Because People Are Concerned: How Should Public "Outrage" Affect Application of the Precautionary Principle?

By Peter M. Sandman, Ph.D.

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This essay was commissioned by Vodafone Group Services Limited. My agreement with Vodafone permits the company to publish or not publish my final draft, but not to alter it in any way (though it may add its own commentary if it so chooses). I am also permitted to publish the final draft, or to submit it for publication, without needing Vodafone's assent. I assume that Vodafone asked me to produce this essay in the expectation that my views on the issues raised would be congruent with the company's views -- but it bought a pig in a poke. The views expressed here are mine alone. The reader may want to make allowances for the possibility that Vodafone has influenced those views, but it had no way to control them.

While I am acknowledging possible conflicts of interest, I should add that I have worked as a risk communication consultant for several mobile telecommunications companies and trade associations, though not for Vodafone. I have also consulted on risk communication for the World Health Organization, whose International EMF Project developed the draft policy statement that led to this assignment. Although I have never worked for the WHO on EMF or telecommunications issues, some of my work for the WHO on infectious disease outbreaks (SARS, flu, avian flu) was ongoing at the same time as I was writing this essay.

1. Executive Summary

The International EMF Project of the World Health Organization has recently initiated an effort to reframe the regulatory implications of the Precautionary Principle (PP), not just as it is applied to mobile telecommunications technology but more broadly as well. Among the issues draft WHO documents raise is the prospect of considering public concern an appropriate reason for a precautionary response, independent of the state of scientific evidence regarding the technical risk posed by the technology in question.

I have long used the terms "hazard" and "outrage" to refer, respectively, to risk as technically defined (a function of probability, magnitude, and uncertainty) and risk as culturally defined (a function of public concern and of "outrage factors" such as voluntariness, control, responsiveness, dread, etc.). As a leading proponent of the idea that outrage shouldn't be ignored merely because the hazard is low, I am often misunderstood to be saying that small hazards deserve to be mitigated when they are also large outrages. I therefore go out of my way to reject this position. My longstanding position has been that the proper response to outrage is neither to ignore it nor to mitigate the hazard. Use hazard mitigation strategies for serious hazards, I tell my clients, and outrage mitigation strategies -- sharing control, acknowledging mistakes and problems, giving away credit, and the like -- for serious outrages. As for regulatory, coercive responses to outrage, I have long argued that the case against a hazard solution to an outrage problem is even stronger when the problem-solver is a regulator.

The recent WHO initiative has led me to consider the issue anew. Reframed in terms of my hazard-versus-outrage terminology, the key question under discussion is whether outrage should influence invocation of the Precautionary Principle for companies and the governments that regulate them -- and, in particular, whether the PP should be interpreted to require a hazard management response to outrage. Attempting to answer this policy question has drawn me into

an empirical question, one with no clear empirical answer as yet: How do government precautions (and government warnings) influence public concern? That is, to what extent is a hazard management response likely to ameliorate outrage, and to what extent is it likely to exacerbate outrage instead?

The result is the essay that follows, a laborious dissection of the likely impact of precautionary regulation on public concern. After several introductory sections on the new WHO initiative and the hazard-versus-outrage distinction, the essay focuses on the key question: Can hazard management reduce outrage. This question is addressed in sections -- dealing separately with the impact on outrage of individual, voluntary precaution-taking; of government precaution-taking; and of government warnings urging individual precautions.

Two addenda take on related but subsidiary questions. Addendum I addresses the appropriate impact on hazard management of such individual outrage components as voluntariness and fairness. Addendum II focuses on three alternative hazard-related ways of responding to outrage: research, education, and labeling.

The longest and most central section of the essay focuses on the ways in which government precautions are likely to ameliorate public concern, and the ways in which they are likely to exacerbate concern. My tentative conclusions are more nuanced than my starting position, but not too distant from it. Government precautions (and government warnings), I conclude, are not reliable ways to mitigate concern. There are times when they may have this effect, but more often they can be expected to exacerbate concern instead -- an impact that is all to the good in the judgment of those who believe the hazard to be serious, but which must be considered undesirable if the starting goal was to reassure.

Governments can best help reassure their publics, I conclude, by telling them what they can do if they're concerned: offering people a range of voluntary individual precautions to match their varying levels of concern. People who are concerned, alarmed, frightened, or outraged feel better if there are things they can do -- things they can decide to do -- to exert control over perceived hazards. This is true whether the hazard is sizable or not, and whether the precaution is effective or not (as long as the government doesn't try to pretend that an ineffective precaution is effective, which can backfire and exacerbate concern). Policy-makers should always try to ally with this impulse toward self-protection. They should try to guide it away from precautions that are actually harmful to oneself or others (or the economy). But they should not oppose it or belittle it.

In addition, I conclude, research, education, and labeling are all appropriate responses to public concern. When people are concerned, it makes sense to respond by investigating the risk (and especially the public's experiences that have led to the concern) more thoroughly. It makes sense to provide as thorough and balanced an educational program as possible (although there are limits to the ability of education to overcome concern). And it makes sense to label -- that is, to give people the information they need in order to take the precautions they wish to take.

By contrast, in the face of existing public concern government precautions ("here's how we are protecting you") and government warnings ("here's how we urge you to protect yourself") seem likelier to backfire, to be alarming rather than reassuring -- even if accompanied by a rhetorical disclaimer ("because people are concerned" or "just to be on the safe side").

Policy-makers, practitioners, or researchers may eventually find ways of taking precautions or issuing warnings that reliably reduce people's concern, that help resolve risk controversies instead of reinvigorating them at a higher level of protectiveness. If such reliably reassuring precautionary approaches materialize, then a PP response to public concern may begin to make sense. Until then, the PP should be seen as a strategy for protecting people from uncertain risks, not as a strategy for reassuring them about those risks.

2. Introduction

Few risk management issues are as polarized today as the so-called Precautionary Principle. The fundamental notion that uncertainty justifies caution is of course beyond debate; the debate is over how much uncertainty justifies what sort of caution, especially given that precautions have costs. What's at stake for one side is the health of the world's environment and human population, callously endangered by technological hazards whose riskiness is difficult to prove but easy to see and almost certainly huge. What's at stake for the other side is technological innovation and all the benefits (and profits) it promises, callously endangered by activists with a hidden political agenda who appeal to the most irrational fears of the general public. While there are certainly centrists and thoughtful commentators about the Precautionary Principle, they are sometimes hard to hear in the conflict of more extreme positions predictably grounded in the self-interest or ideology of those who advocate them.

A secondary but potentially important issue in this debate is the relationship between precaution-taking and public concern. Should precautionary policies be more stringent simply because the public is more upset? And if additional precautions are not the right way for governments to respond to public concern, what is?

In my own writing on risk communication, I have used the terms "hazard" and "outrage" to refer, respectively, to risk as technically defined (a function of probability, magnitude, and uncertainty) and risk as culturally defined (a function of public concern and of "outrage factors" such as voluntariness, control, responsiveness, dread, etc.). Reframed using this terminology, the question under discussion is how outrage should influence invocation of the Precautionary Principle -- or, more broadly, whether there should be a hazard management response to outrage and, if so, what sort of response.

Attempting to answer this policy question has drawn me into an empirical question, one with no clear empirical answer as yet: How do government precautions (and government warnings) influence public concern?

I must immediately add that my focus here is on publics who are already concerned, or at least considering becoming concerned -- that is, on publics who are paying attention. Governments routinely take precautions or issue warnings that are steadfastly ignored by the vast majority of the population, comfortable in their apathy. We are talking about the unusual issue that has aroused significant public attention, or about the unusual citizen who is paying attention to an issue his or her neighbors are ignoring. So we must rephrase the question: How do government precautions (and government warnings) influence the concern of the attentive public?

This is the main question I will address in the essay that follows. I call it an essay (rather than an article) for two reasons. First, it is grounded less in empirical research on the specific question at hand than in risk communication theory and my three decades of experience as a risk communication consultant -- not because I chose to avoid the relevant research, but because I couldn't find much. Hence no footnotes.

The second reason I call it an essay is because it takes a nuanced, complex (some will say tortured and muddled) middle view. As an American, I started without having already staked out a position on the Precautionary Principle, which is much more a preoccupation of European risk managers. And as an ex-academic and consultant who works for all sides in risk controversies, those wishing to arouse concern as well as those wishing to diminish it, I had no predetermined preference for reaching conclusions helpful to industry or to activists. I started with two biases: that public concern ought not to be ignored in deference to "sound science" (this tends to ally me with activists) and that over-mitigation of hazards that are almost certainly small is probably the wrong response to controversies that are certainly big (this tends to ally me with industry). I saw this essay as an opportunity to reconsider these biases.

