “**reasonably**”.

The 1977 Recommendations (ICRP, 1977) set out the new system of dose limitation and introduces the three principles of protection in paragraph 12.

“No practice shall be adopted unless its introduction produces a positive net benefit.

All exposures shall be kept as low as reasonably achievable, economic and social factors being taken into account.

The doses to individuals shall not exceed the limits recommended for the appropriate circumstances by the Commission”

These principles are known as **Justification, Optimisation** (or **ALARA**) and **Limitation**.

The recommendations were much concerned with the bases for deciding what is reasonably achievable in dose reduction. The principles of justification and optimisation aim at doing more good than harm and at maximising the margin of good over harm for Society as a whole. They therefore satisfy the **utilitarian principle of ethics**, whereby actions are judged by their overall consequences,

usually by comparing in monetary terms the relevant benefits (e.g. statistical estimates of lives saved) obtained by a particular protective measure with the net cost of introducing that measure.

Paragraph 72 of Publication 26 suggests that the decision on what is ALARA depends on the answer to the question:

“Is the Collective Dose sufficiently low that further reduction in dose would not justify the incremental cost required to accomplish it?”

Paragraph 75 then recommended the use of differential cost-benefit analysis where the independent variable is the Collective Dose and recommended that there be assigned a monetary value to a unit of Collective Dose.

In 1977 the establishment of the dose limits was of secondary concern to the cost-benefit analysis and use of collective dose. This can be seen in the wording used by ICRP in setting its dose limit for members of the public. Publication 26 states:

“The assumption of a total risk of the order of 10^{-2} Sv⁻¹ would imply restriction of the lifetime dose to the individual member of the public to 1 mSv per year. The Commission’s recommended limit of 5 mSv in a year, as applied to critical groups, has been found to give this degree of safety and the Commission recommends its continued use.”

In a similar manner the dose limit for workers was argued on a comparison of average doses and therefore risk in the workforce with average risks in industries that would be recognised as being “safe”, and not on maximum risks to be accepted.

Conclusions from the middle phase (1960-1990)

Throughout the second period of protection, the Commission was dealing with stochastic risks where the probability of harm was proportional to dose. The question had become one of acceptability of risk, since there was no threshold below which there was zero risk. This acceptability was determined by what was “As Low AS Reasonably Achievable” and the utilitarian ethical approach was used. In essence the principle was:

Protect SOCIETY and the INDIVIDUAL will be adequately protected.

The principles were based on cost-benefit analysis using Collective Dose and individual protection by dose limits was of secondary concern.

Increases In Risk Coefficients – The Current Phase

During the 1980’s there were re-evaluations of the risk estimates derived from the survivors of the atomic bombing at Hiroshima and Nagasaki, partly due to revisions in the dosimetry. The risks of exposure were claimed to be higher than those used by ICRP and pressures began to appear for a reduction in dose limits. This represented the start, as now seen with hindsight, of the rise of the concern over the individual. The ICRP response was initially to emphasise the principle of OPTIMISATION and to claim that the use of collective dose and cost-benefit analysis always ensured that individual doses were sufficiently low.

However by 1989 ICRP had itself revised upwards its estimates of the risks of carcinogenesis from exposure to ionising radiation. In 1990 it adopted new recommendations for a “**system of radiological protection**” (ICRP, 1991) to replace the earlier recommendations, upon which ICRP had been building since they first appeared in Publication 26 (ICRP, 1977).

The principles of protection recommended by the Commission were still based on the general principles given in Publication 26, but with important additions:

- No practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes. (**Justification**)
- In relation to any particular source within a practice, the magnitude of individual doses, the number of people exposed, and the likelihood of incurring exposures where these are not certain to be received should all be kept as low as reasonably achievable, economic and social factors being taken into account. This procedure should be **constrained by restrictions on the doses to individuals** (dose constraints), or on the risks to individuals in the case of potential exposures (risk constraints) *so as to limit the inequity likely to result from the inherent economic and social judgements*. (**Optimisation**)
- The exposure of individuals resulting from the combination of all the relevant practices should be subject to dose limits, or to some control of risk in the case of potential exposures. These are aimed at ensuring that no individual is exposed to radiation risks that are judged to be unacceptable from these practices in any normal circumstances. (**Limitation**)

The most significant change was in the principle of optimisation and the introduction of the concept of a constraint. Optimisation is a source-related process while limits apply to the individual to ensure protection from all sources under control. The aim of dose limitation is to ensure that no individual is exposed to an unacceptable level of risk. The constraint is an **individual-related criterion**, applied to a single source in order to ensure that the most exposed individuals are not subjected to undue risk. Classical cost-benefit analysis is unable to take this into account, so the Commission established an added restriction on the optimisation process.

In the 1990 Recommendations, the ALARA requirement was renamed the optimisation of protection, with no intended change of meaning. In fact, however, the loss of the word “reasonably” and the introduction of “optimisation” overemphasised the use of differential cost-benefit analysis and collective dose. In Publication 77 (ICRP, 1998) the Commission weakened the link to cost-benefit analysis and collective dose.

Thus concern for the protection of the individual was being strengthened. This is a reflection of changing Societal values with more concern about individual welfare, as is demonstrated by the increased desire for litigation – someone else must be to blame, not the individual themselves. Another example would be the refusal by increasing numbers of parents to accept childhood vaccinations because of the fear of deleterious reactions from the vaccine although there are greater risks overall from the disease.

Conclusions from the current phase (1990-)

The principles on which recommendations from ICRP have been made in the last ten years have resulted in controls on **the maximum dose or risk to the individual**. There has been a

corresponding reduction in the emphasis on collective dose and cost-benefit analysis Overall this reflects a shift of the ethical position **from utilitarian values**.

A Look At The Future – The Next Phase

The existing system of protection, set out in the 1990 Recommendations (ICRP, 1991), was developed over some 30 years. Over this period, the system became increasingly complex as the Commission sought to reflect the many situations to which the system applied. This complexity involves the justification of an endeavour, the optimisation of protection, including the use of constraints, and the use of individual dose limits. It has been necessary to deal separately with endeavours and intervention and to apply the recommendations to occupational, medical, and public exposures. This complexity is logical, but in some respects it has been difficult to explain the variations between different applications. The Commission may hope to make the new system more coherent and less confusing, but it is not likely to be very much simpler.

The initial proposals

An outline of the proposed system has already been issued by the Commission (Clarke, 1999) but this outline needs expansion before it can be seen as a proposal.

In protecting individuals from the harmful effects of ionising radiation, it is the controllability of radiation doses that is important, no matter what the source. In most situations, the most effective controls are those applied at or near the source of radiation. In the first place, therefore, consideration should be given to the dose to an individual from a particular source.

The doses may be received at work, in medical practice, in the environment from the use of artificial radionuclides, or from natural sources such as cosmic rays and long lived radionuclides in the earth's crust. The doses may have already been received, or will be received in the future, from the introduction of new sources or following an actual or potential accident.

The first consideration in the proposed system of protection is to limit the dose to each individual from each controllable source. **The need for protective action is influenced by the individual dose, but not by the number of exposed individuals.** The second consideration stems from the recognition that there is likely to be some risk to health, even at small doses. There is then a moral requirement to take all reasonable steps to restrict the exposures from each controllable source.

In the past, the Commission used these considerations, but in the reverse order. It adopted a societal/ethical policy using a **utility-based** criterion, aimed at determining the optimum deployment of resources applied to the control of a source. However, since it does not necessarily provide sufficient protection for each individual, the Commission now considers the application of a different ethical approach, sometimes **called deontological or equity-based ethics**, which start with the premise that all individuals have unconditional rights to certain levels of protection. The new proposals are based on the same ethical policy.

The structure of the proposed system of protection

The current proposals for the form of the system of protection start from the justification of an endeavour. Until justification has been established, there is no need to apply a system of protection. The proposed system of protection starts from a generalised structure of individual doses linked to recommended **Protective Action Levels**. At exposures above an action level, there is an implicit requirement to consider what action is feasible to reduce doses. Below the action level, there is a necessary, but less prescriptive, requirement to take all reasonable steps to achieve further reductions in individual doses. They are influenced by the type of action and by the type of exposed individual. This necessitates a number of such levels.

The medical exposure of patients introduces a different procedure. The principal aim of medical exposures is to do more good than harm to the patient, subsidiary account being taken of the radiation detriment from the exposure of the radiological staff or of other patients. Provided that the necessary resources are available, the responsibility for the justification of a particular procedure falls on the relevant medical practitioners.

This structure emphasises the protection of the individual. To this are added requirements to provide as good a level of protection as reasonable for society.

Optimisation of protection is now modified to introduce more general considerations and less mathematical formality. The Commission's intention is to use optimisation to achieve the best level of protection under the prevailing circumstances, social and economic factors being taken into account. The initial proposals, (Clarke, 1999), suggested that the optimisation of protection as it is now usually understood should be replaced by a different requirement to ensure that the residual doses, after the application of the protective action levels, should be kept "**as low as reasonably practicable**".

One procedure for judging that the doses are as low as reasonably practicable would involve the comparison of a number of feasible protection plans. The comparison would aim at selecting the plan where the step to the plan next in stringency would result in an improvement insufficient to offset the increase in resources needed to take the step. The current plan could then be said to result in exposures that are as low as reasonably practicable. The choice would be dependent on judgement rather than on collective dose.

In most situations, the value of the product or service provided by the endeavour is not significantly influenced by the choice of a protection plan. In the medical exposure of patients, the effectiveness of the treatment or diagnosis is strongly affected by the dose to the patient. The choice of protection plan must then take this into account.

Conclusions

This paper has described the evolution of the ethical basis and principles of protection over the last one hundred years and identified issues involved in the development of the next generation of recommendations from ICRP.

