



# SOCIAL ASSUMPTIONS IN REMEDICATION STRATEGIES

A deliverable report of the STRATEGY project

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Sustainable restoration and long-term management of contaminated rural,  
urban and industrial ecosystems (STRATEGY)

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# **Sustainable Restoration and Long-Term Management of Contaminated Rural, Urban and Industrial Ecosystems (STRATEGY)**

Following large-scale releases of radioactivity, urban, industrial and rural areas may be contaminated for many years. Consequently, areas of industrial and agricultural production, residence and recreation may need to be managed to mitigate the impact of contamination. To sustain acceptable living and working conditions in contaminated areas we need to be able to construct robust, effective restoration strategies which address the many different types of environment, land use and ways of life. Previously, countermeasure research has largely focused on the effectiveness of individual methods. There has been little consideration of how to combine these individual countermeasures within a sustainable restoration strategy for a contaminated area containing urban, rural and industrial systems. To address these issues, a multidisciplinary team, including radioecologists, economists and social scientists, has been formed within the STRATEGY project. The project aims to establish a decision framework to enable the selection of robust and practicable remediation strategies for Europe, which will enable the long-term sustainable management of contaminated areas.

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## **Introduction**

Any countermeasure or set of countermeasures contain within in them a variety of social assumptions - those taken-for-granted expectations about the ways in which people will behave, and what is meaningful, valuable, credible and possible for them. These are often unspoken, maybe implicit assumptions built into other inputs such as information provision and decision making practices. If these assumptions do not accurately reflect social reality, then the effectiveness of any remediation strategy is likely to be reduced. The negative effects of false assumptions in one measure may well spread across the whole institutional programme of remediation *per se*. If one can identify, assess, and where appropriate change these assumptions, better remediation choices are likely, leading to more effective remediation.

In this text, we consider several dimensions of social assumptions and use particular countermeasures to exemplify these. Firstly, we address the embedded assumptions implicit in risk assessment, including those related to both the degree and nature of the risks themselves. Then, we go on to examine particular dimensions of assumptions about behaviour, confidence, institutional capabilities, social and cultural feasibility and compliance.

The context of a large scale nuclear accident and resulting widespread contamination is one that could well change many of the social patterns and assumptions that have been identified in relevant areas of research. The potential need to 'learn to live with' contamination, for example, could result in a 'familiarity breeding contempt' and a lower level of attention to the risks than might be appropriate, or conversely could lead to heightened levels of risk awareness and 'over-reaction'. The precise responses of particular groups are not possible to predict, due to the interactions with a host of other factors, including those which are temporally specific, such as whether there have been other recent relevant accidents<sup>1</sup>.

## **Literature**

Despite quite extensive searching, there seem to be very few studies with sufficient socio-cultural depth to enable the detailed examination of social assumptions in relation to remediation activities in the post-Chernobyl context. The relatively comprehensive studies made of the Saami reindeer herders, village populations in some parts of the former Soviet Union (fSU), and Cumbrian sheep farmers, are not reproduced in comparative studies of other populations. Even in these detailed studies, which report sociological data, analysis has not generally been conducted sociologically, with the exception of Wynne's studies of the Cumbrian sheep farmers (Wynne 1989; 1992). Particularly, there is a dearth of studies on responses to countermeasures in different cultural contexts, and of the social and cultural factors which have been implicated in those responses.

There have been relatively extensive studies in related areas – for example, relocation has been studied primarily in relation to large infrastructure projects such as dams (e.g. Picciotto et al, 2001). Whilst many social and cultural features identified in such studies

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<sup>1</sup> The responses in the Project ISOLUS Front End Consultation, for example, which mapped out concerns and aspirations in relation to the management of radioactive wastes from nuclear powered submarines, was obviously influenced by recent major train crashes in the privatised and contractorised rail sector in the UK. This influence was manifested in a widespread belief that contractors compromised safety in relation to costs (see [www.nucsubs.org.uk](http://www.nucsubs.org.uk))

may be transferable to the situation of extensive radioactive contamination, this is by no means straightforward. The sheer necessity of relocation in relation to dams, for example (i.e. the physical impossibility of remaining in or returning to flooded villages), generates a very different situation to that of radioactive contamination, where there is the physical possibility of remaining. As such choices are strongly related to issues such as the degree of perceived risk, trust in information sources, availability of compensation or employment in new settlements, etc, there is likely to be considerable variation in different contexts. It therefore cannot be assumed that studies in relation to what may be ostensibly comparable issues can be applied to radioecological remediation, or even that what appear within the literature as comparable studies actually capture the dimensions that are relevant to different contexts.

It has therefore been necessary to draw from the wider literature on risk and hazard, and apply the findings to the situation of large-scale radioactive contamination. This must, however, carry the caveat that the case of a large-scale nuclear accident giving rise to extensive contamination is a particular one, and the ways in which it may be understood and responded to are unlikely to be fully analogous to other risk situations.

### ***Assumptions in Risk Assessment***

The approach to developing countermeasures has been dominated by radiological and, to some extent, economic, approaches, conditioned by considerations of perceived practicality (e.g. Roed et al, 1996; Brynildsen et al, 1996). (The perception that something is practical itself makes various social assumptions, yet is often deeply buried and presented as being common sense. Whether these perceived practicalities actually represent the practicalities as understood by the relevant populations cannot be assumed.)