What follows, therefore, may strike many readers as uncomfortably hard to pigeon-hole. On balance, I end not too far from where I started -- with the conclusion that public concern deserves a response from policy-makers, but that precautions that are otherwise

unnecessary (because the hazard they address is probably small) are not likely to reduce the level of concern, and are therefore usually the wrong response. But I reach this conclusion with many exceptions and considerable tentativeness. I hope this essay will prove helpful to those trying to reach or to re-examine their own conclusions about the relationship between precaution-taking and public concern. In particular, I hope it will prove helpful in the continuing revision of the World Health Organization draft policy statement that addresses this question among others.

3. Setting the Stage

Most extended discussions of the Precautionary Principle (PP) make at least a glancing reference to public concern. Advocates of a strong PP are likely to dwell on the extent of public concern at greater length and with greater fervor than its opponents, but all sides seem to feel some obligation to bow in that direction. When people are concerned about a possible risk, the consensus seems to be, it becomes incumbent on the companies whose products or services may pose that risk and on the regulators charged with oversight over those companies, products, and services to take note. In countries with free electorates and free markets, no other view is possible. A responsive corporation and a responsive government must have some response to public concern; the debate is over what that response should be.

Yet most formulations of the PP are not grounded in public concern. The major arguments have focused on much more traditional components of risk (in my terminology, components of "hazard"): probability, magnitude, and uncertainty. How likely or unlikely are the hypothesized health or environmental impacts? How bad are the possible though unlikely worst cases? How confident are we about these judgments? What sorts of evidence should be taken seriously as indicators of possible (though far-from-demonstrated) adverse impacts? How should possible risks be balanced against possible benefits, or against the possible risks of alternative paths, or against the cost of precautionary efforts? Above all, how safe is safe enough and how confident is confident enough to justify moving a technology forward without hindrance; how dangerous is dangerous enough and how uncertain is uncertain enough to justify precautionary action?

The conceptualization of uncertainty is central to all PP formulations. Usually two preconditions for a precautionary approach are stipulated, both of which involve uncertainty but in quite different ways. First, there must be substantial reason to suspect a causal relationship between exposure to the potentially hazardous situation and the health or environmental impact of concern. The stronger the grounds for confidence that some such relationship exists -- that potentially dangerous effects have been identified -- the stronger the case for precautionary action. Only when this first criterion is satisfied (that is, the hypothesis of a causal relationship has some basis), does the second issue arise: How certain or uncertain is our knowledge about the precise nature of this exposure/impact relationship -- for example, about whether low levels of exposure are capable of inducing actual impacts? If we have strong evidence of specific impacts, of course, we take protective action on grounds less controversial than the PP; if we have strong evidence of no impacts, we choose not to act. The PP prescribes precaution in situations where we have reason to believe a causal relationship may well exist, but no adequate evidence describing the nature of that relationship.

I do not intend to burden the already overburdened reader with a dissection of the various definitions of the Precautionary Principle that have been proposed. "Weaker" versions of the PP suggest only that the absence of definitive proof of hazard does not justify inaction; "stronger" versions suggest that the absence of proof of safety justifies protective action. Some European governments have adopted (or implicitly followed) a "stronger" version of the PP than others; still "stronger" versions have been endorsed by many activist NGOs; the "strongest" versions are sometimes put forward as strawmen by industry organizations wishing to argue against a precautionary approach. These versions differ significantly in their treatment of uncertainty, in where they put the burden of proof. They differ much less in the *de minimus*, essentially cosmetic role they all accord to public concern.

Nonetheless, invocation of the PP is strongly correlated with public concern. Governments do sometimes decide on their own that a potential but undemonstrated hazard deserves precautionary action even though public concern is negligible -- but few would doubt that

governments are likelier to see the merits of a precautionary response to the same hazard when public concern is substantial. What is new isn't the empirical relationship between government precaution-taking and citizen outrage; that is well-established. What is new is the explicit argument on behalf of such a relationship. Public concern has often led governments to consider precaution-taking, and the precautions taken have often been a reflection of the extent and nature of the concern. But aside from noting in passing that "people are concerned," governments have rarely asserted that mitigating public concern is an acceptable rationale for regulating risks not believed to represent an actual hazard.

Determining whether a particular risk probability, magnitude, and uncertainty justify precaution-taking revolves around questions that are partly scientific and partly trans-scientific -- that is, they are grounded partly in data and partly in values. But they are at least *about* science. Despite frequent invocations of public concern, and despite the observable tendency of governments to respond to public concern with increased precautions, few have argued explicitly that these questions ought to have more protective answers when public concern is widespread than when the public is calm or apathetic.

Perhaps the unspoken assumption has been that these questions will automatically have more protective answers when public concern is widespread -- that (at least in the west) democracy and capitalism will ensure sufficient responsiveness without any need to advocate on its behalf. Indeed, it has sometimes been argued that leaders must be especially attentive to risk when the public is least concerned; since political and commercial responsiveness will not protect us under these circumstances, governmental and corporate responsibility must do so instead. Among the advocates of this view, the World Health Organization (WHO) has often been prominent, especially in recent years, advocating strongly for government and corporate action on a range of health issues about which the affected public has proved adamantly disinclined to act, from HIV/AIDS to obesity. In the last year, a very different WHO approach to precaution -- and WHO proposal for how we should all approach precaution -- has made its appearance in draft form.

4. A New WHO Approach to Precaution?

The new WHO draft arose in the context of the WHO's assessment of the risks possibly posed by electromagnetic fields (EMFs) from mobile telephones and telephone towers. (A note on language: Americans usually refer to "cell phones" and "towers," while in the U.K. the convention is "mobile handsets" and "masts" or "base stations." I will usually use "mobile phones" and "towers.") But it has emerged into a generic WHO draft policy proposal.

Prior to 2003, the WHO's International EMF Project had generally taken the position that there was not sufficient evidence of mobile phone EMF risks to justify "triggering" the PP. But in the run-up to a Luxembourg conference in February 2003, and at the conference itself, Project staff expressed the view that precautionary approaches to EMF risks were always appropriate in some degree, thus sidestepping the question of an evidentiary "trigger" to justify "invoking" the Precautionary Principle.

This was a fundamental reformulation of the WHO approach to the PP -- and if adopted by the world's governments, would constitute a fundamental reformulation of the PP itself. After the Luxembourg conference, the leadership of the International EMF Project acknowledged as much, and asserted that such a reformulation should be done at a broad theoretical level and not with respect to just one hazard. With that in mind, a new, generic draft report was developed. In May 2003, the new draft was posted on the WHO website and sent to other WHO offices working on other hazards (chemicals, genetically modified organisms, etc.) for their comments. The goal was to test the new framework on several case examples, of which EMFs would be only one. In short, a proposed new WHO approach to applying the PP to EMFs had become a proposed new WHO approach to the PP itself.

Still later clarifications from the International EMF Project have emphasized that the draft was posted for discussion purposes only, that the broad question of how the WHO should address the PP and the narrower question of whether and how the PP should be applied to mobile phone EMF risks were both still undecided, and that additional input was welcome.

As I write this in late December 2003, the May draft (dated 2 May 2003) is still the one on the WHO website. But a revised draft, dated 23 July 2003, has been circulated to interested parties. Entitled "WHO Precautionary Framework for Public Health Protection," the July 2003 draft -- like its predecessors -- includes several references to public concern and its relevance to precautionary responses. Because it is the latest version so far, I will provide examples from this draft; the reader can seek out parallel passages in the posted May 2003 draft, available at http://www.who.int/peh-emf/meetings/archive/Precaution_Draft_2May.pdf.

The July Executive Summary paves the way with an early reference to "incorporating social values into precautionary decisions." A bit later, under the heading "Democracy, Citizens, and Stakeholders," the Executive Summary notes that "science often leaves gaps and uncertainties. In any case science alone may not be enough. Cultural values and commitments are important in precautionary decisions." It isn't entirely clear what this means, but it seems to be suggesting that precautionary policy should be influenced not just by scientific uncertainty but also by "cultural" issues that have nothing to do with science or uncertainty.

The next paragraph of the Executive Summary is more explicit:

> Under the precautionary framework, the public exchange of reasons, accounts, and narratives are indispensable. Public fear itself can be a harm. At the same time, it can produce a wide range of additional harms and dislocations, in the form of "ripple effects" amplifying the consequences of risks. One of the major goals of the WHO PF [precautionary framework] is to ensure against neglect of serious problems while also reducing the danger of public overreaction. The public should be informed, and people's informed judgements should play a large role in decisions about precautions.