Initially when there were only deterministic effects of radiation to be considered, the principle for protection was to keep below the relevant thresholds. Once the stochastic effects of

radiation exposure were identified, protection developed to ensure risks were 'acceptable'. The first approach was to adopt utilitarian ethics and the principles were based on the classical cost-benefit analysis utilising collective dose. The inability of the system of utilitarian ethics to account for the inequalities of the distribution of risks and benefits across society led, increasingly, to emphasis on individual protection.

For the future, ICRP is considering an individual-based philosophy using a deontological or equity-based ethical approach. The principle would be the concept of controllability of sources. The system of protection would then require that exposures subject to control are first justified and then restricted by individual-based Protective Action Levels. There still remains a requirement to do all that can be done to make exposures as low as reasonably practicable below the Protective Action Levels.

This system could have advantages by being similar to the methods used to control other non-radioactive pollutants, thus offering the potential for an integrated policy. It may also allow the development of a straightforward philosophy for protection of the environment and species other than humans from radiation damage.

References

- Clarke, R.H. (1999). Control of low-level radiation exposure: time for a change? *J.Rad. Prot.* **19** (2).
- ICRP, (1934) International recommendations for x-ray and radium protection. *Br. J. Rad.* 7: 1-5.
- ICRP, (1951) International recommendations on radiological protection. *Br. J. Rad.* 24: 46-53.
- ICRP, (1955) Recommendations of the ICRP. *Br. J. Radiol. Suppl.* No. 6.
- ICRP, (1959) Recommendations of the ICRP. Publication 1. Pergamon Press, Oxford, UK.
- ICRP, (1966) Recommendations of the ICRP. Publication 9. Pergamon Press, Oxford, UK.
- ICRP, (1973) Implications of Commission Recommendations that Doses be kept as Low as Readily Achievable. Publication 22, Pergamon Press, Oxford, UK.
- ICRP, (1977) Recommendations of the ICRP. Publication 26. *Annals of the ICRP* 1 (3).
- ICRP, (1991) 1990 Recommendations of the ICRP. Publication 60. *Annals of the ICRP* 21 (1-3).
- ICRP, (1998) Radiological protection policy for the disposal of radioactive waste. Publication 77. *Annals of the ICRP* 27 (Supplement).

THE ROLE OF SCIENTIFIC INSTITUTIONS

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Introduction

The topic that I was requested to address at this NEA seminar is the **role** (i.e., what is expected to be done) by **institutions** (i.e., organisations for the promotion of a public object) of a **scientific nature** (assisted by expert knowledge), with regard to a better integration of radiation protection in modern society. Thus, in defining the scope of the paper, it seems to be necessary to ask ourselves a number of questions:

- The role we seek should be aimed at an objective: What is this objective?
- Is it to solve a radiation protection problem?
- What is the problem?
- Is such problem a better integration of radiation protection in society...integration for what purpose?...for the purpose of achieving society's credibility ?
- Credibility of whom?...the radiation protection experts?...the radiation protection science?...the nuclear safety regulators?...the nuclear industry?

In identifying the role of scientific institutions, we should keep these questions in mind.

Although scientific institutions can be classified in a number of ways, for the purpose of this presentation I will presuppose the essential classification:

- national scientific institutions: (i.e. national and local regulatory bodies; research and advisory institutes, academia, professional and other societies); and
- supra-national ones (i.e. international organisations, regional agencies, global charities, associations of professional societies and non-governmental organisations [NGOs]).

With this classification in mind, would it be possible to integrate radiation protection in society today purely from a national perspective or does globalisation require fundamental radiation protection issues to be resolved internationally? The first premise of this paper is that fundamental radiation protection in society today should be integrated from an international perspective.

Scientific institutions which have a role to play in radiation protection can exist at a governmental level (multinational organisations, national and local regulatory bodies, research and advisory institutes, academia, professional societies) and at a non-governmental level (NGOs, international charities, associations of professional societies). Keeping this perspective in mind, would

it be possible to integrate radiation protection into society from a purely governmental or non-governmental perspective or is radiation protection policy now evolving from a “decide-announce-defend” authoritative attitude into a consensus-among-all-stakeholders stance? The second premise of this paper is that integration of radiation into society requires:

- scientific plausibility on the health effects attributable to radiation exposure,
- technical agreement on the desirable level of radiation protection, and
- local and global social harmony.

This paper’s view is that at least the two first points require international agreements. From the perspectives indicated, current international institutions address radiation protection issues as follows:

- The scientific state-of-the-art knowledge of the health effects of radiation is provided by:
 - the International Commission on Radiological Protection (ICRP) at the international non-governmental level, and
 - the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) at the international governmental level. (UNSCEAR’s functions are to assess the estimates, levels and effects of radiation and report on these to the UN General Assembly.)
- Technical agreement on the desirable level of radiation protection are:
 - formally established by the International Atomic Energy Agency (IAEA), in collaboration and co-operation with other organisations in the UN family, at the international governmental level.

In summary, the *de facto* scientific radiation protection institutions at an international level are the ICRP (non-governmental), UNSCEAR (governmental) and the IAEA, acting together as an international forum. They will be the focus of this paper.

The current scene up to the end of the 20th century

As we enter the 21st century, the vast amount of new information accumulated on the levels and effects of exposures to ionizing radiation and on the safety of radiation sources and a number of developments have brought radiation protection to the attention of the public and its political representatives. New radioepidemiological and radiobiological findings roughly corroborate previous estimates of the risks attributable to radiation exposure. A number of events have had a lasting effect on public perception of the potential danger from radiation exposure. These were primarily the nuclear accidents at Three Mile Island in 1979 and at Chernobyl in 1986 with its unprecedented transboundary contamination. In some countries, the public was concerned about the safe transport of radioactive materials. The safe management of radioactive waste also developed into an issue of public debate and the disposal of high level radioactive waste came to a standstill because of concern over potential radiation exposure. Accidents with radiation sources used in medicine and industry also attracted widespread attention from the public and governments. Furthermore, the 1980s saw the rediscovery of natural radiation as a cause of concern for health: some dwellings were found to have surprisingly high levels of radon in air; natural radiation exposures of some non-radiation-related workers were discovered to be at levels much higher than the occupational limits specified in radiation protection standards.

In line with these developments, a number of significant scientific steps were taken in the 1990s at the international level. On the one hand, UNSCEAR reviewed the global levels and effects of radiation exposure. This highly respected body is responsible for keeping the highest UN body, the United Nations General Assembly (UNGA), informed about these levels and effects. A new UNSCEAR report was issued at the end of 2000. On the other hand, the ICRP, which in 1990 had revised its standing recommendations, has now issued a number of documents to apply these recommendations in specific situations. In 1991 six organisations – FAO, IAEA, ILO, NEA/OECD, PAHO, and WHO – created a Joint Secretariat co-ordinated by the IAEA with the purpose of establishing the International Basic Standards for Protection against Ionizing Radiation and the Safety of Radiation Sources (the so-called BSS). This was the peak of decades of work and marked an unprecedented international co-operation that involved hundreds of experts from the Member States of the sponsoring organisations establishing the BSS. The IAEA, is the only organisation in the UN family with specific statutory functions, duties and responsibilities in establishing international standards for radiation protection and safety. By analysing the functions and roles of UNSCEAR and the IAEA, it is clear how the UN policy on this matter has been built up and where it now stands. It should be emphasized that both UNSCEAR and the IAEA are not free “think tanks”. They are governmental organisations. Their policies therefore reflect those of their constituencies, namely their Member States.

The international scientific consensus on the plausibility of health effects attributable to radiation exposure

In its recent report to the UN General Assembly, UNSCEAR reconfirmed that natural sources of radiation are the main contributors to human exposure. All peaceful nuclear activities taken together deliver a global exposure equivalent to just a few days of exposure to natural radiation sources. The normal operation of all peaceful nuclear installations contributes insignificantly to the global exposure to radiation. Even if all the nuclear accidents that have occurred to date are considered (including the Chernobyl accident), the additional exposure would be equivalent to only around 20 days of natural exposure. According to UNSCEAR, the military uses of nuclear energy have committed the world population to most of the radiation exposure caused by human activities. Exposure that has been and will continue to be delivered by all atmospheric explosions that have been carried out for the testing of nuclear weapons – not including other related activities such as the production of weapon materials or other military activities – is equivalent to 2.3 years of exposure to natural sources. Medical exposures take second place: one year of medical exposures to patients is responsible, on average, for the equivalent of 90 additional days of exposure of the world population to natural radiation. The annual occupational exposure to workers, averaged over the world population, is equivalent to a few additional hours of exposure to natural radiation sources. There are wide differences in exposures incurred by particular individuals, but UNSCEAR is mainly concerned with the global picture of radiation exposures. The Committee’s report can be construed to imply where the priorities should lie for the global protection of human beings against radiation. The peaceful uses of nuclear power are far down the list of concerns. Public perceptions vary, but this is frequently the case in relation to radiation exposure.