Radiological and economic approaches apply forms of traditional risk assessment, whereby the effects of contamination are focused on radiological dose, wherein the primary assumption is that dose should be reduced to 'safe' levels, and that the cost of implementing countermeasures can be weighed against the reduced dose through cost or risk benefit analysis. In conjunction with this, the pattern of research funding has encouraged a quest to produce generalisable and standardised countermeasures, relevant for application or at least consideration across wide variations in local cultural and social contexts. Although field workers have rapidly become aware of the significance of local social conditions (particularly in the extensive work in the fSU, where such social conditions are made more visible by their difference to conditions in many researchers' home countries wherein the social context is made invisible by its familiarity and taken-for-granted ness), acknowledgement of such social conditions is lacking in, for example, the REACT proceeding (Howard & Desmet, 1993) as in other publications produced from such research.

It is not only the remediation scenario or option which may embody problematic social assumptions – so too may prior the risk assessment itself. Thus for example Wynne (1989) showed how even the very precise probabilistically-modelled scientific risk analysis of pressure-vessels for nuclear reactors involved assumptions that the future institutional qualities of manufacture, maintenance, operation and inspection will be at least as good as those past examples from which the failure-data were accumulated. Other scientific risk assessments like those of chemical pesticides in farming embody quite demanding social assumptions about the practical disciplines involved in spraying pesticides in real farming conditions where time is crucial, proper equipment may be unavailable, training may be

inadequate and weather conditions inappropriate. A similar situation existed in the notorious British case of mad cow disease, where the specified bovine offal ban of 1990 which was supposed to ensure that no such sensitive tissues entered the human food chain, was undermined for several years, against the naïve assumptions of government regulatory officials, by actual slaughterhouse practices.

The implication of this is that the more ‘technocratic’ approaches (Jamison, 2001) to risk assessment and management have inadvertently occluded the more textured social and cultural dimensions of the relevant processes. They have been overly dominated by the factors which appear to promise precision and control, at the expense of serious thinking about the more contingent factors which shape the harder technical processes in so doing, the alienation of lay publics and citizenry from dominant institutions in a range of environmental and technological arenas identified by Jamison and others is reproduced. The epistemological commitments of responsible institutions exclude consideration of the alternatives epistemologies and ideologies of many of the very groups who have been affected, whilst the (scientific) drive towards standardised terms has further served to negate the plurality of contemporary social realities. Thus, the apparently simple case of cleaning buildings to reduce contamination and exposure – a measure which can be technologically straightforward, requires little or no specialist equipment or skills, and can result in substantial reductions in dose, needs to also take account of the meanings which radioactive contamination carries for affected communities, the acceptability of doses accruing to those carrying out the cleaning, the cultural significance of concepts of ‘cleanliness’ (Douglas, 1966), stigma, the acceptability of residual contamination, and so forth. The complexity of this reality then surfaces in decisions and implementation, resulting in complex negotiation between affected parties in the attempt to find viable strategies, or, in some cases, the failure or subversion of some measures.

The STRATEGY project has recognised the social dimensions of countermeasures, and has attempted to incorporate them, for example, through codification in individual datasheets. However, the datasheets can do no more than indicate where particular social dimensions may be especially relevant – they cannot capture the interrelationships between aspects such as trust and information, for example. Local agents acting in the real situation may have to be trained to take such dimensions into account along with the more technical parameters and judgements.

The risk assessment project is considered by Jasanoff (1999) in relation to both the significance of concepts of risk in relation to environmental management, and the limitations of particular understandings of risk (cf Krimsky and Golding, 1992). Jasanoff considers risk concepts along two dimensions: ‘their theoretical stance with respect to the nature of environmental knowledge’ and ‘their prescriptions for linking knowledge to political action’ (1999:137). She identifies three major traditions in the sociological analysis of risk:

- 1) a positivist/realist theory of knowledge, with a bureaucratic-rationalistic policy orientation, whereby risk can be measured and mapped, and thus controlled (within limits) and where failures in risk management are understood as being due to inadequate knowledge or competence or a failure of political will
- 2) a social constructivist theory of knowledge, with a liberal-pluralistic approach to integrating knowledge and action, whereby risks are understood through ‘lenses shaped by history, politics and culture’ (1999:137) and risk management requires negotiation and dialogue to enable the inclusion of different perspectives, and

- 3) a constructivist theory of knowledge focussing on the mediation of knowledge and power, which sees risk analysis as a particular discourse (among others), which empowers some and excludes others.

Jasanoff concludes that 'Judgements about the nature and severity of environmental risk inevitably incorporate tacit understandings concerning causality, agency, and uncertainty, and these are by no means universally shared even in similarly situated western societies' (1999:150), and that recognition of this requires more deliberative politics, which can enable environmental decision making to become a 'more-open ended process, with multiple access points for dissenting views and unorthodox perspectives' (1999:150) This approach allows identification of the historic risk management practices related to radioactive contamination as embodying positivist/realist conceptions of knowledge, alongside bureaucratic-rationalistic policy. That is, such risk management practices assume that the relevant factors can all be adequately identified and measured, and the relationships between them understood. Thus risks are seen as controllable given adequate resourcing to develop this necessary knowledge base and the political and managerial competence and will. However, the scientific knowledge base is demonstrably incomplete, and social and ethical knowledge makes no pretensions to producing the sort of knowledge that can be straightforwardly incorporated into such risk assessment.