In other words, the draft asserts that the WHO's Precautionary Framework should aim not just at reducing serious hazards, but also at reducing public concern about small hazards. The body of the draft clarifies this purpose. Under the heading "Option generation," the report says "the goal is to reduce exposure or concern."

The claim that public concern can cause harm is beyond debate; the deleterious effect of anxiety on health is well-established, and anxiety is also a quality-of-life factor in its own right. Of course concern/anxiety/outrage is simultaneously a social good with respect to serious hazards, because it motivates precautions. But if a hazard is not believed to be serious, reducing public concern about that hazard seems unarguably desirable. The question is how this should be done.

The "Option generation" section goes on to list examples of options that might be used to reduce exposure or concern. The list appears to be in order of severity, starting with "Decision to take no formal action" and ending with "Limiting exposure or banning the source of exposure altogether." The options that seem most directly relevant to reducing concern -- things like "Communication and engagement programmes" -- are generally near the top of the list. What we have, in other words, is one list of things governments might do to accomplish two objectives -- that is, "to reduce exposure or concern." It is hard to avoid the inference that the WHO intends the concern-related solutions to be responses to small risks, and the exposure-related solutions to be responses to big ones. But concern versus exposure is a qualitative distinction. It doesn't map well on small versus big. Like the level of technical risk, the level of public concern can be modest or substantial, presumably justifying a modest or substantial government mitigation effort aimed directly at that problem (concern) ... not the other problem (exposure). A big controversy doesn't necessarily equal a small risk to health; it can be a big risk to health, or none at all. Two lists would be an improvement.

In discussing the "no formal action" alternative, the draft notes that this option "may increase anxiety which itself is detrimental to mental and social well being." Implied here is the value judgment that decreasing public anxiety, or at least avoiding its increase, is an appropriate reason to take precautions, whether or not the anxiety and the precautions are technically justified. Also implied is an empirical judgment: While inaction "may increase anxiety," precautionary action is presumed to decrease anxiety. Nowhere does the draft suggest that government precautions can alarm the public, or that such a predicted increase in anxiety would be an appropriate reason not to take a precaution. The undesirability of public concern is taken

for granted, and is seen only as a reason to ratchet precaution-taking upward, not as a reason to ratchet it down.

Taken together, these provisions appear to articulate two new roles for the PP: To reduce public concern about small hazards, and (in order to achieve this) to reduce small hazards about which the public is concerned.

Like everything in the WHO's various drafts, these references to the intersection of the PP and public concern are preliminary; the final document could back away from these implications, or it could strengthen them. Some of those who attended the February 2003 Luxembourg meeting at which an earlier, EMF-focused draft was discussed came away with a stronger impression than the more recent generic drafts convey that the WHO's International EMF Project was leaning toward a recommendation that member states adopt explicitly precautionary responses to public concern about possible mobile phone EMF risks. It is that impression, more than the later draft reports, that led to my being asked to prepare comments. Many interested parties on both sides of the controversy, in fact, had the impression in late 2003 that the International EMF Project was retreating from the more revolutionary implications of the PP approach articulated at the Luxembourg meeting. But as of early 2004 the draft policy statement is still in circulation, and presumably the draft policy is still in play.

In addition to its references to public concern, the July 2003 draft also includes references to several other aspects of risk controversies that go beyond the bounds of the traditional PP debate. Under the heading "Distributional Considerations," the Executive Summary notes that the Precautionary Framework "attempts to protect the most vulnerable members of society. If members of especially disadvantaged groups face a risk, this is special reason to take precautionary steps. If regulation would itself harm members of especially disadvantaged groups, one should proceed cautiously with regulation. Particular concern should be devoted to risks faced involuntarily by disadvantaged members of society."

The body of the draft goes into more detail on non-technical aspects of risk the WHO considers relevant to precaution-taking. The section on "Health Issues in Context" is most explicit:

> Prior experiences, beliefs and societal values are important considerations in putting uncertain health issues in context within the WHO PF.
>
> - Many societies have a heightened level of concern to protect vulnerable populations such as the infirm, the elderly and children because they may be unable to take actions to manage effectively their own risk. Furthermore, many societies believe that the child and the fêtes should be afforded an even higher level of protection because of their potentially increased vulnerability, increased potential for exposure over their lifetime and because they are the future.
>
> - Inequities in the distribution and magnitude of actual and potential exposures (individual and total) and consequent adverse health outcomes are part of potential public health impact....
>
> - Involuntary exposures, particularly if they could be viewed as inequitable or unjust with respect to the distribution of risks and benefits over time, space and social status could impact on how risks should be dealt with. Particular concern should be devoted to risks faced involuntarily by disadvantaged members of society.
>
> - The nature of the presumed health effect is also a factor in putting the health issue in context. Some diseases, such as cancer are particularly dreaded....

Later the report refers to the desirability of "adding perspectives based on experience or observation and recognizing the validity of people's values." The first half of this is unobjectionable; anecdotal data are data too. The second half is more perplexing. Values are trans-scientific. They aren't valid or invalid like scientific generalizations; they just are. Surely governments should recognize that their citizens have values, and surely their citizens' values should appropriately find reflection in government action. The question is whether values that are not hazard-related (moral disapproval of genetically modified foods or birth control, for

example) should be nonetheless reflected in hazard management via the Precautionary Principle.

What these additional factors have in common with public concern is that they relate to cultural rather than technical aspects of risk. The magnitude, probability, and uncertainty associated with a risk do not depend on whether the risk is involuntary, or on whether it penalizes children, or on whether it adds to the burden on already overburdened groups, or on whether it offends moral or ethical values. But the psychometric literature has established that these additional factors significantly affect risk perception, and that they are part of what most people mean when they consider the size of a risk.

In other words, the following five truths are well-established:

1. Factors like voluntariness and fairness (which I have termed "outrage factors") are not part of the technical definition of risk.

2. These factors contribute substantially to public concern about risk (outrage).

3. Together with public concern, these factors have a sizable effect on people's perception of and beliefs about the technical risk (hazard). That is, people tend to overestimate underestimate risk probability and magnitude depending in large measure on these factors.

4. Separately from their effect on risk perception, these factors are part of people's broader definition of what risk means. That is, even when persuaded that a particular coerced risk (for example) is actually smaller, technically, than some other voluntary risk, people continue to want to say the coerced risk is the "more serious" of the two.

5. People tend to believe that these factors should affect risk policy. For example, they want tougher regulatory standards or coerced risks than for voluntary risks, and see no contradiction in the fact that smoking is legal although it is far more hazardous to the smoker than prohibited industrial emissions.

Addendum I addresses the complex relationships between hazard management and precaution-taking on the one hand and such specific outrage factors as voluntariness, fairness, and impact on vulnerable populations on the other hand. The main essay will focus on the relationship between the PP and public concern -- that is, between hazard management and outrage itself.

I want to emphasize that one's answer to the question of whether there should be a hazard management response to outrage is independent of one's views on a PP response to uncertainty. The WHO draft report stakes out a particular position on both issues. I suspect that there is an empirical correlation: Those who support a strong PP tend to think public concern is a good reason to mitigate hazard, while those who want a less precautionary response to technical uncertainty also tend to want a less precautionary response to public concern. But I see no connection in principle between the two issues. All four quadrants of a 2x2 table are defensible.

	Strong response to uncertain hazards	Weak (or no) response to uncertain hazards
Strong response to public concern	WHO draft	???
Weak (or no) response to public concern	EU Framework	US EPA?

Nonetheless, before pontificating on the first question, let me briefly outline my views on the second, the PP response to uncertainty. I am a risk communication expert, not a risk assessment or hazard management expert. I have no professional opinion on how uncertain the data actually are about any particular risk, including mobile phone and tower EMFs. Like most other non-experts, I believe that risk assessment experts are likelier than amateurs to be right, but they are sometimes biased and sometimes spectacularly wrong, and when challenged by amateurs they tend to get defensive, over-confident, and slow to acknowledge problems and errors. (The same is true of risk communication experts.) As for the question of how much uncertainty justifies how much precaution-taking (once the evidence of a potential hazard is sufficient), this is a values question and there are no experts. For what it's worth, my own views tend to ally with the activists when it comes to the riskiness of novel technologies, but I tend to ally with industry when it comes to the riskiness of forgoing novel technologies, as well as the riskiness of precautions themselves. That is, I think most actions and most decisions not to act ultimately turn out to have more of a downside than was originally realized; I think most risk management policy decisions come down to choices among options that are worse than their proponents claim.