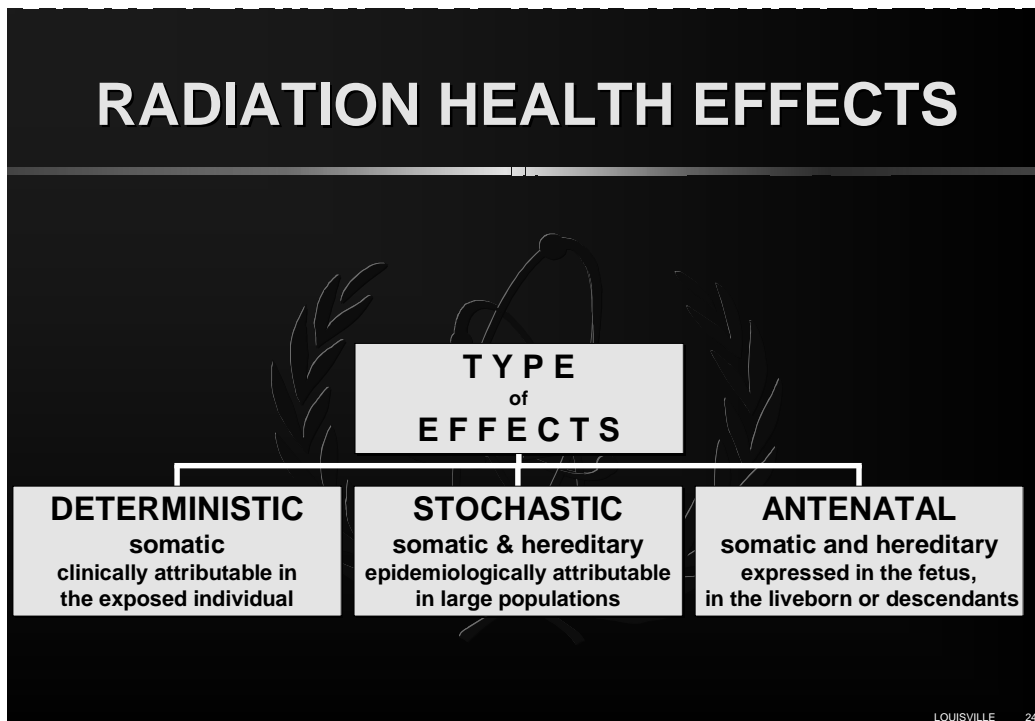
However, the most important contribution of UNSCEAR to the development of radiation protection is its estimations of the health effects of radiation. Through UNSCEAR’s comprehensive work, the international community has received a fuller picture of the biological effects attributable to exposure to ionizing radiation.

Since the beginning of the 20th century, it has been known that high doses of ionizing radiation produce clinically detectable harm in an exposed individual that can be serious enough to be fatal. Some decades ago, it became clear that also low radiation doses could induce serious health

effects, although of low incidence and only detectable through sophisticated epidemiological studies of large populations. Because of UNSCEAR's work, these effects are widely understood and better quantified.

The UNSCEAR *de facto* classification of radiation health effects is presented in Figure 1.

Figure 1. Schematic presentation of the type of effects from radiation exposure.



Taking account of the available radiobiological and radioepidemiological information, UNSCEAR has made a number of quantitative estimates in relation to health effects of high and low radiation doses. UNSCEAR's position is the UN position. It is the result of considerable analysis of the available scientific information by experts from all over the world.

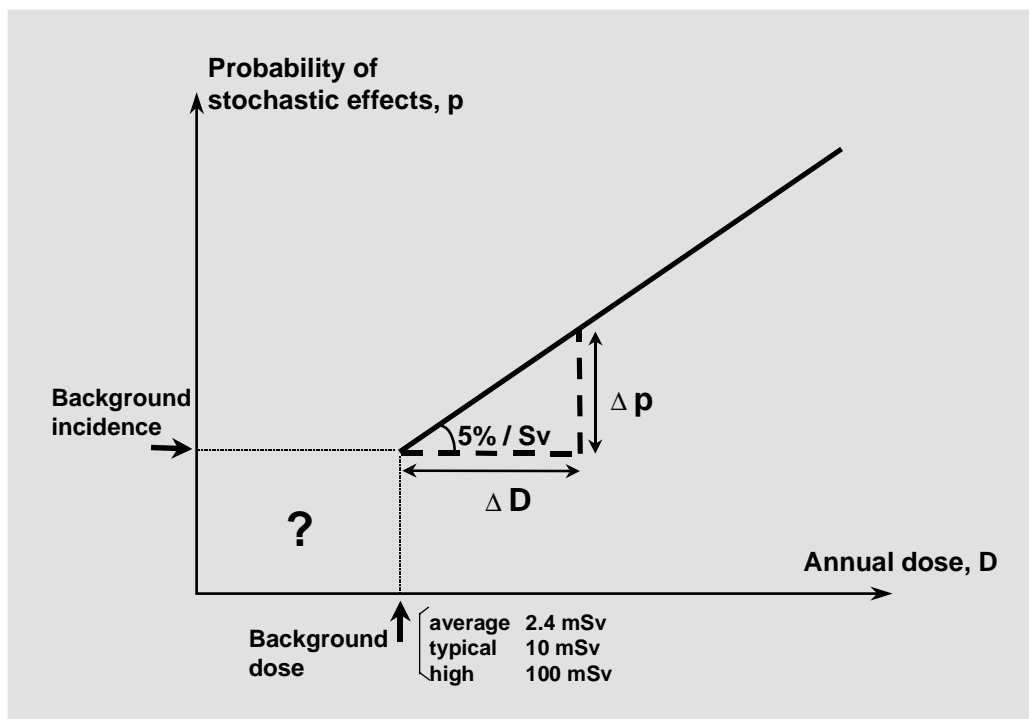
The most controversial for society has been its estimates of the effects of low radiation exposures. In this regard, UNSCEAR considers that radiation is a weak carcinogen and an even weaker potential cause of hereditary diseases.

The linear, non-threshold assumption for stochastic effects:

The stochastic effects have given rise to controversy over a concept known as the 'linear-non-threshold' or LNT. The position of the international community on LNT is more subtle than the simplistic formulation of those who attack it. The international formulation is as follows: **“above the prevalent background dose an increment in dose results in a proportional increment in the probability of incurring stochastic effects”**. As indicated, the prevalent background doses estimated by UNSCEAR are rather high. A dose equal to or above the average, which is incurred by almost everyone on earth, is equivalent (for a person living a full span of life) to around 200 mSv. The

graphical representation of the position of the international community on the LNT controversy is presented in Figure 2.

Figure 2. Schematic presentation of the “linar non-threshold relationship”.



As can be seen from the graph, the international community is not interested in the slope of the relationship for doses below the background dose. The reason is simple: radiation is regulated above the background level.

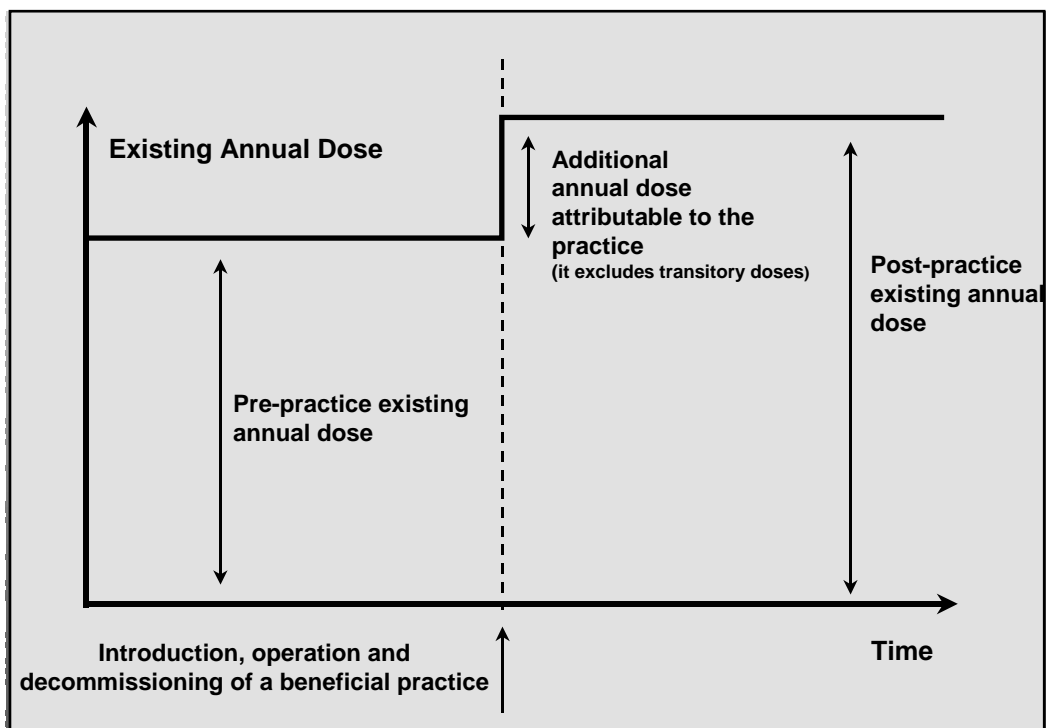
Regulating radiation: the ICRP approach

The ICRP recommendations, in simple terms, divide radiation exposure situations into prospective situations and *de facto* situations. Prospectively, radiation exposure is expected to be delivered by regulated activities that increase the overall exposure of people to radiation; these activities are termed “practices”. Also, it may be the delivered by *de facto* situations, e.g. natural sources and radioactive residues from past unregulated activities and events. Exposure already existing *de facto* in human habitats can be subject to protective actions, through a process termed “intervention”, which is intended to decrease the overall exposure of people. Many exposures to natural sources and almost all other exposures are “controllable”. Exposures that are essentially uncontrollable, or unamenable to control (for instance, exposure to cosmic radiation), are generally “excluded” from the scope of regulations on radiological protection.