Experience with the real implementation of countermeasures (Wynne, 1989) demonstrates the need instead for more inclusive and deliberative processes of both defining the nature of problems, and of generating solutions, grounded in appropriate combinations of scientific understanding of radioactivity and relevant processes, and local practical knowledge's, and including social and ethical dimensions through appropriate participation.

### Risk perception

Extensive research on risk perception (e.g. Jaegar et al, 2001) demonstrates some of the ways in which the lay public consider risks. Risks are experienced differently dependent on a wealth of inter-related factors such as:

- Who is at risk? Risks to young people and old people are considered to be different, as are risks to people with whom individuals have close relationships. Further, risks to identifiable individuals rather than statistical populations also carry different meanings.
- What is the distribution of risks and benefits? Who benefits, and who carries the risk burden?
- Does the risk have catastrophic potential? Routine risk assessment tends to value high consequence low probability events very low, whereas high consequence events – whether these be in terms of mass consequences, or consequences to a single individual – are generally valued highly by lay publics.
- Is the risk familiar? Research has shown that risks which are familiar are generally considered to be less significant than those that are unfamiliar. The direction of causality, however, should not be assumed: risks may be familiar because they are acceptable or necessary, and it is then reasonable that the risks should be considered to be low when judged against the alternatives.
- Who is in control? There is an expectation in western cultures that formally constituted institutions will take responsibility for decisions and actions, especially in relation to complex technologies where expert inputs are required. However, whether or not these institutions have the confidence and trust of their publics is another question. Environmental, health and food issues in particular have highlighted the



lack of confidence in many of the relevant institutions. When risks are managed by the private sector, and in the UK, particularly where extensive contractorisation has occurred, confidence is often very low. When confidence is low, it follows quite logically that the risk that is being managed is likely to be miss-managed, and hence greater.

- Do we need to take the risk? Perhaps the most fundamental question raised by lay understandings of risk is that of whether the activity giving rise to the risk is needed in the first place. More than all others, this raises the complex and multi-faceted social nature of risks as something that cannot be judged solely on technological, scientific or economic merits, but which raise ethical issues and the underlying question of what sort of society or world do we want to live in?

One insight which deserves special attention in the present context is that emphasised in a recent EU study of public attitudes to agricultural biotechnologies in Europe, PABE (Marris et al, 2002). This is the point that ordinary publics are typically responding to risk situations not only in terms of their perception of *risks* per se; they are responding (for good reason) to the behaviour, including past behaviour, of the institutions supposedly taking responsibility for the situation. Public responses to new technologies and policy interventions are usually mistakenly understood to be responses to risks (as defined by relevant scientific disciplines), when they are better seen as responses to the institutions supposedly in charge of the risk-generating activity. When one understands that public awareness and acceptance of scientific ignorance, thus unanticipated consequences, is central, this is a perfectly logical standpoint, since scientific knowledge of the risks does not even refer to the unknowns which stalk existing scientific understanding of salient causal mechanisms. If unanticipated effects are central, then the risk question is less relevant than the question, “who will be in charge of societal responses to the unpredictable events which will arise from these actions? – and, can we trust them to act rigorously in the public interest?” (Wynne, 1980; 1992)

This summary of findings from risk perception research gives some indication of the range of inter-related dimensions which shape the way people understand, and respond to, risks and risk events, and emphasises the significance of taking these very different attributes into consideration when designing and implementing viable and effective countermeasure strategies.

### ***Dimensions of variability***

That there is cultural, social and economic variability in different places, as well as variations in the salient physical and biological characteristics, is self-evident. Cultural variations include things such as the meanings and values of place, or the meaning of risk (Jasanoff, 1999), and the ways in which these are integrated in social systems. Taken-for-granted ideas about how much (of what?) humans should control, are also culturally-shaped ideas close to different concepts of risk. Social dimensions include the relationships between various groups, including issues such as the trust in relevant authorities, and issues such as the distribution of power, communication, and risk perceptions and knowledge's. The quality of institutions in various specific dimensions – training, resources, morale and discipline, openness or dogmatism - is also a key dimension as indicated earlier. Economic aspects include issues such as what is produced and the patterns of wealth distribution. There is a relationship between physical and cultural, social and physical characteristics – industries have developed where relevant resources are available, patterns of agriculture reflect environmental conditions, etc. This relationship is not determinate, and is increasingly detached as technological

developments enable alternative land uses, raising the issue of time as a (socially-conditioned) possibly relevant variable.