5. My Starting Position: Outrage Solutions for Outrage Problems

Over the past two decades I have written and spoken extensively on my "Risk = Hazard + Outrage" formula and my various prescriptions for outrage management. (See my website, www.psandman.com, for more than you want to read along these lines.) As a leading proponent of the idea that outrage shouldn't be ignored merely because the hazard is low, I am often misunderstood to be saying that small hazards deserve to be mitigated when they are also large outrages. I therefore go out of my way to reject this position. One of my presentation handouts, for example, ends with this recommendation:

> When hazard is high, manage the hazard. When outrage is high, don't ignore it, and don't manage the hazard: Manage the outrage. (When both are high, obviously, manage both.) If your problem is an outrage problem to begin with, outrage management is easier, cheaper, and more effective than hazard management. If what people need is an apology and a Community Advisory Panel, in other words, don't install a dimethylmeatloaf vapor recovery system instead.

I often conclude my outrage management seminars by describing what I call the four stages of a typical risk controversy. In the first stage, I say, people are concerned about a risk; you investigate and determine to your satisfaction that the hazard is low ... so you ignore them. This reliably increases their outrage. In the second stage, having failed to ignore them into oblivion, you try to prove to them that you're right and they're fools to be concerned. This reliably increases their outrage. In the third stage, having failed to bury them in the data, you counter-attack, charging them with ignorance or hysteria or animus. This reliably increases their outrage. In the fourth and final stage, someone in top management complains to you that these outraged citizens have become a serious liability, and instructs you to get the problem solved. So you do something not about the outrage but about the hazard, even though you continue to be convinced that the hazard is small. This does very little to reduce their outrage, but a great deal to increase your own outrage. Bottom line: Use hazard mitigation strategies for serious hazards, and outrage mitigation strategies -- sharing control, acknowledging mistakes and problems, giving away credit, and the like -- for serious outrages.

Do I advise my corporate clients *never* to attempt a hazard management response to outrage? Not quite never. If a hazard can be eliminated -- not just mitigated, but eliminated -- easily and inexpensively, it sometimes makes sense to do so. If employees are frightened by the odor of Solvent X, and solvent Y has a less objectionable odor and is otherwise equivalent in efficacy, risk, and cost, why not make the switch? If your child is afraid of the dark, why not turn on a light? There are three specifications here for a hazard management response to an outrage problem: it's cheap, it's easy, and it's total. Even when these specs are satisfied, I am sceptical. If the underlying reasons for the outrage haven't been addressed, the outrage is all too likely to attach itself to a different risk, and you're back and Square One again. Still, if it's cheap, easy, and total, it might be worth trying.

Why the insistence on total? There is substantial research evidence that people value the elimination of a hazard far more than its mitigation. If there are two flu viruses of equal frequency and equal virulence, for example, most people will pay far more for a vaccine that eliminates one of the two completely than for a vaccine that reduces both by half. In outrage terms, moreover, a hazard that's gone probably won't provoke any further outrage -- though outrage provoked by other causes may migrate to a different hazard. A hazard that's still present, albeit smaller, is likely to be associated with continuing outrage.

This advice is aimed at the source of the problem, the company responsible for creating the risk. The case against a hazard solution to an outrage problem is even stronger when the problem-solver is a regulator. It has long been known that regulators tend to take the same hazard more seriously when people are upset than when they are contented; the squeaky wheel gets the grease. But it's hard to argue that regulators should do so as a matter of policy. It is especially hard to argue that regulators should knowingly over-regulate risks they believe (albeit without certainty) to be small, on the grounds that people are upset (probably needlessly). Since regulatory resources are finite, this usually means under-regulating some other set of risks that are likelier to be hazardous but do not provoke comparable outrage. And of course it imposes financial and reputational costs on the regulated industry as well. Regulators certainly should address outrage rather than ignoring or disparaging it. But they shouldn't address it by over-regulating the hazard!

Many of my clients are disposed to ignore outrage until much too late, until it has grown to overwhelming proportions, until outraged citizens and their advocates have acquired the political power to demand and achieve a hazard mitigation response. A big part of what I offer clients is a way to address outrage earlier and more directly, thus forestalling the belated and indirect response of hazard mitigation. I am delighted that the WHO appears to want to see outrage as a part of risk that deserves a prompt response. But I am dismayed that the WHO appears to see hazard mitigation as a perfectly appropriate response. My industry clients typically want no response to outrage, and end up with a belated hazard response. The new WHO proposal contemplates a prompt hazard response. I urge a prompt response, but not a hazard response.

In fact, the WHO comes close to implying that there are two equally valid ways of apprehending hazard, science and intuition, and that public concern is therefore as meaningful a measure of hazard as scientific evidence is. This strikes me as insupportable, just as insupportable as the view that people's intuition and public concern can be ignored. One view undermines the special value of science; the other undervalues everything other than science! In contrast to both positions, I have long argued that intuition and concern have their own validity as outrage, an aspect of risk as meaningful as hazard ... but not the same as hazard. (I also argue that the science of outrage measurement is as empirical as the science of hazard measurement; in fact, we often have better data about outrage than about hazard.) Of course there are also clues to hazard hypotheses to be found in the intuitions and concerns of outraged citizens. So outrage plays two roles: as an indicator of possible hazard (to be investigated by science) and as a constituent of risk in its own right (to be mitigated directly through outrage mitigation, not indirectly through hazard mitigation). But outrage is not a kind of hazard, nor is it a reliable measure of hazard.

This is where I started -- and doubtless why Vodafone sought my views in the first place. What follows is my reassessment of the key empirical question underlying this entire issue: whether or not hazard management can be expected to reduce public outrage.

6. Can Hazard Management Reduce Outrage?

The counter-argument to my starting position goes something like this: Even if people are wrong to be concerned, they are concerned, even distressed, perhaps even panicky. These states of mind are themselves damaging to health and quality of life. They are also ultimately threatening to the commercial success of the technology that provokes them. We must therefore do something to reassure frightened people. Taking steps to reduce the hazard should help accomplish this, even if it accomplishes nothing else.

A well-designed precautionary approach, this argument concludes, can give people the additional measure of confidence they need to coexist more comfortably with the technology they fear, even if the precautions taken are technically excessive.

Note that this argument is *never* advanced by proponents of a strong PP -- and it is therefore seldom explicitly advanced at all. Proponents of a strong PP are usually convinced that many if not most controversial technologies are actually harmful. They do acknowledge in principle that uncertainty can be reduced in either direction, that new data may sometimes reveal a precautionary approach to have been, in hindsight, unnecessary. But they expect this to be the exception; usually, they believe, the precautions taken because of uncertainty will look ever-wiser as we learn more about the relevant risks. When PP proponents reference public concern, therefore, it is not to argue that the concern needs to be ameliorated so people become more comfortable and better able to bear their fears and the risk that provokes them. Their argument is that the public's concern is itself evidence of problems that further research will ultimately demonstrate. They want a hazard management response to outrage not because they believe this is a good way to diminish the outrage, but because they believe the outrage is technically justified and it is the hazard that needs to be diminished.

Indeed, the most deeply committed proponents of a strong PP might well need to rethink their position if they believed precautionary steps would have the effect of diminishing public concern (as the WHO appears to believe). Maintaining and mobilizing citizen outrage is how they apply pressure on behalf of more protective regulation of hazards they believe to be significant. If activists believed that precautionary regulations tended to reduce public concern as a byproduct of the increased protectiveness, endorsing such regulations would be potentially very problematic for the accomplishment of their long-term objectives. There is no evidence that activists see any such conflict; they endorse precautionary regulations without ambivalence, secure in their conviction that such regulations will not undermine their campaigns. To the contrary, activists seem to believe that each new regulation helps build additional pressure for the next.

Activists, in short, apparently do not believe and surely do not argue that tougher hazard management of uncertain risks tends to reduce public outrage about those risks. Of course they do claim that tougher hazard management will reduce the hazard itself, and that it will thereby reduce the reason for outrage and thus ultimately will reduce the outrage (when the hazard has been greatly reduced or even eliminated). But the view that assuaging fears that are probably technically inappropriate is a good reason for imposing hazard regulations that are probably technically unnecessary is not a view usually endorsed by the activist community.

(There are occasional exceptions. After a decade of arguing unsuccessfully that the undamaged nuclear reactor at Three Mile Island was too dangerous to restart, antinuclear activists eventually resorted to the alternative argument that, even if it were not dangerous, restarting it would exacerbate the anxiety of nearby residents. Noting the activists' substantial contributions to that anxiety, the Court rejected the argument as analogous to the child who kills his parents and then seeks mercy because he's an orphan.)

Though activists do not advocate hazard regulation on grounds of outrage mitigation, this notion often underlies the willingness of policy-makers to go along. It is the only argument that could justify going along in cases where the policy-maker was confident that the hazard in question was low and not worth mitigating for its own sake. So the argument deserves to be examined in detail.