The principles of the System of Radiological Protection for practices are: **the justification of the practice**; the **optimization of radiological protection**, with regard to any source within the practice; and the **limitation of individual doses** attributable to the practice. These principles should be applied prospectively at the planning stage of any practice expected to deliver prolonged exposures. In

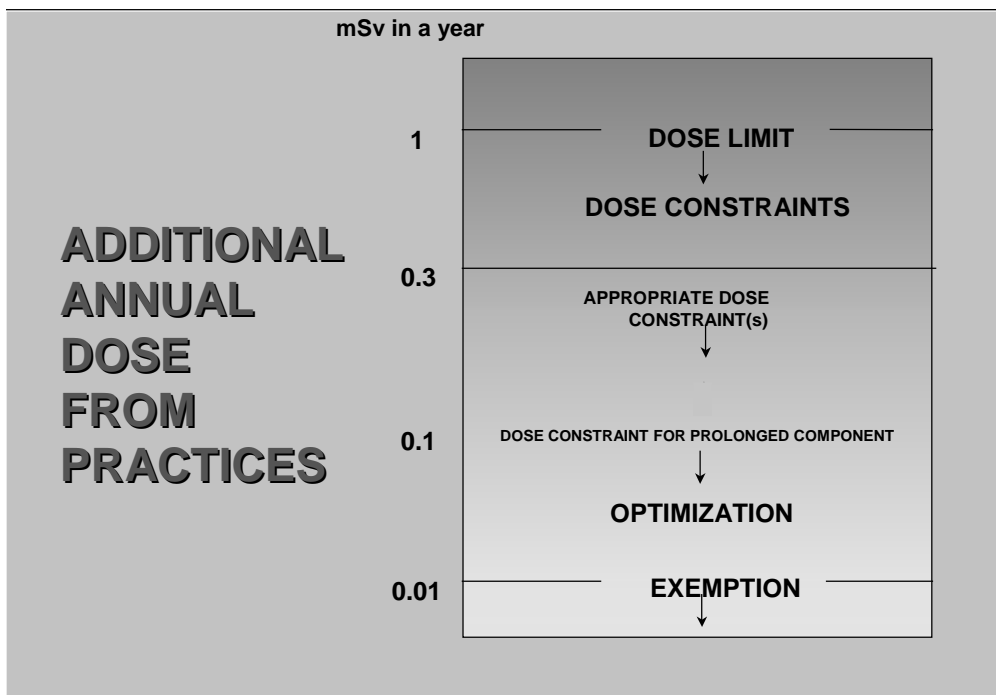
cases of practices involving prolonged exposure, the principles generally operate as follows. Before a justified practice is introduced, people will already be incurring a pre-practice existing annual dose, usually, but not necessarily, of mostly natural origin. The practice is expected to add to this existing annual dose both transitory additional annual doses, which will cease soon after the practice is terminated, and prolonged additional annual doses, which will persist over time. The System of Radiological Protection calls for the optimization of protection and the restriction of all additional annual doses attributable to the practice, including those due to prolonged exposure. After the practice is terminated, the post-practice existing annual dose will be higher than the pre-practice existing annual dose because the residual prolonged additional annual dose, ΔE , attributable to the practice, will be added to the pre-practice existing annual dose. See simplified schematic presentation in Figure 3.

Figure 3. Schematic presentation of the existing annual dose before and after a practice



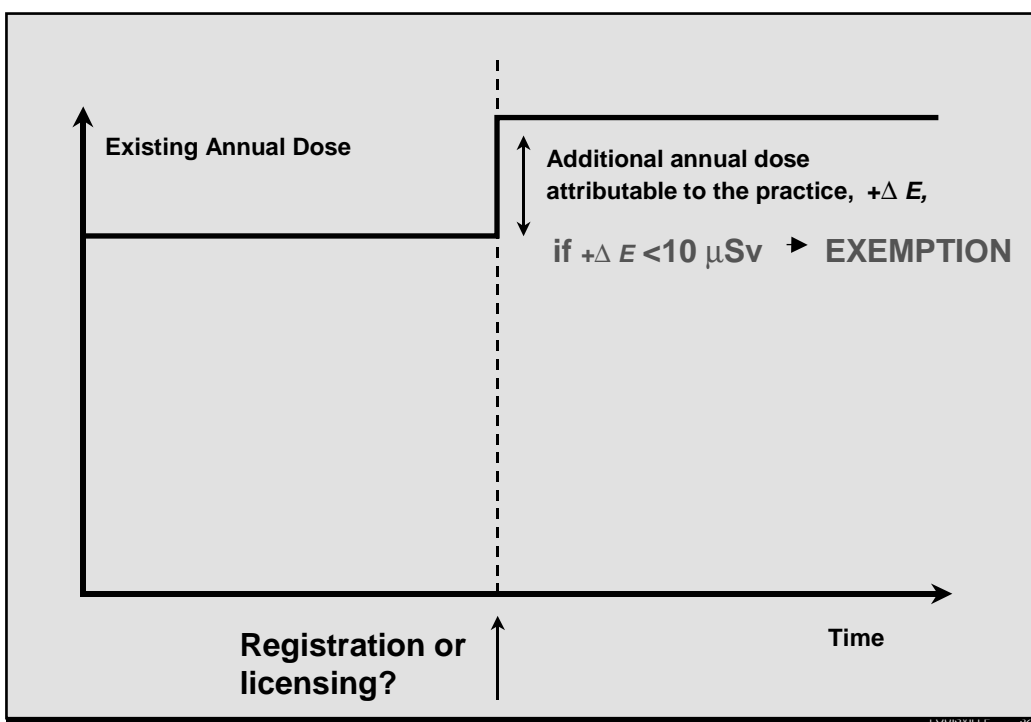
The dose restrictions on the additional annual dose recommended by the ICRP are presented in Figure 4.

Figure 4. Numerical recommendations on dose constraints and dose limits for practices



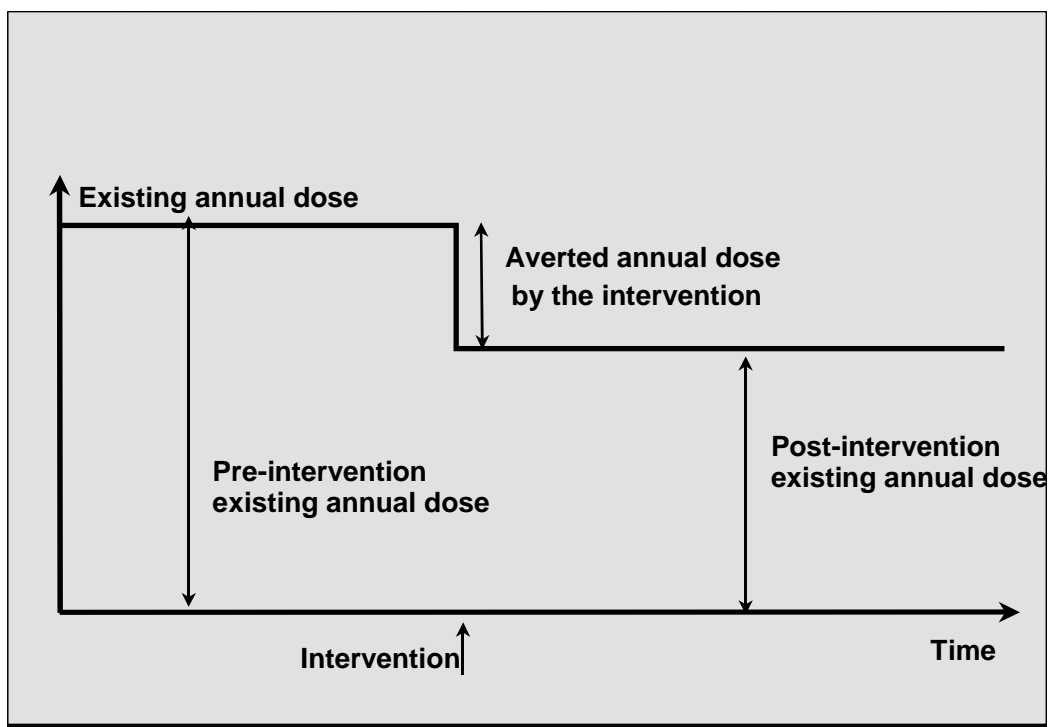
Under certain conditions, sources used in justified practices can be exempted from regulatory requirements if the individual additional annual doses attributable to the source are below around 0.01 mSv in a year. Figure 5 shows this position.

Figure 5. Exemption from regulatory control



Intervention is required to reduce the existing radiation exposure in a *de facto* situation that is judged to be unsatisfactory from the point of view of radiological protection. The principles of the System of Radiological Protection for intervention are the *justification of intervention* and the *optimization of the protective actions*. In prolonged exposure situations, the principles generally operate as follows. The System of Radiological Protection calls for the consideration of intervention to reduce components of the pre-intervention existing annual dose. (There is usually but not always just one component attributable to one source.) The intervention will achieve an averted annual dose, $-\Delta E$. A residual post-intervention existing annual dose will remain: this will equate to the pre-intervention existing annual dose minus the averted annual dose (see Figure 6). If the protective actions to avert annual doses have been optimized, the post-intervention existing annual dose is not subject to further reductions.

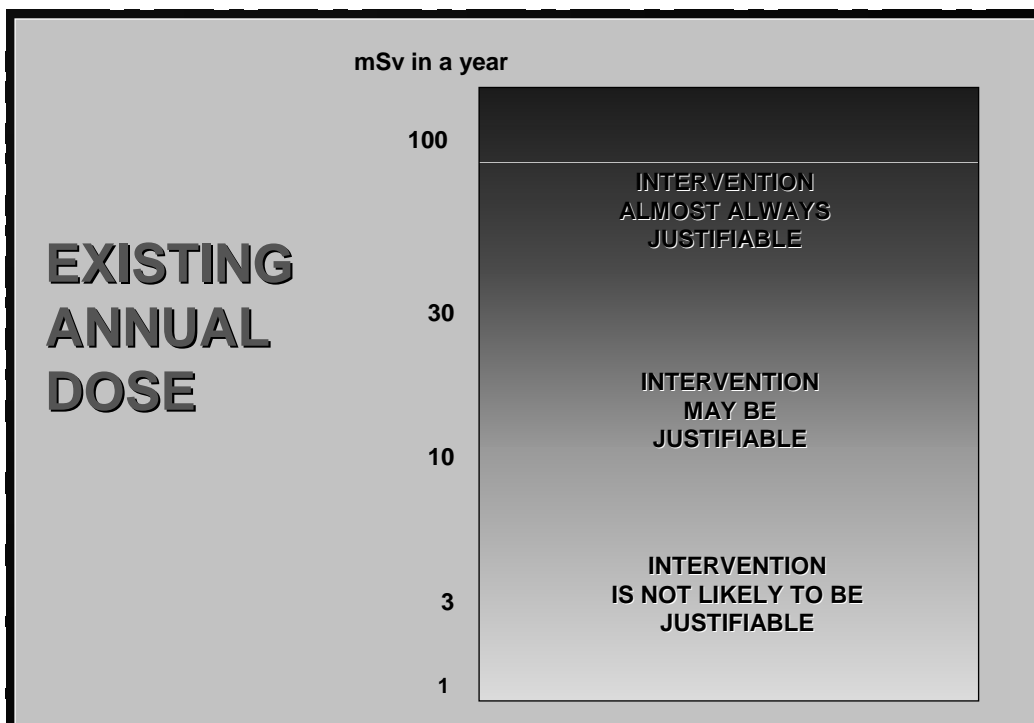
Figure 6. Schematic presentation of the existing annual dose before and after an intervention