Marples (1991; 1996) describes the significance of Chernobyl in relation to the major political changes occurring in the FSU over the same time scale, raising the question of the assumptions that are made within planning about the continuity of particular forms of governance and the implications of these for the potential of particular countermeasures or strategies. On a micro-level, variations in the annual patterns of food consumption (e.g. see Beresford and Wright, 1999) have more obvious implications for the viability of countermeasures, but are also related to variables such as the temporal availability of alternatives, and the relationship of harvesting or slaughter times to cultural and social patterns, such as those practised by the Saami (Gould, 1990), which influence the practicability and acceptability of countermeasures.

It is possible to make generalisations about the relevant characteristics of different groups. Cross national surveys such as the Eurobarometer series provide broad brush pictures: for example, respondents across Europe consistently reported feeling poorly informed, and had a high level of concern, regarding radioactive waste management (INRA, 1999). Many studies have found that women tend to perceive risks, and specifically nuclear risks, as higher than men do (e.g. Barke et al, 1997; Weisaeth and Tonnesson, 1995). The cultural and social location of a risk source, such as a nuclear power station, varies in different nations and communities – in France, for example, nuclear power has a stronger association with national independence (Chafer, 1985, cf Jasanoff, 1999). There are other identifiable characteristics of different groups at a sub-national level, such as a stronger or weaker tradition of ‘do-it-yourself’ with regard to household maintenance (which has implications for both the degree of self-help in countermeasures such as cleaning of buildings or those involving the removal of vegetation or burial of soil, and for ‘over-compliance’, see below). However, this level of generalisation is problematic if it is applied to the local application of countermeasure strategies, where deviations from the median are common.

Local variations will supersede these national generalisations. A simple countermeasure such as turning flagstones may be inappropriate because the paving has a high cultural value in a particular area, making cleaning more appropriate, or because they are unsuitable for turning due to only having smooth surfaces on one side – something which may not be known at a regional or national level. A particular mayor may own a cleaning company, and be seen to be motivated by his own self interest in recommending widespread cleaning and hence to be instigating measures that are not justified and therefore do not have to be taken seriously. This might then have the effect that people did not implement cleaning as a self-help measure. That Southern Saami reindeer herders report both resuming a higher level of consumption of reindeer meat after initially reducing their intake in the first years after Chernobyl, and that men generally eat more of the reindeer meat than women and children (Mehli et al, 1996), demonstrates the importance of considering relatively fine-grained variations in the selection of countermeasures, both within populations and over time. Wynne’s accounts of the inappropriateness of some measures suggested in the early aftermath of Chernobyl for Cumbrian sheep farmers, measures which did not take account of the farmers’ own knowledge of factors such as the availability of pasture, market requirements, and the behaviour of sheep on upland pastures, and the incorrect early assumption that radionuclides would behave on upland soils as they did on clay based lowland soils, demonstrate the need to take account of local variations in remediation strategies.

These local variations mean that countermeasure strategies need to be responsive to particular local conditions, not just in environmental and economic terms, but in terms of the local social and cultural characteristics. This requires that strategies can be varied at a relatively fine-grained spatial scale, to reflect local conditions, and this, in turn, requires that those conditions are known and understood. In addition it requires that relevant operational staff are trained in asking the right kinds of question, and have procedures which allow negotiation to take place between carriers of relevant local practical knowledge and scientists.

Local knowledge is a key dimension of any countermeasure strategy. It is essential that responsible authorities seek out and listen to reports of local conditions, and take these into account in designing and implementing remediation strategies. It is not, however, possible to codify all such knowledge in advance, not least because conditions change (the mayor may not be re-elected; around 20% of Cumbrian sheep farmers are not re-stocking after the 2001 foot and mouth outbreak). This therefore implies that one activity to be undertaken in the short term after a contamination event is for local authorities to engage with local communities, to present and discuss remediation options and ascertain those which best meet local needs and conditions.

Some countermeasures, of course, need to be applied at regional, national or supra-national levels, or have implications or requirements at these levels. Restrictions on foodstuffs, for example, have implications for the supply and demand of alternative foods in a larger area than that in which the restrictions apply. In these cases, obviously, the communication network needs to extend to the areas – social and spatial – involved, for example by convening stakeholder forums where information can be exchanged and a better understanding of the ways in which different groups are operating can be developed. If, for example, a skim and burial plough is to be undertaken over large areas, the network extends beyond local landowners and land-users to the owners and suppliers of relevant equipment; if sites of high conservation value are within the area to be treated, then discussion with conservation groups will assist in identifying key areas of value and possible alternative or additional measures which can be taken to protect them, and so on.

The assumption that sufficient is known about cultural, social and economic variations, or that generalisations at the national or regional level are sufficient, is clearly inadequate with respect to many if not all remediation strategies. Communication between the relevant parties, alongside the retention of flexibility in strategies in order to respond to local conditions, is thus essential.

### ***Immediate Aftermath and Trust***

The immediate aftermath of any large scale disaster, and the ways in which the authorities act in this period, will have a powerful influence on the ways in which subsequent remediation measures are understood and acted upon. Relationships of trust and authority will be crucially dependent on these immediate responses, and on the previous histories of different communities.