When I began work on this essay, I thought I would conclude (as I have long argued) that the proper response to outrage is outrage management, not hazard management -- period. And I thought I would find empirical research to support my impression that technically unnecessary protective measures tend to exacerbate the public's concern, not to calm it. As it turned out, I wasn't able to find much research on the issue. As I tried to think it through in the context of my thirty years of risk communication consulting, I saw anecdotal evidence and theoretical arguments in both directions. I end up still concluding that public concern is a poor reason for a more precautionary approach to hazard than would be appropriate otherwise -- but with more wrinkles and less confidence than I had hoped.

6.1 Individual Precautions

Clearly, precautions can be reassuring under some circumstances. This is most obviously true when the precautions are voluntarily undertaken by the individual requiring reassurance. She's worried about catching influenza, so she gets herself vaccinated and then she's less worried. Nor is this true only when the hazard is demonstrably sizable and the precaution is demonstrably effective, as in the case of flu. He's worried about anthrax contaminating his mail, so he opens strange letters wearing latex gloves and then he's less worried. As a risk communication consultant, I often face situations where concerned people want to take voluntary precautions the authorities consider unnecessary. Some Toronto taxi drivers and flight attendants wanted to wear masks to protect against SARS (experts considered the masks neither necessary nor effective); some employees at a hazardous waste cleanup site wanted to wear respirators to protect against emissions (experts said the excess weight of the respirators posed a greater risk than the low-level emissions). My advice in such cases is always to try to find a way to let people take the precautions they want to take, even if expert opinions says the precautions are inappropriate. Precautionary action reduces anxiety, I tell my clients; it gives people some sense of control; it helps them get used to the new risk. In addition, people seem to revert to complacency (for better or worse), or adjust to a "new normal," or move on to other concerns, faster when they are not accused of being irrational for wanting to take technically inappropriate precautions.

As suggested above, precautions taken by the concerned individual are likelier to reassure that individual than precautions taken by third parties such as the government. As mental health (and military) professionals have long recognized, action binds anxiety; we're less frightened when acting than when waiting and worrying. And among actions taken by the individual, voluntary precautions are likelier to be reassuring than mandatory precautions, because they involve the concerned individual not just in acting but in deciding how to act. They thus enable the concerned individual to exercise a measure of control over the source of the concern.

People who are concerned, alarmed, frightened, or outraged feel better if there are things they can do -- things they can decide to do -- to exert control over perceived hazards. This is true whether the hazard is sizable or not, and whether the precaution is effective or not. Policy-makers should always try to ally with this impulse toward self-protection. They should try to guide it away from precautions that are actually harmful to oneself or others (or the economy). But they should not oppose it or belittle it. This is as true for mobile phone EMF risks as it is for all other risks. People who are alarmed about mobile telephones or towers would be less alarmed if there were ways for them to reduce their personal risk without unduly obstructing the actions of others. This is easy to accomplish with respect to mobile telephone handsets, much harder with respect to the towers (which is largely why the towers generate more outrage). It is beyond doubt that individual precaution-taking reduces individual concern.

6.2 Government Precautions

In contrast to individual precautions, government precautions do not typically entail individual action or individual decision-making. They are precautions we observe, rather than precautions we take. (If we don't even observe them, of course, they cannot affect our level of concern.) When people are told that their government is taking particular precautions against a particular hazard, is that still reassuring to them, albeit less so than if they were taking the precautions themselves?

The answer to this question is complicated, and not yet wholly known. We can at least identify a list of ways in which government precautions ought to be reassuring, and a longer list of ways in which government precautions might paradoxically exacerbate people's concern. Resolving the two lists into a clear conclusion is much harder.

6.2.1 What about government precautions is reassuring?

There are at least five items on this list:

1. The government's action objectively provides an extra measure of protection. However endangered we believe ourselves to be, all third-party steps to reduce the danger should reassure us in proportion to how effective we believe these steps to be. This is the most fundamental reassuring impact of government precautions. It is the one activists point to when urging the precautions: People will feel safer because they will be safer. It applies, moreover, even in situations where the experts consider the hazard too low to require mitigation. A precaution may be objectively effective even if it is arguably unnecessary; those who are not so sure it's unnecessary can thus be reassured by the reality that it is effective.

2. The government's action allies it with us in our concern, instead of leaving us alone with our concern. Fearful people find the validation of shared concern strangely reassuring; fear, like misery, likes company. This is less obvious than the first point, but it is often important -- especially for the most alarming risks or the most alarmed publics. Crisis communication specialists know that people cope better with fearful events if the government validates and shares their concern than if the government derides it. This is what New York City's mayor did right in the days after the September 11 attacks, and what the U.K. government did wrong in the early months of that country's Mad Cow Disease outbreak.

3. The government's action contributes to our sense that the government is vigilant and proactive in protecting us, which in turn is reassuring with respect to a range of risks that appear to be under the regulatory umbrella. Ineffective or unnecessary precautions may contribute nearly as much as useful ones to the public perception of a protective government -- at least until they are exposed as ineffective or unnecessary, as window-dressing rather than genuinely protective. U.S. citizens tend to have more faith in food and drug safety than people in many other countries; this is widely attributed to Americans' perception that the U.S. Food and Drug Administration and the U.S. Department of Agriculture are comparatively strong regulators. Such perceptions can leak from one risk venue to another; some have argued that the U.K.'s high public concern about mobile telephone and tower EMFs results in part from the prior mishandling of that country's Mad Cow Disease crisis. Of course it is hard to know just what a government is doing well or badly, to disentangle the effects of precaution-taking from the effects of good risk communication (not understating the risk, being empathic about people's concern, etc.). Nonetheless, a broadly protective government should yield a less anxious public than a government that appears to be overly casual about risk. The fact that a government has adopted the PP as its guiding approach to risk management may be broadly reassuring to its citizens, even if a particular precaution taken in response to a particular hazard is not at all reassuring about that hazard.

4. There is a paradoxical "risk communication seesaw" at work in many risk controversies. Insofar as we are ambivalent about whether or not to be concerned, the government's visible concern allows us to ride the other seat on of the seesaw. An apathetic or over-reassuring government, on the other hand, forces us toward the alarmist seat. This is clearest for the low-probability high-magnitude risk, the worst-case scenario. If the government overstresses how unlikely this scenario is, the ambivalent public will focus on how horrific it is; if the government stresses how horrific it is, the public will see more clearly how unlikely it is.

5. As we saw in our discussion of voluntary precautions, the exercise of control is profoundly reassuring -- or, to put it differently, the feeling of powerlessness is profoundly alarming. Government precautions, too, are more likely to be reassuring when concerned people sees those precautions as their achievement, their action, rather than as just something the government decided to do to protect them. It follows that visible responsiveness, power-sharing, and accountability help make precautions more reassuring. If we have pressured the government to take a particular

precaution, and if it acknowledges that it is doing so largely in response to our demands, our satisfaction at having prodded the government into action will itself generate considerable outrage reduction. In a crisis, when concern and outrage are really widespread, the question of governmental responsiveness may be more important than the risk question. Even if the precautions themselves are not reassuring, they may generate less outrage than persistent governmental refusal to do anything.

It is for these five reasons that governments often institute precautions in situations where they consider the risk to be tiny or the precaution to be ineffective or both. Examples are not hard to come by. During the SARS outbreak, Canadian authorities installed equipment in airports to monitor passengers' body temperature, in hopes of detecting SARS-infected travelers. Although a government report found that the monitors were ineffective, the decision (until very recently) was to keep them in place for reasons of reassurance. Of course people who consider the risk trivial may resent the precaution as inconvenient or costly; worse, people who consider the risk serious but the precaution ineffective may resent the effort at false reassurance. (Many travelers have one or the other reaction to anti-terrorism baggage inspection protocols.) But presumably those who consider the risk serious and the precaution useful must be reassured by the effort.

There is an additional way government precautions can be reassuring -- but it is not an argument on their behalf. Assume for a moment that a government routinely responds to public concern with precautions that are otherwise probably unnecessary or even ill-advised. Assume that I as a citizen understand this. Now assume a new hazard arises that the government thinks is genuinely serious, meriting both government precautions and individual precautions. My government initiates its precautions. Having learned that governmental precautions are often merely a sop to inappropriate public concerns, I may well hesitate to initiate precautions of my own. The government, in short, has not merely reassured me about the hazard it meant to reassure me about; it has taught me that government precautions are not a reliable signal of a serious hazard that merits my attention. As a very practical example, consider the debate in the United States in recent years over whether various precautions against terrorism are effective and necessary or merely window-dressing meant to calm an over-anxious public. The argument that anti-terrorism measures are mostly window-dressing is strengthened by precedent, by prior U.S. governmental precautions against small hazards that were mostly window-dressing. How does a government that is willing to take precautions purely for purposes of reassurance signal its citizens that this time it means it?