The international community has been using (and the ICRP is now recommending) *generic reference levels* for interventions. These levels can conveniently be expressed in terms of the *existing annual dose*. They are particularly useful when intervention is being considered in some situations, such as exposures to high natural background radiation and to those radioactive residues that are a legacy from the distant past. Generic reference levels, however, should be used with extreme caution. If some controllable components of the existing annual dose are clearly dominant, the use of the generic reference levels should not prevent protective actions from being taken to reduce these dominant components. Either specific reference levels or case-by-case decisions following the requirements of the System of Radiological Protection for interventions can trigger these actions. Nor should the use of the generic reference levels encourage a “trade-off” of protective actions among the various components of the existing annual dose. A low level of existing annual dose does not necessarily imply that protective actions should not be applied to any of its components; conversely, a high level of existing annual dose does not necessarily require intervention. With these provisos, it is considered that an existing annual dose approaching about 10 mSv may be used as a generic reference

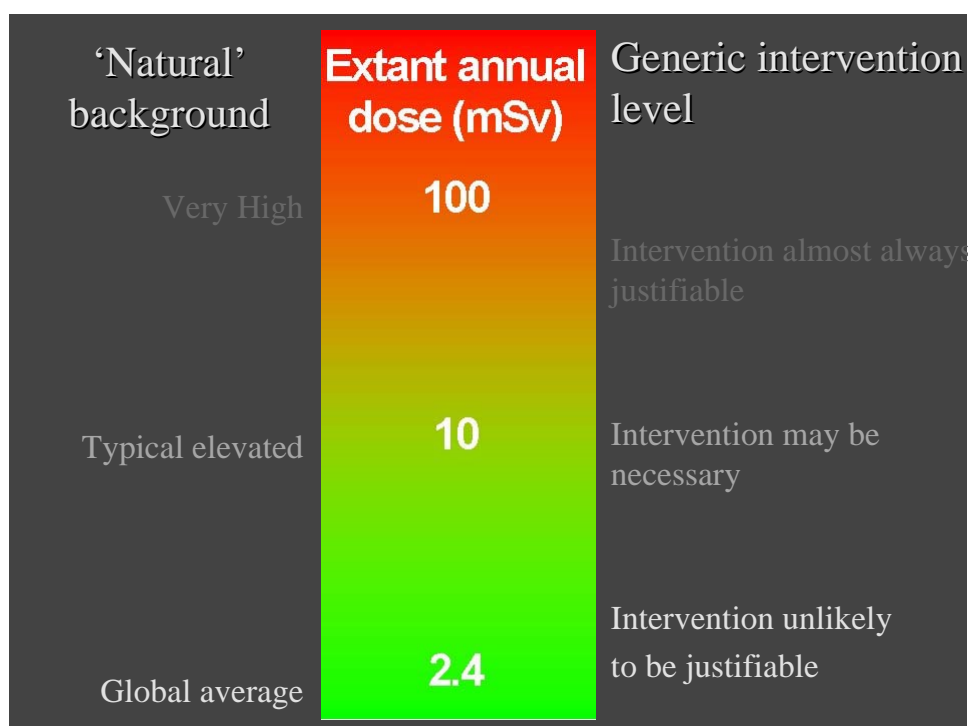
level below which intervention is not likely to be justifiable for some prolonged exposure situations. However, below this level, protective actions to reduce a dominant component of the existing annual dose are still optional and might be justifiable. In such cases, action levels specific to particular components can be established on the basis of appropriate fractions of the recommended generic reference level. Above the level below which intervention is not likely to be justifiable, intervention may possibly be necessary and should be justified on a case-by-case basis. Situations in which the annual (equivalent) dose thresholds for deterministic effects in relevant organs could be exceeded should require intervention. An existing annual dose rising towards 100 mSv will almost always justify intervention and may be used as a generic reference level for establishing protective actions under nearly any conceivable circumstance (See Figure 7).

Figure 7. **Recommended generic intervention levels in terms of existing annual dose**



A perspective on the recommended levels for the generic intervention levels of existing annual dose can be gained by presenting them *vis-à-vis* dose values of natural background radiation, as shown in the following Figure 8.

Figure 8. **Generic intervention levels**



The international regime on radiation protection

The International Atomic Energy Agency (IAEA)

The IAEA is an independent governmental organisation of, at present, around 130 Member States. It is governed by a General Conference of all its Members and by a reduced Board of Governors. A Director General heads its Secretariat. The Division that discharges the IAEA's responsibilities in the subject area of our current meeting is the Division of Radiation and Waste Safety that I have the honour to head. The IAEA reports its findings to the UN Security Council. It has an annual budget of more than a quarter billion dollars and a staff of 800 professionals and 900 administrative supporters.

The Three IAEA Pillars: Safeguards, Technology and Safety

The IAEA is essentially based on three pillars sustaining its duties:

- **Safeguards**, or the verification of peaceful uses and security of nuclear material, is probably the best known: it is the one that has given the IAEA the nickname of **the nuclear watchdog of Vienna**.
- **Technology**, or the fostering of transfer of the body of knowledge in the radiation and nuclear field is another well-known pillar of the IAEA.
- **Safety**, or rather its global promotion, is the least known of the IAEA's functions, but is the IAEA pillar that is the most essential for the purpose of this paper.

The IAEA Safety Functions

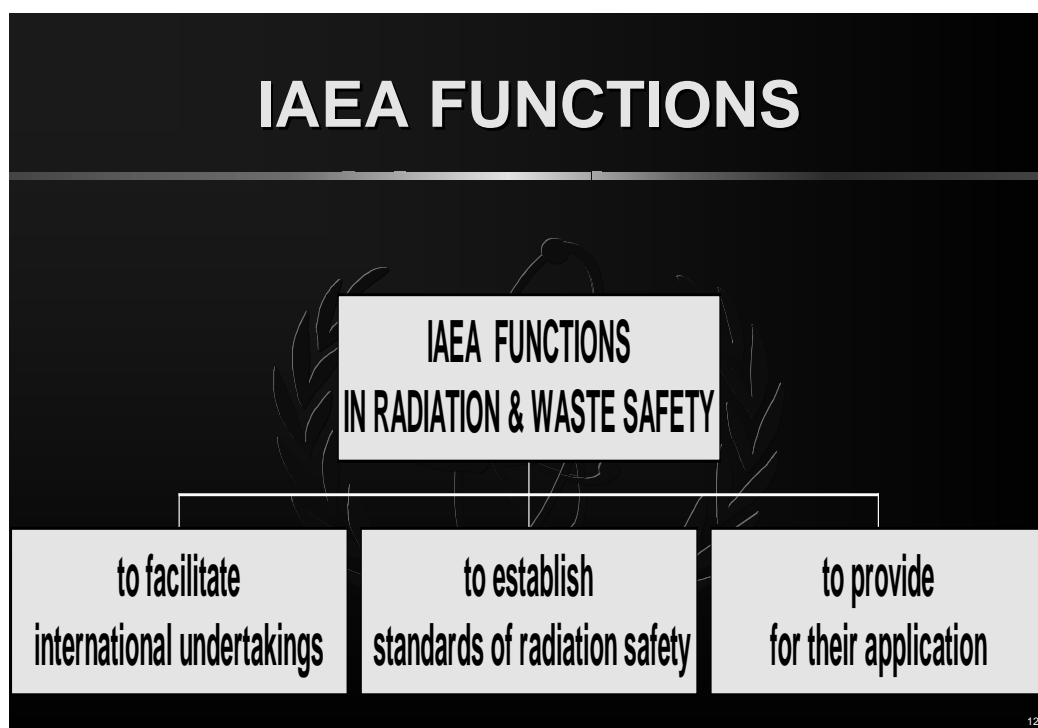
Since its creation in 1957, the IAEA has exercised two radiation protection-related statutory functions, which were forecast surprisingly early by its founders, namely:

- **establishing standards of safety** for the protection of health against the effects of radiation, and
- **providing for the application of these standards at the request of a State.**¹

With these statutory functions, the IAEA is unique among international organisations.

The IAEA has also be assigned with the functions of facilitating and servicing Conventions and other international undertakings related to radiation protection (See Figure 9).

Figure 9. **IAEA functions in radiation and waste safety**



The Emergence of an international regime on radiation safety

The implementation of the IAEA's safety functions has been instrumental in the emergence during the 1990s of what might be called a:

- *de facto* international regime on radiation safety.

1. Statute of the IAEA, Article III.A.6.

This regime includes three key elements:

- legally binding international undertakings among States;
- globally agreed international safety standards; and
- international provisions for facilitating the application of those standards.