Analysis of European governmental responses to Chernobyl in the immediate aftermath (Gould, 1990) demonstrates that the reassurances proffered in many countries, shortly to be followed by restrictions and other actions which invalidated those reassurances, along with the generally confused and contradictory messages and large gaps in information

available, gave rise to confusion, anxiety, and a lack of confidence in many of the responsible authorities (cf Nohrstedt, 1991). Gould also describes the deliberate withholding or suppression of information in some states, which added to a failure of confidence when that information was revealed from other sources, sometimes neighbouring states. Weisaeth and Tonnessen (1995) identify a lack of understanding and a lack of confidence in the Norwegian population in relation to information after the accident. This confusion – along with more deliberate use of representations of Chernobyl in relation to nuclear activity more generally – served to amplify the risks, generating a sense of lack of control and loss of confidence amongst the general public

The association of statements of low or limited risks with proponents of the nuclear industry has been documented (Gould, 1990; Marples, 1991) and adds a further dimension to mistrust and lack of confidence, wherein any statement of low risk is tainted by the association with the nuclear industry and is not believed. Again, this will vary across social groups and with the prevailing national perception and associations of the nuclear industry – which are, of course, likely to be rather problematic after a major nuclear accident

The experience of poor, confused and contradictory information provision after the Chernobyl accident, and the associated inability of many of the responsible institutions – including government – to respond efficiently and effectively in the short term, generating a lack of confidence in subsequent information and measures, leads to the conclusion that it is essential that the relationship of trust is generated, not dissipated, in the immediate aftermath. The effectiveness of subsequent countermeasures is heavily dependent on the relationships generated during this period. Measures which rely on, for example, the acceptance of particular knowledge claims such as the safety of food stuffs and water or the protection offering by shielding (e.g. as provided by ploughing or digging in) could well be significantly compromised if confidence in the relevant authorities is low.

### ***Institutional Ability to Cope***

The problems encountered by relevant institutions in the immediate aftermath of Chernobyl, generally attributed to lack of preparedness and lack of clarity regarding distribution of responsibility (Czada, 1990; Marples, 1991; Nohrstedt, 1991), have been recognised in the research and development effort for the management and amelioration of large scale nuclear disasters. However, it cannot be assumed that this research and development means that in the event of a further disaster, the institutional machinery will run smoothly. Much has been learnt, but there has been no opportunity to put this learning into practice. The assumption that the immediate and longer-term requirements made of a variety of institutions, including the decision-making apparatus, will be straightforward is belied by the sheer unpredictability of the pattern of contamination from a large scale nuclear disaster. Institutions will be faced with developing new abilities, and new patterns of practice, and with negotiating and communicating within unfamiliar networks. Many cleaning countermeasures in urban areas, for example, rely on an institutional ability to organise the appropriate resources, and to develop and carry out the necessary communication activities, at regional and sub-regional levels. Gaining acceptance for radioactive waste disposal activities, for example, is something in which very few authorities at any level have any experience.

Operating in a context of long-term contamination is inherently unpredictable and closely linked with indeterminacies of in some cases related effects on employment and other features of the social context. In the Ukraine and Belarus, for example, the acceptability

of relocation is linked to the availability of jobs elsewhere, age, and strength of sense of community – and there is some evidence that the sense of community is itself strengthened by living in the relocation zone (Marples, 1997). These inter-related indeterminacies make it impossible to predict the more precise demands that will be placed on institutions, but imply that it will be necessary to monitor and support, rather than presume, effective institutional action, and at the least to assess the viability of the existing institutional infrastructures in relation to particular countermeasures.

The range of indeterminacies and uncertainties of what the effects of a large scale nuclear accident might be – including environmental, social, cultural dimensions – is huge. In combination with the presumption that such an event is unlikely, and that the resources devoted to preparation must be balanced with against other needs, the sort of comprehensive training and skill development, information gathering and other preparation that could be undertaken is necessarily limited, particularly and the local and more specific level. The UK Agriculture and Food Countermeasures Working Group (AFCWG), and similarly the FARMING network, provide one model for preparation which incorporates at least some of the social dimensions through a process of stakeholder discussion. The involvement of stakeholders, including NGOs, enables inclusion of a much greater representation of social experience and knowledge of relevant networks and conditions, and adds to the credibility and authority of the information and advice that the group can provide. Where relevant systems – such as milk collection – are already in place, these can be identified and relevant stakeholders included in collecting information and developing the processes to support effective countermeasure implementation. For all countermeasures, this needs to include identification of areas where particular processes cannot be developed in advance of the event, but will need attention subsequently, such as the many instances where local public deliberation is required or where local conditions need detailed attention. Any processes established now have to remain sensitive to the possible need for change in the particular circumstances that might arise.

### ***Behaviour***

Optimal remediation strategies are premised on assumptions about people's behaviour. Such assumptions range from those that are relatively straightforward, such as assumptions about the amount of time people spend in various buildings or parts of buildings, to those which are more complicated, such as assumptions concerned with cultural significance of responses. In both cases, however, behaviour is rarely explicable by reference to linear models or single causes, but is the product of interactions in a number of dimensions. For example, behaviour in relation to a street that has recently been cleaned might be to spend less time on that street, as its cleanliness has associations with middle class mores, control and gentrification which pre-empt 'street corner society'. Selecting various areas for cleaning because (in part) of the amount of time people spend there could thus be invalidated. But in another case, a street might attract more people after cleaning, if (following the same example), there is a nascent middle class community 'looking for somewhere to go' as a public space, and the same gentrification which deters some might then attract this community. It is therefore necessary to consider the particular social characteristics of the area in which a countermeasure takes place, and to recognise that the day-to-day behaviour of individuals and communities cannot be assumed to be unaffected by the implementation of countermeasures. Moreover, countermeasures may interact – skimming or ploughing in parks, with the consequent, albeit partly short-term, destruction of amenity may change some patterns of activity and, for example, lead to

people spending more time in private gardens, thus increasing their potential exposure there.