This is a crucial point to consider. When governments respond to a serious hazard, they mean their response to be interpreted by the public as evidence that the hazard is serious. If the signal works reliably, it follows that it will tend to "work" also in cases where the hazard is probably not serious; that is, government precautions will increase public concern in such cases, rather than providing the desired reassurance. If on the other hand precautions can be successfully used to provide reassurance, then necessarily the clarity of the this-is-serious signal is vitiated. In fact the effort to use government precautions as a tool of reassurance, even if it fails, can be expected to vitiate the value of government precautions as a signal that a hazard is serious and should be taken seriously. Government precautions cannot serve both purposes: a signal of serious risk and a tool of reassurance. The effort to make them serve both purposes may end in their serving neither.

6.2.2 What about government precautions is alarming?

The previous section identified five ways that government precautions tend to reassure people. But quite often governments take precautions and people are not reassured! This is because governmental precautions usually have other effects in addition to the five listed above. Here are some ways government precautions tend to be alarming:

1. Government precautions are a signal that the risk is serious. As noted above, precautions are often used this way intentionally. But the signal isn't turned off just because it isn't intended. By validating that the risk is serious and concern is justified, moreover, government precautions raise the floor of appropriate precaution-taking. This is particularly true for those who consider governments insufficiently protective in

general. If I see the government as an over-worried mother hen, government precautions may be more a source of irritation than a sign of risk. But if I see the government as inclined to defer more to commercial interests than to health concerns, then government precautions send a powerful signal: Even the government is taking this seriously, so it must be really bad! Given this belief, it become easy to suppose that the government's precautions are likely to be insufficient palliatives reluctantly enacted in the face of overwhelming evidence and public pressure, aimed at heading off more serious restrictions. There is a cycle at work here, vicious or virtuous. If government is seen as generally over-protective, a new government precaution will tend to be seen as reassuring evidence of continuing over-protectiveness. But if government is seen as insufficiently protective overall, a new precaution will tend to be seen as alarming evidence that the situation is so bad the government had to do something. Food regulators in the U.S. are seen as more protective than food regulators in Europe, or than pollution regulators in the U.S. So U.S. government precautions about food tend to be reassuring, while European food precautions and U.S. pollution precautions tend to be alarming.

2. More obviously, government precautions raise the floor legally and politically. To change the architectural metaphor, they are a foot in the door. It becomes easier to argue on behalf of tougher restrictions. And it becomes easier to justify demands for compensation for the behaviors that are now prohibited. In countries with strong traditions of tort litigation, for example, recent prohibitions become persuasive evidence of prior damage.

3. Government precautions can also raise the floor of appropriate emotional involvement. They tell me I was right to be frightened. If I was in a battle with my friends and family over the legitimacy of the concern, the government's precautions quickly become my strongest argument. If I was in a battle with myself -- half-inclined to worry, half-inclined to shrug -- the government's alliance with my worrying half may win the day for that half. This is a perplexing phenomenon. Sometimes the seesaw prevails: The government is worried for me so I can relax. Sometimes the alliance prevails: The government it telling me I was right to worry, so I should shift into high gear. The choice seems to depend on the character of the ambivalence: Was I looking for a replacement, a reason/excuse to calm down, or was I looking for validation, a reason/excuse to gear up?

4. If nothing else, government precautions redirect the focus of concern. Perhaps I am worried that a controversial technological installation next door might damage my property values; perhaps I am esthetically repelled by my new neighbor; perhaps I am offended or irritated by the way the technology is deployed; perhaps I feel some class antipathy toward the sorts of people the new technology serves. (This choice of non-risk concerns was certainly influenced by some of the underlying issues in controversies over mobile telephones and telephone towers, but obviously these sorts of concerns underlie many risk controversies.) If a risk issue arises that has the potential to win me more converts and victories than my other concerns, I will inevitably turn my focus to this issue, and thus to risk. This is a perfectly legitimate strategic choice, but it doesn't remain only strategic; if I am not actually all that worried about risk at the beginning, cognitive dissonance will ensure that in short order my heartfelt concerns will shift to match my arguments. And so a source of irritation or disapproval becomes, under government auspices, a source of concern. Controversies over mobile telephone towers have tended to shift from aesthetic and property value concerns to health concerns at least partly in response to government reports addressing possible health impacts and recommending a precautionary approach.

5. The same is true for subcategories of risk. Risk to health, environment, and security are all valid contenders. They mix in different proportions depending largely on which arguments have the strongest standing and which government agencies seem most responsive. Once again, government precautions send signals that shape the focus of public concern.

6. Just as government precautions tell people which aspects of a hazard to focus on, they also tell people which hazards to focus on. For most individuals and societies, the overall level of "concern" changes glacially if at all; mostly it gets reallocated among objects. I have sometimes spoken, only half in jest, of a "law of conservation of outrage," noting that people who have just successfully fought off one scary technology tend to be in the market for another to oppose. When no suitable target is at hand, concern temporarily takes the form (or formlessness) of free-floating anxiety. Government precautions help signal a suitable, government-approved target.

7. There is a class of hazards with respect to which societal action through governmental decree is the only sort of precaution-taking we can imagine -- global warming, for example, or weapons of mass destruction. In such cases, the individual's role is either passive or political -- wait for the government to act or urge the government to act. But most hazards have an individual element as well as a societal one. We must decide whether or not to take our own precautionary action. The precautionary actions of others (including governments) may be models or even reproaches, but they are not replacements for our own action. Learning that others are taking precautions becomes, then, a reason to take precautions also; not to do so could lead to feelings of irresponsibility. In this way, government precautions about strictly societal risks (where there is nothing I can imagine doing myself) should tend to be reassuring, whereas government precautions about risks where the individual can play a role ought to be alarming, building the case for individual action to match the government's action. Reading that governments are taking precautions against EMFs from mobile telephones might lead me to feel the problem is under control -- but it would likelier lead me to feel I have a responsibility to check out my own phones. Hearing that many communities are taking action against mobile phone towers might lead me to feel my local government will probably do whatever is needed -- but it would likelier lead me to feel I have a responsibility to see what local politicians are doing about it.

6.2.3 Reconciling the lists: How do government precautions affect public concern?

I have listed five ways government precautions can reassure the public, and seven ways they can increase public concern instead. And I have identified some of the factors that seem likely to propel the outcome in one direction or the other. Predicting which outcome will result in a particular situation now strikes me as much tougher than I expected when I began work on this essay.

It is extremely easy to come up with examples of risk controversies that have taken the following form:

1. The controversy arises; some people express concern or outrage about a possible new risk.

2. The government and its experts assert that the evidence suggests the hazard is negligible.

3. The controversy continues to mount.

4. The government responds to the controversy by instituting (or recommending) new precautions.

5. The controversy becomes still greater; the new precautions are cited as a basis for litigation and for demands for further precautions.

6. The evidence continues to suggest the hazard is negligible, but a high level of precaution- taking has become standard, as has a widespread public conviction that the hazard is serious.

From silicone breast implants (connective tissue diseases) to thimerosol in vaccines (autism), the examples are endless.

Of course it is also easy to come up with examples of another pattern: cases where the government steadfastly maintained that the hazard was negligible and refused to take precautions but the controversy nevertheless continued to mount. Many controversies, in fact, illustrate both dynamics. First the government holds the line, to no avail; then it crumbles, also to no avail. (I must add that there are also cases where the hazard turned out serious in the end, and it was either fortunate that the government crumbled or unfortunate that it held the line.) And of course sometimes controversies do abate -- either after the government instituted precautions or after it declined to do so.

The evidence is very persuasive that public outrage, mobilized by activist groups, has quite a good record at pressuring governments (and companies) to take precautions. This is why prompt outrage mitigation is effective; direct efforts to reduce outrage can reduce the pressure to over-respond to hazard with otherwise unnecessary precautions. But the evidence of a causal link in the other direction is far from clear. There is no convincing evidence that either strategy on a government's part -- taking precautions or refusing to take precautions -- has a consistently good record at reducing public outrage.

The likely effects of cognitive dissonance on the pattern of responses to precautions is worth noting. Cognitive dissonance is a well-established psychological phenomenon. People who are exposed to information conflicting with their pre-existing beliefs and feelings tend to feel uncomfortable. In order to reduce the discomfort (the cognitive dissonance), they pursue a variety of cognitive strategies: They seek out information that supports their original view; they misinterpret or misremember the discrepant information; they discount its validity and disparage its source; etc.