Conventions

Under the auspices of the IAEA, four major international conventions closely related to the topic of this Conference have been adopted in recent years, namely:

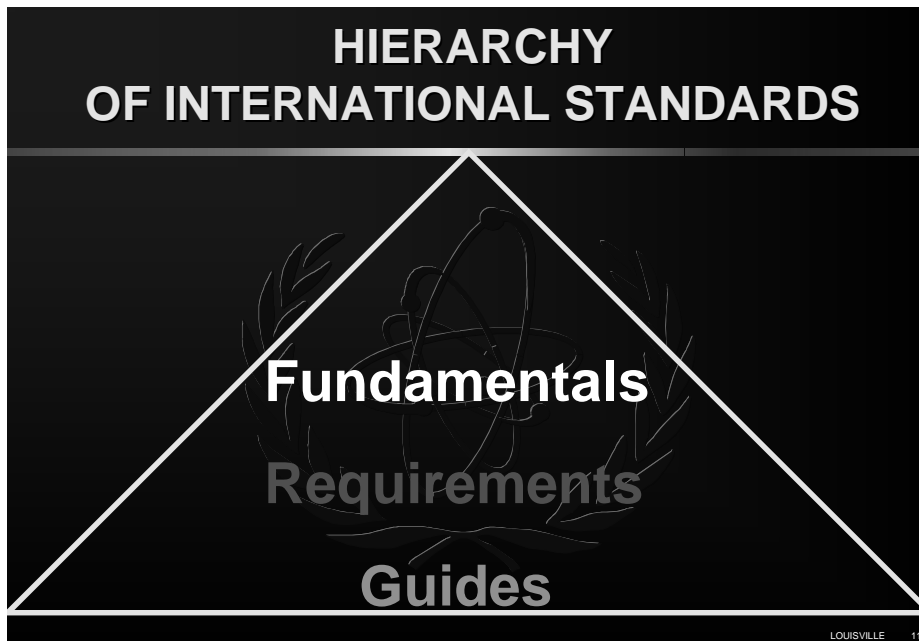
- the Convention on Early Notification of a Nuclear Accident;
- the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency;
- the Convention on Nuclear Safety; and
- the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Joint Convention).

While the first two of these Conventions impose clear radiation protection obligations on their parties, both, the Nuclear Safety and the Joint Conventions, create in fact incentives rather than detailed contractual accountability. However, they establish some commonly shared radiation protection objectives and set out specific responsibilities for the Contracting Parties aimed at achieving those objectives. Adherence to the objectives is monitored by means of an international process of peer review by the other Contracting Parties. Every three years, each Contracting Party must prepare a report on the measures it has taken to meet its obligations under the Convention, and each national report is distributed for review by all of the Contracting Parties. The three-year cycle culminates in a Review Meeting, in which each national report is discussed in turn, along with the comments and questions on the report from other Contracting Parties. There is something in common in the four Conventions, however. This is the sharing of basic principles on radiation protection.

International Standards

Over the years the IAEA, sometimes jointly with other international organisations of the UN system, has developed a corpus of more than 200 safety standards. They are grouped in a hierarchical family. At the top of the family there are the so-called Fundamentals, basic policy documents for decision makers. They are supported by standards proper, the so-called Requirements. These are *shall* documents and the backbone of the IAEA's corpus of standards. At the base of the pyramid are the so-called Guides – *should* documents that indicate how to implement the requirements (See Figure 10).

Figure 10



The IAEA Safety Standards Preparation Process:

The IAEA radiation safety standards are established following a sophisticated and formal process, which include full participation of expertise and governmental representation. The process is illustrated in Figure 11.

Figure 11

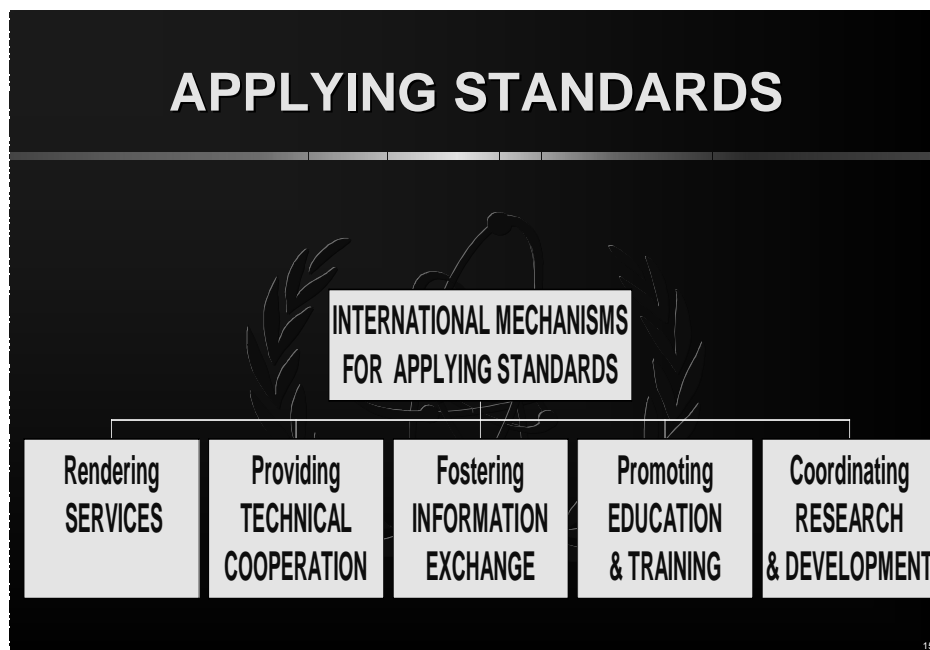


International Provisions for the Application of International Standards

An area that represents a substantial amount of the IAEA's work in radiation protection is **“providing for the application of radiation protection standards”**. The IAEA mechanisms for discharging this function includes (see Figure 12):

- providing direct radiation protection assistance to Member States;
- rendering radiation protection review services;
- fostering information exchange;
- promoting education and training; and
- supporting research and development.

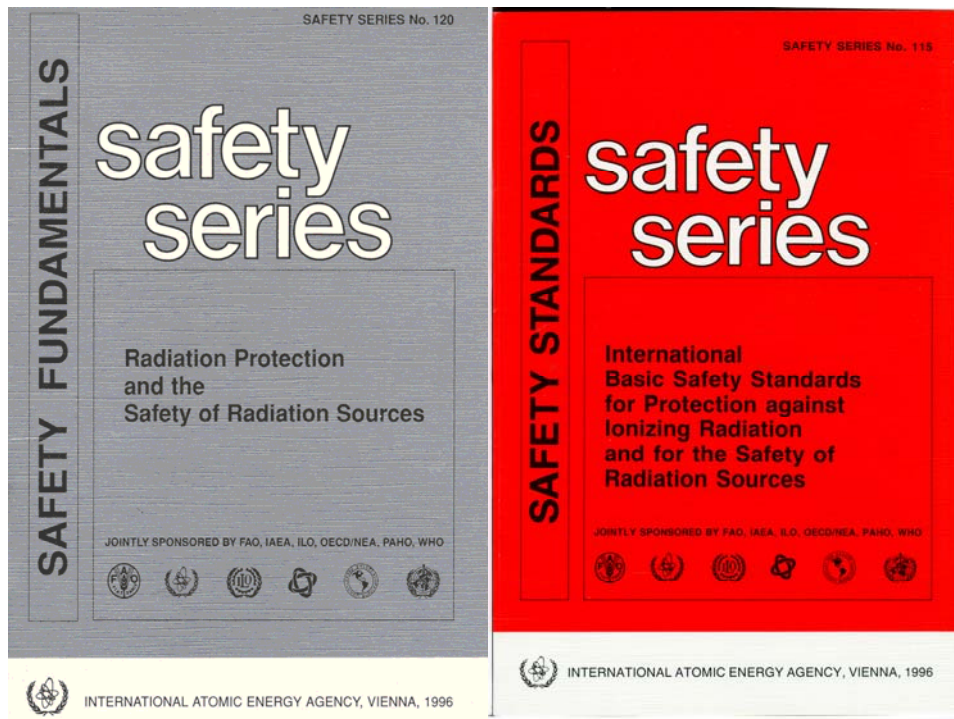
Figure 12



The current international radiation protection standards

Certainly, in the field of radiation protection, the most relevant of the international safety standards is the Fundamentals on radiation protection and safety of radiation sources, which is co-sponsored by the same six international organisations that co-sponsor the BSS. However, the document that includes in its preamble the UN's basic approach to radiation protection is the BSS (See Figure 13). A large number of Guides support the BSS.

Figure 13



An unprecedented international effort:

The BSS mark the culmination of attempts that have continued over the past several decades towards the harmonisation of radiation protection and safety standards internationally. Following this unprecedented international effort to draft and review the Standards, the BSS were endorsed at a meeting of a Technical Committee held at IAEA headquarters in Vienna in December 1993. It was attended by 127 experts from 52 countries and 11 organisations. A further Technical Committee verified the technical editing and the translations from English into Arabic, Chinese, French, Russian and Spanish. The IAEA's Board of Governors approved the Standards at its 847th Meeting on 12 September 1994. For PAHO, the XXIV Pan American Sanitary Conference endorsed the Standards on 28 September 1994 following a recommendation from the 113th Meeting of the PAHO Executive Committee on 28 June 1994. The Director General of the FAO confirmed the FAO's technical endorsement of the Standards on 14 November 1994. WHO completed its adoption process for the Standards on 27 January 1995 when the Director-General's report on the subject was noted by the Executive Board at its 95th session. The ILO's Governing Body approved publication of the Standards at its meeting on 17 November 1994. The OECD/NEA Steering Committee approved the Standards at its meeting on 2 May 1995. This completed the authorisation process for joint publication by all the Sponsoring Organisations. The BSS have been issued in the IAEA Safety Series in Arabic, Chinese, English, French, Russian and Spanish.²

2. FAO, IAEA, ILO, OECD/NEA, PAHO, WHO, International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No. 115, IAEA, Vienna (1996).

Other relevant institutions

Other relevant international institutions are:

- specialised governmental organisations of the UN (WHO, FAO, ILO, UNESCO, UNEP);
- governmental organisations (OECD/NEA, EC, WHO's regional branches, e.g. PAHO);
- non-governmental organisations (IRPA, Greenpeace, Friends of the Earth, The Labour Movement).