The impacts on behaviour of particular countermeasures are obviously significant, yet unlikely to be easy to predict, and likely to be locally variable dependent on a range of interacting factors. Again, this points to the need for local level communication to identify positive and negative impacts on behaviour.

### **Stigma**

The act of implementing countermeasures is a statement that an area or resource is contaminated. As such, it is likely to engender stigma if this did not already exist, and there is likely to be a relationship between the degree of significance attributed to the countermeasure and the extent of stigma. That is, a countermeasure which is unfamiliar or otherwise suggests that the action being taken is substantial (such as food restrictions, or the highly visible removal of topsoil or skim and burial of topsoil, and certainly the profound effects of re-location) is more likely to be associated with stigma. Countermeasures which are more 'ordinary' – such as cleaning buildings, or mowing lawns – do not carry such a strong implicit message that something substantial is occurring, and are likely to be less associated with stigma. In both cases, however, contamination is likely to be associated with stigma, with consequent effects on behaviour such as avoidance of contaminated areas or foods (Flynn et al, 2001).

It should not be assumed that once an area or resource is treated, the stigma will dissipate. Kunreuther and Slovic (2001) consider that the following strategies are viable for managing stigma:

- preventing stigmatizing events – model stigma impacts as explicit costs in decision analysis
- reduce perceived risk – create and maintain trust; inform, educate and desensitise the public
- reduce social amplification – educate the media about stigma, educate the government about stigma
- reduce impacts – provide insurance, guarantee property values, provide compensation. (2001:341)

This emphasises the need to include consideration of the impacts of stigma in assessing countermeasure strategies, including evaluation of the economic costs of, for example, falling house prices and impacts on industries such as tourism and locally produced foods. The second arena of management suggested is to do with the nexus of trust and communication, with the implication that risks should be 'played down'. This, however, is a highly sensitive arena – statements that risks are lower or less significant than is popularly perceived can generate mistrust. This then again highlights the need for a comprehensive, open, sensitive and trustworthy communication strategy, whereby trust is generated, and where the significance of risks can be negotiated and agreed rather than assumed and imposed.

## ***Social and cultural feasibility and constraints***

Any countermeasure assumes that people will be able to do whatever is required of them by that countermeasure. We discuss this in terms of material, communicative and cultural feasibility.

### **Material feasibility**

That some countermeasures are not materially or practically feasible is obvious. The substitution of foodstuffs (be they human or animal) with high cost imports is obviously not possible for poorer populations unless the cost of substitutes is sufficiently subsidised and those populations thereby have the real option of purchasing alternatives. That substitutes, or other resources, equipment and skills (including management capacity), are physically available is an obvious constraint. British farmers reportedly found harvesting, landspreading and ploughing in of contaminated crops to be less acceptable than ploughing in or burning due to its higher labour intensity (Woodman and Nisbet, 2000). The assessment of self-help measures in fSU identifies, for example, the inappropriateness of fertilisation of meadows to reduce radiocaesium transfer as a self help measure, as the local population do not have the available resources to implement this (Beresford and Wright, 1999). Any countermeasure requiring monitoring, such as live monitoring, obviously require the availability of the appropriate equipment and training; countermeasures that depend on lay understanding and application of monitoring results, such as processing milk or crops, also require that the material, as well as the social, aspects of communication (such as leaflets and the capacity to produce and distribute these) are available.

### **Communicative feasibility**

Self-help measures which rely on the provision of information, such as dietary advice, food labelling and restrictions on gathering food, are obviously highly dependent on the ability to communicate effectively. Other measures, such as modification of tree felling times, or clean feeding, are similarly dependent on the ability to communicate effectively with foresters and farmers.

Communicative feasibility depends not only on the material requirements of communication (such as production and distribution in appropriate forms and through appropriate networks) but also on the extent to which information is authoritative, and the extent to which it is meaningful to relevant groups, and takes account of existing and inter-related practices. This implies the need for two way communication strategies, where information is both provided and sought.

Countermeasures assume that the necessary conditions for successful implementation are available and monitored and enforced. It has already been noted that these conditions cannot be assumed: if used according to instructions, pesticides meet the regulatory requirements, but it cannot be assumed that instructions are read, understood and acted upon, especially where there are countervailing factors which obviate against this. So, for example, the distribution and application of potassium or lime, or of concentrates such as AFCF or calcium, assume that instructions for use will be read, understood, and complied with. Where farmers are familiar with the use of chemicals, and the importance of correct rates and means of application, this may be more warranted than in situations where chemical application is less familiar.