Cognitive dissonance theory tells us that any communication is likelier to confirm the position of those who agree than to undermine the position of those who disagree. It follows that even if government precautions do communicate a reason to feel reassured, they are more likely to confirm the unconcern of those who are unconcerned than to reduce the concern of those who are most highly concerned. Moreover, cognitive dissonance theory also tells us that an ambiguous communication is likely to be seen as supportive by both sides. It is not unlikely, therefore, that government precautions would confirm the unconcerned in their unconcern ("the government is handling it, so I don't have to worry"), while also confirming the concerned in their concern ("even the government is taking this seriously, so certainly I am right to worry").

As I write in December 2003, the United States has just discovered its first case of Mad Cow Disease (Bovine Spongiform Encephalopathy, or BSE). It remains to be seen how this discovery will impact U.S. beef consumption, but the U.S. will almost certainly ramp up its beef inspection program in the coming months. It is arguable whether or not this will constitute an appropriate response to the hazard -- now that the identified U.S. BSE incidence is one, not zero, the hazard is presumably greater than it was. But U.S. authorities continue to maintain that the risk to the U.S. food supply is minimal, even as they prepare to reduce it. Assume for the moment that the new U.S. precautions will be aimed at reassuring us more than at protecting us. Will they accomplish their objective, or will they give credence to the activists' contention that the risk is substantial and the government's precautions inadequate, and thus boomerang? We have identified some of the factors that will play out in this case. But there are factors working in both directions.

If the U.S. government is determined to impose new restrictions, I can certainly suggest ways of making those restrictions likelier to be reassuring -- document that you are responding to citizen demands and activist pressure; validate that despite the low statistical risk it is natural for people to be concerned (and disgusted) by the possibility of eating meat from a cow whose brain was rotting; give people "permission" to reduce their beef consumption for a while as they watch how the crisis progresses; etc. I can even be fairly sure that additional government precautions will probably go down better in the short term, mid-crisis, than the government's refusing to take any additional precautions. What I cannot do is assess confidently whether the new precautions, overall, will reduce or deepen the public's long-term concern about Mad Cow Disease in particular or food risks in general.

Right now Mad Cow Disease is a huge public issue in the U.S. Odds are it won't be huge for long; it has replaced flu as the health risk crisis of the moment, and will be replaced in its turn by something else. Most Americans are enormously more concerned about BSE this week than they were last week, or than they will be in six months (unless there's an epidemic or a human case) -- regardless of what additional precautions the government decides to take. Who, exactly, will be reassured by the additional precautions? Who will see them as evidence of the seriousness of the risk? I'm not certain. Nor can I confidently answer a somewhat different question: how these precautions would have affected the level of public concern about Mad Cow Disease if they had been adopted before the current crisis. Most Americans imagined (without thinking about it) that there were already more precautions in place than their actually were. Given that we wrongly assumed sick animals weren't allowed into the human food chain, how much additional reassurance would have resulted if that were actually the case? Presumably not much then, but a fair amount now.

To some significant extent, the answers to these questions (about BSE or EMFs or any risk) must depend on the specific precaution. Consider for example the well-established finding that risks provoke more concern (more outrage, in my terms) if they come to mind frequently and dramatically -- or, a closely related phenomenon, if they are the subject of frequent and dramatic media attention. The term of art for this is the availability heuristic. Precautions that bring the risk to mind are therefore likely to increase people's concern. (In fact, some precautions are so effective at accomplishing this that they backfire; excessively frightened people may avoid taking the precaution in order to avoid having to face their fear; women's breast self-examination is one of many documented examples of this.) Precautions that enable people to set the issue aside, on the other hand, may be reassuring.

More often than not, I think, government precautions about a controversial issue make the issue more visible and thus increase its "availability" and its power to arouse concern and outrage. But not always. In the case of Mad Cow Disease, for example, a government action that kept BSE-afflicted animals from reaching the testing point would keep Mad Cow Disease out of the newspapers and out of the public's consciousness; the result should be reduced public concern. A government action that tested more animals, on the other hand, would presumably achieve more test results positive for BSE. This would periodically re-raise the issue, journalistically, politically, and psychologically; it would surely increase the level of public concern -- at least until people and institutions became accustomed to the test findings and stopped reacting so strongly.

[A post-script, added in late February 2004: As I predicted, in January the U.S. Department of Agriculture did ramp up its mad cow precaution-taking, and after an almost undetectable dip U.S. beef consumption recovered fully. The two events occurred at about the same time; it's hard to infer any causal relationship. Demands for still more government precautions continue to mount. Are these demands fueled by the precautions the government has already taken? Conceivably -- though I think they are fueled more by the Agriculture Department's failure to be candid. Without quite lying, the department encouraged U.S. consumers and journalists to suppose (a) that the cow that turned out to have BSE was a "downer" cow, unable to walk on its own; and (b) that the government had a prior policy of testing all "downer" cows; and (c) that finding that one mad cow therefore demonstrated the effectiveness of the policy; and (d) that there was reason to assume the U.S. food supply probably had no other mad cows in it. Little by little in January and February, it became clear that the first assumption was hotly debated, the second was empirically false, and the other two were therefore insupportable. As legislators, activists, and others became aware of the Agriculture Department's misleading half-truths, they became commensurately skeptical about the safety of the U.S. food supply -- a non-sequitur as inevitable as it is technically illogical. (In a broader view, it is not at all illogical to require stricter precautions from a regulator that can't be trusted.) I believe these communication failures are chiefly responsible for the pressure now being exerted for still more strenuous government BSE precautions. But certainly the much-publicized January precautions did not prevent this reaction.]

Two additional problems with government precautions as a tool of reassurance deserve mention.

First is the problem of cost. Precautions are seldom cost-free, and often very expensive. Usually though not always, outrage mitigation is significantly less costly than hazard mitigation. Putting critics on an oversight committee and apologizing to them for prior misbehaviors, for example, are actions with a well-documented mitigating effect on outrage. They cost far less than installing new equipment. Of course, hazard mitigation is the only way to mitigate hazard. But hazard mitigation is a very inefficient, expensive way to mitigate outrage -- even if it doesn't backfire, even if it works. That is, substantive, technical precautions are an inefficient, expensive way to reduce public concern.

When people choose to take personal precautions against risks that concern them, the cost of this individual hazard approach to outrage may still be excessive. But at least it is voluntary and widely dispersed; the cost is borne by those who are concerned, not by their unconcerned neighbors, by the government, or by industry. A mandatory precaution entails cost to all. The expenditure is obviously appropriate when there is reason to believe the hazard is serious. But when the precaution is a response to outrage, it is hard to justify. This is partly an ethical issue -- is it fair to make us all pay to mitigate a trivial hazard in order to reduce other people's outrage (even if it works)? But mostly it is a practical issue -- is it as cost-effective as direct outrage mitigation (even if it works)?

The second problem is about measurement. In order to institute a hazard response to outrage, it is necessary to be able to measure the outrage. I do not believe this is an insurmountable task. In fact, it is often less problematic than measuring hazard. (Consider the possibility of complex interaction effects between mobile phone tower EMFs and other radiation sources. We have good data documenting people's concern about this possible hazard; we do not have good data about the hazard itself.) Nonetheless, outrage is a complex multi-dimensional phenomenon; measuring the extent of people's outrage about a potentially infinite list of risks is a little daunting.

And of course the measurement of outrage raises its own values questions. Assuming we can measure both the intensity and the incidence of outrage about a particular risk, how do we reconcile the two -- that is, how many mildly concerned citizens equals one terrified one? Does it matter what form the outrage takes -- for example, does "terrified" make a stronger case for precaution than "infuriated"? Does it matter whether the outrage is expressed via a spontaneous upwelling or an organized campaign -- is a coherent movement more deserving of a government response because it is making proper use of the political system, or is it less deserving of such a response because the outrage is "manufactured" rather than "natural"? How are we to judge the permanence or transience of the outrage -- do we response quickly in hopes of nipping the problem in the bud, or wait for a while to see if it is merely the risk-of-the-week? How can we come up with a way to measure concern that is not reactive -- that is, a measurement strategy that doesn't itself encourage people to express more and stronger concern in order to bolster the case for additional precautions? If governments are going to initiate a PP response to public concern, such questions will require defensible answers.

6.2.4 Mobile telephone and tower precautions

What do we know specifically about the impact of government precautions on public concern with respect to mobile phones and towers? Is there any evidence directly on point?