Their roles have to be fully investigated, perhaps by themselves. I can only conclude that:

- ILO is the only real stakeholders' forum within the UN family, including all interested parties in occupational protection – namely workers, employers and governmental departments of labour.
- WHO has a potentially large role, which until now has not been clear.
- The main role of FAO is in the consensus around the Codex Alimentarius.
- UNEP's role is unclear and for the time being has simply been a controversial administrator of UNSCEAR.
- UNESCO should play an essential role in education.
- The EC has the dual, undefined role of a supranational regulatory body (according to Article 31 of the Euratom treaty) and also of an inter-governmental organisation.
- OECD/NEA facilitates topical information exchange.

The role of national organisations has been to act as the building blocks for international consensus.

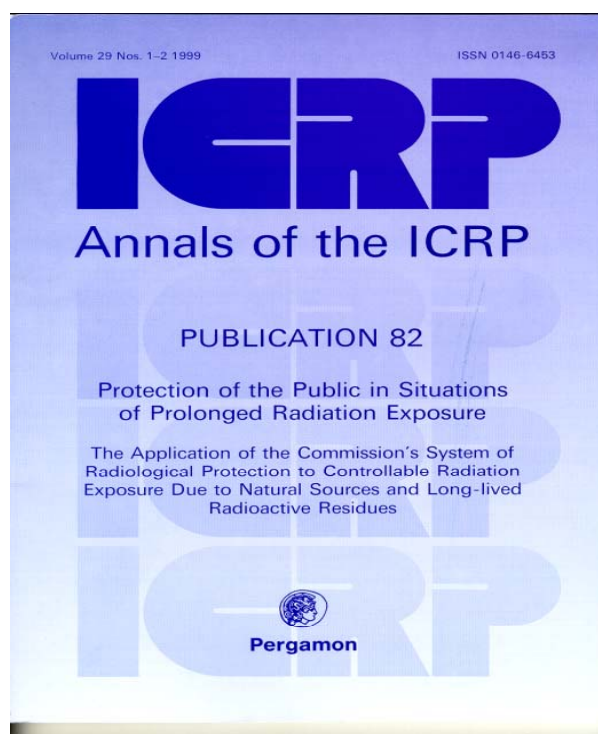
Local and global social harmony

The current scientific and technical consensus on radiation protection is based on objective assessments of the health risks associated with radiation exposure and on radiological protection attributes of various exposure situations. However, members of the public (and sometimes their political representatives) may have personal and distinct views on the radiation risks attributable to artificial sources of radiation exposure, for instance in relation to those due to natural sources. This usually results in differently perceived needs for response and a different scale of protection, depending on the origin of the exposure. The claim for protection is generally stronger when the source of exposure is a technological by-product rather than when it is considered to be of natural origin. Typically elevated exposures due to natural radiation sources are usually ignored by society, while relatively minor exposures to artificial radioactive residues are a cause of concern and sometimes prompt unnecessary actions. This reality of social and political attributes, generally unrelated to radiological protection, usually influences the final decision on the level of protection against radiation exposure.

It should therefore be cautiously recognised that the current consensus around the ICRP recommendations, the UNSCEAR estimates, and the IAEA radiation safety standards should be seen as a **decision-aiding** tool, based mainly on scientific considerations on radiological protection. The outcome of this will be expected to serve as an input to a final (usually wider) **decision-making** process, which may include other societal concerns and considerations. The final decision-making process for radiation protection may include the participation of relevant **stakeholders** rather than radiological protection specialists alone.

With regard to this distinction between **decision aiding** and **decision making**, a number of developments have occurred recently. First, ICRP's Publication 82 titled Protection of the Publication in Situations of Prolonged Radiation Exposure (The Application of the Commission's System of Radiation Protection to Controllable Radiation Exposure due to Natural Sources and Long-Lived Radioactive Residues) has, for the first time in the ICRP history, addressed the issue (see Figure 14)

Figure 14



Second, the issue has been fully discussed at the recent IAEA Symposium on Restoration of Environments with Radioactive Residues (see the Proceedings of the International Symposium held in Arlington, Virginia, USA, 29 November-3 December 1999), and at the IAEA Conference on the Safety of Radioactive Waste Management (see the Proceedings of the International Conference, held in Córdoba, Spain, 13-17 March 2000 – Figure 15).

Figure 15



Highlights of the latter two meetings with regard to the decision-aiding process were: the support gained for the IAEA's international radiation safety regime, in particular for the international conventions and the international corpus of safety standards and their application. Moreover, in order to facilitate the decision-making process, the creation of international fora of stakeholders was encouraged. "Stakeholders" has become a politically popular term but one should be clear of who they really are.

The relevant international organisations for integrating radiation protection into society, namely, the ICRP, UNSCEAR and the IAEA, provide a natural forum for governmental international consensus on decision-aiding paradigms for radiation safety. However this forum does not provide for the integration of other stakeholders. I conclude therefore, that in order to facilitate better integration of radiation protection into modern society and, thereby, the decision-making process, international stakeholders' fora should be promoted.

Outlook

Looking at where we stand today we must ask ourselves whether the problems occurring lie with society or ourselves? International governmental consensus on the health effects of radiation has been reached by UNSCEAR. The international consensus reached is that, if the prevalent backgrounds of dose and cancer incidence increase, an increment in dose should result in a proportional increment in the probability of incurring cancer of around 0.005% per mSv. International governmental consensus on adequate levels of protection against radiation was reached in the form of the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS) jointly sponsored by FAO, IAEA, ILO, OECD/NEA, PAHO and WHO.

The third millennium will see an expansion in the global co-operation in radiation protection and safety and therefore in the international harmonisation of radiation protection and safety standards. This development will permit an homogeneous strengthening of the control of radiation sources worldwide. A mechanism for achieving this goal is the international regime on radiation safety that is being established *de facto* under the aegis of the IAEA. In addition to the existing international conventions, corpus of international standards, and international provisions for the application of these standards, new elements will be soon incorporated into this regime once countries agree them. The first new element to be incorporated in the regime is a *code of good conduct* for the safety of radiation sources and the security of radioactive materials that has just been approved under the auspices of the IAEA.

Therefore, in order to better integrate radiation protection into modern society I feel we should strengthen the roles of the key international institutions, namely: the ICRP – the academic international forum for agreeing on a basic policy on radiation protection; UNSCEAR – the authoritative global intergovernmental body for estimating the health effects attributable to exposure to ionizing radiations; and the IAEA – a focal point for a comprehensive global radiation safety regime and the international “watchdog” for radiation safety. This is however a necessary but not sufficient condition. In addition we need to integrate the relevant stakeholder into the decision making process: this is the forthcoming challenge for the international community.

THE ROLE OF THE INTERNATIONAL RADIATION PROTECTION ASSOCIATION IN DEVELOPMENT AND IMPLEMENTATION OF RADIATION PROTECTION STANDARDS

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Abstract

The International Radiation Protection Association (IRPA) is an affiliation of national and regional professional societies. Its individual membership is approaching some 20 000 professionals from 42 societies and covering 50 countries. Its primary objective is to provide a platform for collaboration between members of its affiliate societies to further radiation protection and safety. The IRPA is mandated to promote and facilitate the establishment of radiation protection societies, support international meetings and to encourage international publications, research and education and the establishment and review of standards. Through its membership base and its observer status on bodies such as the ICRP and the safety standards committees of the IAEA, the IRPA is in a position to provide valuable input to the safety standards development process. This factor has been increasingly recognised more recently within the IRPA and the various organisations involved in the development of safety standards. This paper addresses the mechanisms that have been established to enhance the input of the IRPA into the safety standards development process and for their subsequent implementation.

1. Introduction

The International Radiation Protection Association (IRPA) was created in 1965 following an initiative from the US Health Physics Society. IRPA is an international organisation with membership of individual professionals who are members of an affiliated national or regional society. The association initially included 11 societies representing 16 countries. IRPA membership is now approaching 20 000 individuals from 42 societies covering more than 50 countries.

The primary objective of IRPA is to provide a medium whereby international contacts and co-operation may be promoted among those engaged in radiation protection work, which includes relevant aspects of such branches of knowledge as science, medicine, engineering, technology and law, in the effort to provide for the protection of man and his environment from the hazards caused by ionising and non-ionising radiation and thereby facilitate the exploitation of radiation and nuclear energy for the benefit of mankind.

In order to accomplish this primary objective, the Constitution lists a number of activities that are regarded as appropriate. These will be referred to in more detail later in the paper but in broad terms they are:

- (i) Establishment of Radiation Protection Societies
- (ii) Support for International Meetings
- (iii) Encouragement of International Publications
- (iv) Encouragement of Research and Education, and
- (v) Establishment and Review of Standards

In the context of this workshop IRPA can be seen as a representative of a major stakeholder in the process, namely those professionals in “radiation protection” or “health physics” who have to take the standards on board, explain them and implement them in the real world. The IRPA membership includes most of the professionals working in all radiation protection areas and disciplines in essentially all developed countries and many developing countries.

It is also important to recognise what IRPA is not. It is not a reviewer of basic science like UNSCEAR, not an issuer of recommendations like ICRP or ICRU, not a large UN organisation like IAEA or WHO. Whilst a number of the larger Associate Societies have considerable resources available to them, the Officers and Members of the Executive Council who are elected at the General Assembly held every four years are all part-time and unpaid. The annual IRPA budget is only just over \$50 000 in total. So although IRPA has huge resources in terms of the expertise of its membership in its associate Societies, it has only minimal resources in terms of central effort and funds.

2. Development of Standards

The wording of the constitution on this point is:

“To encourage the establishment and continuous review of universally acceptable radiation protection standards or recommendations through the international bodies concerned.”