There is a tension between the provision of information which is simplified and standardised, and the real environmental and social complexity of the contexts in which

this information is to be applied, for example in relation to the different radionuclide uptake and consumption of fungi (Beresford et al, 1999). The question here is when it is possible to provide information which is sufficiently standardised and simplified to enable widespread distribution, as is required, for example, by food labelling, and when more particular and specific information is required – which is the ‘real case’ with food labelling, where the risk posed by residual contamination of foods is related to the dose being received from other sources (including other foods). Where foods are, for example, carrying a radiological burden which varies through the year, the standard ‘avoidance’ message is over-simplified when judged in relation to the economic and nutritional benefits of maintaining consumption.

The key assumption in relation to communication is that it will be adequate to enable the effective implementation of a countermeasure or countermeasure strategy, and again, this requires a relatively detailed knowledge of the relevant groups, and their particular social and cultural conditions. In addition to conditions for communication, this also involves the larger sense of agency which local people feel, in relation to how much of their own responsibility will they take for learning the best conditions and practices *for themselves in their particular situation*.

### Cultural and social feasibility

‘Nuclear’ and ‘radioactive’ carry powerful connotations; radioactivity has been widely identified by social risk researchers as a somewhat special case. Whilst this has sometimes been interpreted as an irrational response by the lay public and attributed to the ‘dread factor’ of an invisible threat, more sophisticated analysis demonstrates that the social dimensions of a risk – such as who is in control, what the need for taking the risk is, how the activity has been promoted with what excessive promises, and the extent of general confidence in knowledge claims – can explain the high loading that is associated with radioactive hazards. The variation in the ways in which different groups respond to radiological risks needs to be assessed rather than assumed.

The identification of land as contaminated can significantly change the relationship to that land, which might no longer be seen as ‘natural’ but as damaged (cf Douglas, 1966).

Many countermeasures imply some disturbance to everyday life, ranging from the almost total impact of re-location, to the less overwhelming but nonetheless sometimes significant impacts of such apparently small changes as temporary restrictions on behaviour patterns. Disturbance can be in terms of short term disruption as is the case with cleaning measures, or longer term or permanent changes, as with changes in farming practice or education programmes. The significance of disruption is only partly predictable. It is plausible, for example, to presume that the disruption caused by turning flagstones or road planing is predictable by analogy to other road maintenance activities, and is relatively superficial. Ploughing measures in park areas – with the consequent destruction of amenity – might have more considerable impacts, more analogous to the complete removal of a set of leisure amenities or spaces for social interaction, such as closure of local facilities. Changes in land use for farming communities – whether it be to alternative crops or cessation of farming – obviously imply profound changes with impacts throughout a community. The extent to which the need for such changes will engender acceptance or resistance to countermeasures is inherently unpredictable but requires attention in the event.



The Saami responded to dietary advice in the early post-Chernobyl years, reducing their intake of reindeer meat and freshwater fish considerably (Strand et al, 1992). The Southern Saami later selected reindeer for consumption from grazing areas with lower levels of consumption, or after live-monitoring, and less commonly after clean feeding or having changed the time of slaughter. Animals for consumption were given clean feed for longer periods than those for sale. The relatively detailed accounts of the Saami show that countermeasures are selected in relation to their fit with existing cultural and social patterns, and excessive disruption (such as that caused by changing the slaughter time), avoided. It is important to note here that these countermeasures were those selected by the Saami, rather than being imposed upon them, and thus countermeasures could be chosen that enabled the more important continuities – as judged by the Saami – to be maintained.

The use of water from reservoirs does not require any action on the part of the consumer. However, it does require that consumers have confidence in the relevant authorities that tap water is safe (enough) to use, including confidence that any countermeasures applied have been carried out properly. Confidence in the decisions made, the knowledge bases feeding those decisions, and their implementation, are a fundamental requirement that cannot be assumed to exist; as discussed above, confidence is likely to be highly dependent on activities in the immediate aftermath of an event, and on activities in analogous arenas. The level of confidence will need to be assessed in relation to countermeasure strategies.

### **Compliance**

Successful application of any countermeasure assumes compliance, or at least that there will be sufficient compliance to make the countermeasure worth implementing. There is also the assumption that a countermeasure or strategy will not, of itself, provoke activity or have side effects that undermine the countermeasure or make it counterproductive. A further problem is ‘over-compliance’, where, rather than not complying with a countermeasure, people apply countermeasures when they are likely to be better off not doing so.

### **Black market potential**

There are reports from the post-Chernobyl period of, for example, farmers selling foodstuffs which were above intervention limits on the black market, and of produce designated for disposal appearing on markets in other countries (Gould, 1989). Such activities both undermine confidence (especially when conducted on a large scale) and undermine the effectiveness of countermeasures.

### **‘Rip-off’ scope**

Clearly, there is potential for some counter-measures to be subject to abuse: cleaning contractors, for example, could take-short cuts and fail to properly clean buildings, sub-standard materials could be used, etc. These are ‘normal’ (i.e. not specific to remediation strategies) events and can be dealt with through the ‘normal’ methods of policing, e.g. inspection, monitoring and quality assurance. Estimates of ‘normal’ levels of non-compliance can be used to anticipate the level of non-compliance that might occur, although this too needs to be considered in the light of the ‘change of context’ that severe radioactive contamination produces.

### **Waste dumping**

There are numerous cases of wastes of all types being disposed of illegally or improperly. Such cases tend to be related to instances where the costs of proper waste disposal are

high, or the form of waste disposal inconvenient, to cultural perceptions of acceptability of forms of waste disposal, to knowledge about the implications of waste disposal, and to levels of policing and punishment. The assumption that radioactive wastes generated by cleaning operations and the disposal of contaminated materials generally will be consistently carried out properly is not tenable, and is complicated by the fact that radioactive wastes tend to more powerful negative associations than other waste forms, implying that it is not possible to transfer experience with other wastes to radioactive wastes in a straightforward way. It might be that those who are willing to contravene regulations with regard to other wastes are more circumspect with regard to radioactive wastes. Alternatively, it might be that higher sensitivity of radioactive wastes increases the costs of disposal and management and thus encourages non-compliance. It is likely that any instances of non-compliance that become public knowledge will engender considerable concern and undermine confidence in the responsible authorities more widely. This is accentuated by the fact that there have been widely publicised instances, such as the disposal of radiation sources in South America, that have had observable detrimental effects, and that non-compliance with disposal regulations for radioactive wastes could carry relatively high risks. It is therefore worthwhile considering what the impacts of non-compliance in relation to waste management are likely to be, both in radiological and social terms, and there may be some cases where the costs of ensuring compliance, or the lack of the means of ensuring compliance, undermine a countermeasure strategy.

### Restrictions

A number of countermeasures involve restrictions on use or consumption, such as restrictions of use of recreation areas, and changes in hunting systems. These are largely dependent on individual compliance. When compliance with hunting restrictions, for example, is coupled to the potential for black markets to arise, effects go beyond the individual. The costs of policing to ensure adequate compliance are a necessary consideration when assessing countermeasures.

### Undermining and provoking

Some countermeasures might of themselves provoke responses which undermine the remediation strategy. Dilution of food crops, for example, might well generate substantial mistrust in a wide range of foods which are suspected of being contaminated. Its acceptability will be dependent on the extent to which intervention levels are perceived as sufficiently safe, and, conversely, the extent to which the view that any contamination is problematic and should be avoided is sustained. 'Contamination by association' is a known response, and requires consideration.

The ways in which information is generated and provided, and decisions made, has the potential to undermine countermeasure strategies and provoke negative responses. The issues of trust and confidence in relation to information have been discussed. A further dimension is that of the ways in which decisions are seen as being inclusive and legitimate, or, conversely, being imposed by external authorities. Here again, sufficient communication – not only one-way - within the local arenas of application are the key means to preventing political provocation.

### **'Over-compliance'**

As well as problems of assuming that compliance will be forthcoming, there are problems in cases where people are overly-compliant in the sense that they apply a countermeasure when it might be better not to. For example, roof cleaning might be undertaken without suitable safety precautions, and by people inexperienced in roof work, and the radiological gain is outweighed by the risks of serious accidents. During the immediate Chernobyl aftermath, there are reported instances of iodine, in any available form, being taken as a prophylactic, and in some cases causing death (Gould, 1989). A third example is that of restrictions on leisure use of countryside in some areas might generate a distrust of the countryside more generally, and lead to people not undertaking outdoor leisure pursuits with consequent effects on the rural economy and potentially on health due to lack of exercise. A fourth example is that of particular foodstuffs being avoided completely rather than limited and nutritional requirements not being met. The roof cleaning case, again, is analogous to 'normal' circumstances, where roof-work is undertaken without due regard for safety measures, and the iodine case, to some extent, analogous to self-administration of a range of drugs for a variety of reasons. Better information provision will ameliorate these effects to some extent, as will the way in which countermeasures are implemented – that is, for example, that if cleaning is proceeding rapidly, and the rationale for the selection of areas to be cleaned understood, individuals are less likely to 'over-comply'. That the promotion of some countermeasures can give rise to 'over-compliance' needs to be acknowledged and addressed in the selection and implementation of a countermeasure strategy.

### **Conclusions**

Embedded in the use of all countermeasures and countermeasure strategies are a set of assumptions about the ways in which the social world works. These assumptions include commitments to what counts as appropriate and adequate knowledge; to prevailing social habits, norms and relationships; to values, to behaviours and their variability within the relevant populations, amongst other dimensions.

These assumptions need to be recognised, and their validity assessed in the socially and culturally variable range of contexts in which countermeasure strategies may be implemented. Social assumptions need to be monitored subsequent to implementation to identify and address unforeseen consequences. To do this involves a greater degree of local knowledge, and of local participation, than has hitherto been the case. Yet, to enable effective implementation, it is necessary to have knowledge of the local conditions which will affect that effectiveness. Multi-sided and inclusive communicative and deliberative processes enable both the collation of local knowledge, more learning, and representation of the differing preferences of particular communities. In general, participation in decision making enables greater compliance and acceptability, leading to more appropriate choices in strategies and greater effectiveness in the dimensions which are of primary importance to affected groups.

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