Bearing in mind that IRPA should provide a means by which the professionals working in the field can influence the standard-setting process, this aspect has received insufficient attention in the past, except in the non-ionising radiation area. The current process for setting standards in ionising

radiation protection relies heavily on ICRP to make recommendations. These are then translated into more or less binding form internationally (e.g. IAEA Basic Safety Standards), regionally (e.g. Euratom Directives) and nationally. This second phase relies primarily on governmental nominees. IRPA has observer status on some committees of some of these bodies but has not had any mechanism for ascertaining the views of the constituent societies or pressing them in the standards-setting process.

While accepting that it is unlikely to be possible to arrive at a single view of the many thousands of professionals in IRPA, this difficulty should be faced and some procedures evolved to overcome it, otherwise the professionals have essentially no collective voice in the process.

This matter was discussed in depth at the Associate Societies Forum during the IRPA-10 Congress in Hiroshima in May 2000. A clear consensus existed among societies present that IRPA must play a larger role in the standard setting process. The mechanisms to fulfil this role have still to be elaborated but two processes have been identified. One for collecting and transmitting societies' views on proposals by standards-setting bodies and another for quickly informing societies about the developments within international bodies on which IRPA acts as an observer.

With respect to the first process this has already been carried out and in particular more recently with some considerable success. In the autumn of 1999 IRPA invited its Member Societies to comment on Professor Roger Clarke's (ICRP Chairman) "Controllable Dose" paper from August 1998 and subsequent article "Control of Low Level Radiation Exposure: Time for a Change?" which was published in JRP Vol.19 No.2 107-115(1999).

The IRPA-10 Congress again provided the obvious focus for bringing together the responses from the various societies. Many societies had formed working groups, or undertaken member consultation exercises, in order to develop views and perspectives on the proposals. In the interim, the debate had continued with Professor Clarke participating in a number of prestigious meetings and with bodies such as NEA-CRPPH publishing related reports or commentaries.

During the topical session at Hiroshima Professor Clarke gave a short introduction to his proposals. Following this, presentations were made by the French, German/Swiss, USA, Nordic, South African, UK, Japanese and Spanish societies on the results of their preliminary consultations. A paper was also presented prepared by the CRPPH of OECD/NEA. Responses from the floor included delegates from Australia and New Zealand, Japan, the Netherlands, Hungary and India, and referred to further position papers that had been developed.

Following the discussions in Hiroshima, IRPA collected the written statements, position papers etc. from as many societies as possible, including those referred to in the debate but which could not be fully considered because of lack of time. These were brought together in a report entitled "IRPA Member Societies' Contributions to the Development of New ICRP Recommendations" and transmitted to ICRP by the IRPA Secretariat. It is clear from the subsequent presentations by Professor Clarke and indeed from the new paper now being considered in the same way that the results of this wide consultation were helpful to ICRP in refining and developing the proposals.

IRPA intends to continue to use this mechanism for major proposals for Standards, including in due course the revision of the Interagency Basic Safety Standards and the Fundamental Principles of Nuclear Radiation and Radioactive Waste Safety.

The second procedure (information dissemination) is more established as IRPA has observer status with a number of organisations including ICRP, IAEA, ICNRP, ICRU and NEA and on interagency committees such as the Interagency Committee on Radiation Safety Standards (IACRS).

This enables representative to attend meetings and keep abreast of developments within these organisations. The main change here is in the means of disseminating the information gleaned to the Associate Societies. This now takes place exclusively through the IRPA web-site, which has been completely rebuilt during the second part of the year 2000. Reports of attendance at meetings such as the Radiation Safety Standards Advisory Committee of the IAEA are posted on the site and from time to time Associate Societies are reminded by e-mail of new items on the site. The site can be found at: www.irpa.net.

3. Implementation of Standards

As noted in the introduction the individual members of IRPA have the main responsibility for acting on any new standards, normally after they have been translated into national regulations. Several other aspects of the IRPA Constitution are relevant here. One of the most important in an international sense is:

“To encourage the establishment of radiation protection societies throughout the world as a means of achieving international co-operation among those engaged in radiation protection.”

This may be seen as an activity aimed at improving professional societies throughout the world and enhancing the global “safety culture”.

This aspect was also considered during the forum in Hiroshima. Despite the admission of five new societies during the preceding four years the Executive Council felt that many other countries have the potential to join IRPA and that a more pro-active role should be adopted toward them. Most of the countries which are still not members of the IRPA family are generally facing difficulties in initiating networks among the professionals and are severely limited as far as financial matters are concerned. Accordingly, a simplification and clarification of the procedures for admission of new societies was adopted which included the suggestion to professionals in a country to make contact with IRPA early in the process – even before there is a society – to assist in its creation. This might even involve a visit to the country to provide assistance and advice on the spot.

Several of the largest societies attending the Forum expressed their support to the proposed approach and declared they were ready to consider direct commitment in the preliminary phase of this process on a case by case basis. They also suggested establishing special links with newly formed societies to assist them in the first years of their development. Regional federations of societies were also proposed as a means to overcome the difficulties small and isolated societies are facing.

Over the next few years particular attention will be paid to promotion of new societies in Africa. IRPA hopes to enlist the support of the societies in South Africa, UK and France in this initiative.

A further and also very important aspect of IRPA activities is:

“To encourage research and educational opportunities in those scientific and related disciplines which support radiation protection”

Education and professional training has become an increasingly important component of IRPA Congresses and of IRPA sponsored meetings. In 1991, members of the IRPA Executive Council were assigned to a task force to review the certification and training issue. Two surveys were conducted in 1991 and 1994 by the Task Force. The large difference in formality, legal requirements, recognition and training methods found in the 1991 and 1994 surveys illustrated how difficult it could be to unify professional recognition on a world-wide scale. In view of the results of these surveys it

did not seem practical for IRPA to try to promote an internationally recognised or standardised certification process. However, recognising the recent and fruitful initiative by the European societies through the EC, it may be appropriate for IRPA to act as a link on the matter of mutual recognition with the non-European societies. The problem of the recognition of transient radiation workers was also pointed out during the forum as something IRPA could look at in the future.

The discussion in the Hiroshima Forum confirmed the need to pursue the efforts concerning the inclusion of supplementary training and refresher courses through IRPA Congresses held round the world as well as in meetings organised by societies. The possibility for IRPA itself to develop professional enrichment courses by making use of the materials and expertise available in its member societies was mentioned. Some attendees pointed out the particular needs in training for the newly formed societies.

Building on this suggestion and the fact that the greatest opportunities for major improvements in radiation protection are in the developing countries, IRPA has recently come to an agreement with the IAEA to co-ordinate the provision of expertise to assist developing countries. One of the main functions of the IAEA, through its Technical Co-operation Programme, is to encourage the dissemination and application of nuclear techniques including medical and industrial applications. As part of this, there is a requirement that the countries developing such techniques have the safety infrastructure necessary to control sources and radiation generators. The IAEA has, during the 1990s, moved to a more systematic and pro-active approach to the improvement of safety.

4. Conclusions

The professionals in radiation protection, as major stakeholders, should have more impact on the development of standards and their implementation world-wide. As their representation in the international arena, IRPA is working to develop and enhance the mechanisms by which their influence can be brought to bear.

CONCLUDING REMARKS

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I have really enjoyed participating in this second Villigen Workshop. First of all, the general atmosphere during the three days was excellent and all participants adopted a very open and constructive attitude with regard to the potentially controversial issues that have been discussed in the various sessions. Secondly, and this is for me the most important aspect, this workshop helped me to better understand one of the key points of the evolution of our profession over the recent years.

I have been working in the radiological protection field since 1977. Until the late eighties, I only left my office, where I was mainly developing methods and tools to implement the optimisation principle, to attend meetings and conferences in France and elsewhere. I have to say that I also spent quite a lot of time in nuclear installation, working with managers or operators on the best way to put into practice ALARA for occupational or public exposure. But, as far as the protection of the public was concerned, everything was prepared, implemented and controlled from inside the plants, without any need to contact and to talk with those concerned by the risk.

The turning point was the series of missions I made with other European colleagues during the summer of 1990. We were in the former republics of the Soviet Union affected by the Chernobyl accident to evaluate the effectiveness of possible countermeasures to be adopted in the contaminated territories. I rapidly realised how I was deprived of the knowledge and words to answer simply the multitude of justified questions raised by young mothers, nurses, farmers and local authorities anxious about the situation and expecting some reassurance from foreign "experts". It took me many years to be able to enter into a real dialogue with the population of these contaminated territories.

Many of us, in fact, have been confronted over the last decade about what we have named in between the "complex situations". Everywhere in the world, the profession is confronted with the legacy of the past: fallout from atomic tests, radioactive residues from past activities, decommissioning of old nuclear installations. The time when it was possible to manage from inside the office is over. We need to go outside and to interact with the population. We have to answer unexpected and difficult questions. We are facing values, concerns and emotions that were not part of our decision-aiding models. In fact, we are challenged at all levels of our expertise.

This workshop was important because I have the feeling that the perspectives opened by the speakers coming from other disciplines, and the practical experiences that have been reported from various parts of the world, helped us to become more aware of a new facet of our role in the future. We have to listen, and adopt a more modest and learning attitude as far as societal issues are concerned if we want to effectively take part as stakeholders in the decision-making processes in the future. This implies both a mourning process as far as our past position is concerned and some courage to overcome the fear of change. But, the challenge to develop a new skill in the profession to

contribute more effectively to the decision-making processes related to radiological risk assessment and management is very exciting.

Our meeting was successful because we were all able to adopt an introspective attitude, and have been courageous enough to recognise our present limits.

Before officially closing the Workshop, I would like to thank, in the name of the Programme Committee, all the speakers and chairpersons, the technical staff of HSK and particularly Mr. Wolfgang Jeschki, who kindly invited us, and Mr. Serge Prêtre who, once again, raised from the very beginning of the meeting the key questions.

I wish to all of you a nice and safe journey back home.

Thank you very much for your attention.

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