In a recent article and an even more recent book, sociologist Adam Burgess argues persuasively that public concern in Europe about mobile telephone and telephone tower EMFs has been substantially influenced by government precaution-taking. When national governments took the issue seriously and responded with investigative commissions and regulatory initiatives, activist pressure and media coverage tended to increase, as did the size and fervour of the concerned segment of the public. (See Adam Burgess, "Comparing National Responses to Perceived Health Risks from Mobile Phone Masts," *Health, Risk & Society*, 4(2), 2002. See also Adam Burgess, *Cellular Phones, Public Fears, and a Culture of Precaution*, Cambridge University Press, 2004.) The cycle Burgess describes certainly does occur: Activist pressure and public concern lead to government action, which leads to increased media coverage and thus to increased activist pressure and public concern, and to further government

action. By contrast, Burgess says, European governments that paid less attention to the emerging EMF risk controversy saw declines in the level of controversy.

(Let me note again that a decline in concern and controversy is desirable only if we stipulate that the hazard is not in fact serious. Concern and controversy are how we mobilize to combat serious hazards. Nothing in this essay addresses whether mobile telephone hazards justify a precautionary response. I am focusing only on whether outrage justifies such a response.)

A recent risk perception study by Peter M. Wiedemann and Holger Schuetz is also relevant. (The original study, in German, is available on the Web at http://www.fz-juelich.de/mut/hefte/heft_84.pdf; I am working from an English PowerPoint summary graciously provided by Peter Wiedemann.) The authors asked residents of two Austrian communities how their concern about mobile phones and towers would be affected by various events, including warning or reassuring statements issued by the Radiation Protection Board or by the World Health Organization. Regardless of the respondents' original positions, they predicted that alarming statements would have more impact on their opinions than reassuring statements. In keeping with cognitive dissonance theory, the respondents also predicted that statements confirming their prior view would have more impact than statements conflicting with that view; this discrepancy was the greatest for those whose prior view was concerned.

Of course respondents' predictions of how a statement would affect their opinions are not direct evidence on how such statements actually affect people's opinions. Moreover, the study did not ask respondents to predict the effect of a government precaution, as opposed to a government statement of warning or reassurance.

To me it seems likely that most respondents, especially those who started out concerned about mobile phones and towers, would view a new government precaution as equivalent to a warning statement -- in which case concern would increase, and would increase the most among the already concerned. But perhaps some respondents might see the new precaution as reason to believe the government has taken the problem in hand and thus as reason to be less concerned than previously. I have not found a study on any risk, much less specifically on mobile telecommunications risk, that tests this question directly -- neither a study that asks respondents to guess how they would be affected or to remember how they were affected, nor a study that measures how they are actually affected.

Some particular mobile telephone precautions seem almost designed to increase rather than reduce concern -- which makes the precautions doubly desirable to those who consider the hazard serious, and doubly undesirable to those who do not. For example, some European governments have mandated or are considering mandating reductions in maximum system power. Such reductions reduce EMF emissions from telephone handsets or from towers or both. As a direct result, they increase the number of towers required to service the system and provide coverage. Are a larger number of weaker towers safer than a smaller number of more powerful ones? I don't know. But surely a larger number of weaker towers means more tower siting controversies and more local media stories about tower risks. And a larger number of weaker towers means more people living or working near a tower. If we assume that proximity has more impact on outrage than power does -- a safe assumption, I think -- the net effect of this precaution has got to be a more concerned public.

Tower risks have long been a greater source of controversy than handset risks, in large measure because for handsets the hazard and the benefit are aligned and the exposure is voluntary. Towers, on the other hand, have an oppression problem -- people forced to live close to a tower that serves other people's telephone needs. And they have a free-rider problem -- people getting mobile telephone service without being forced to live close to a tower at all. Many technologies (microwave ovens and cordless phones, for example) have no oppression and free-rider problems. Mobile telephone technology does have these problems. Government precautions that reduce (or aim to reduce) handset hazard but necessitate increasing the number of towers exacerbate these problems. In this way, at least, they increase public outrage.

Note also a difference between mobile telephone controversies and, say, controversies over genetically modified foods. Like mobile phone handsets, GM foods are in principle avoidable on an individual level (if we assume effective labeling and alternative product streams); there is no oppression or free-rider problem, no individual consumers enduring GM risks without GM benefits, or accruing GM benefits without GM risks. But opponents of GM foods hate the technology; they view it as dangerous to all life, and they want it eliminated. GM controversies are mostly about societal risk. By contrast. mobile telephone controversies -- which are usually tower controversies -- are mostly about individual risk. Very few people want to eliminate mobile telephones. People want their phones, but they don't want more than their fair share of the accompanying hazard (or potential hazard) -- and if possible they do want less than their fair share. Mobile phone users may be a little more willing to endure a tower next door than non-users are, but only a little. Plenty of users rationally if selfishly would prefer to be free-riders, to see the towers they need installed elsewhere.

Given this reasoning, the relationship between the number of towers and public outrage should be a U-curve. Very few towers means a small number of outraged victims; this is the typical rural pattern today. A huge number of towers means everybody is enduring a fair share of the potential risk, and only non-users have a grievance on grounds of oppression; though users may well covet the free-rider role, if that role is vanishingly scarce they are unlikely to feel entitled to it themselves. Some urban neighborhoods in high-penetration countries may be getting close to this many-towers no-free-riders paradigm. In between is the most outrage-provoking middle, with lots of victims forced to live near a tower and lots of free-riders lucky enough or determined enough to avoid that fate. Government regulations that limit the maximum power of towers or handsets would tend to increase the number of towers; this should increase the outrage in most areas by exposing new people to towers, but perhaps not in areas with so many towers already that nobody feels unfairly singled out.

Note that the complex relationship between government precautions and public concern plays out independently of which effect (more concern or less concern) is desirable. When a risk is genuinely serious, we presumably want people to take it seriously. In such a case the reassuring impacts of government precautions are an undesirable side-effect, while their alarming impacts are societally useful.

But this essay focuses on the opposite situation. We are assuming that the risk in question is probably (though not definitely) small, that the level of risk and the level of uncertainty are low enough that absent high public concern few if any government precautions would be appropriate. We are inquiring about whether additional precautions can be justified as a way to mitigate the concern itself. Our answer: occasionally, perhaps -- but not efficiently and not reliably, certainly not efficiently and reliably enough to be a basis for policy. In practice, government precautions -- regulatory, coercive precautions -- are at least as likely to lead to increased public alarm as to a reassured, calmer and less concerned public. As noted earlier, the most vivid evidence that this is the case is that activists do not worry that they may undermine their own constituency by successfully advocating government action. They believe that in the vast majority of cases government action will help build momentum for more government action. Odds are they are right.

6.3 Government Warnings

The previous discussion of government precautions focused on actions taken or mandated by a government. But often governments do not actually take or mandate a precaution. They *recommend* a precaution. And the World Health Organization is not a government at all, nor are the national commissions many nations have established to investigate mobile telephone risks; these organizations can do nothing but make recommendations. In these cases, the government's (or the WHO's, or the commission's) precautions are purely rhetorical, and cannot be reassuring. They are, explicitly, warnings.

Actual government precautions, in other words, may be reassuring or they may be alarming -- though more often than not, for the reasons listed above, I think they are alarming. But government precautionary recommendations are necessarily alarming; indeed they are meant to be alarming -- at least until they are acted upon. (Bear in mind that we are talking about

situations that are the subject of unusual interest, or about parts of the public that are unusually interested. For most people and most issues, government precautions and government warnings are neither reassuring nor alarming; they are ignored.)

But what about after they are acted upon ... or not acted upon? The ultimate impact of an official warning on public concern depends on how the warning is responded to. Distinguish five situations:

1. The recommended precautions are societal rather than individual, and are taken. For example, the WHO recommends certain EMF regulations, and various national governments enact them. This is just government precaution-taking again. I may feel reassured that the issue has been dealt with; I am likelier to feel validated that the issue merits my concern.

2. The recommended precautions are societal and are not taken. For example, the WHO recommends certain EMF regulations, but various national governments fail to enact them. Obviously, this can only increase my concern. How much my concern is increased by a warning that my government has chosen to ignore depends on how much credence I give to the warning and how much to the government -- but there is no case in which I am less concerned than if there hadn't been a warning in the first place.

3. The recommended precautions are individual -- and I act as recommended. For example, the WHO or my national government says I should limit my children's mobile phone use, and I do so. As with the first case, I may feel reassured that I have followed the precautionary instructions, or I may feel that the floor has been raised and there is more I ought to do. As discussed at length above, the second response seems likelier, especially if I was already concerned before the warning was issued. Highly concerned individuals -- the people most in need of reassurance about a risk that is probably small -- are both the most likely to obey a precautionary recommendation and the least likely to be reassured by having acted.

4. The recommended precautions are individual; I think they are foolish and I do not act. For example, I disregard the recommendation that I should limit my children's mobile phone use. By choosing not to act I am affirming my absence of concern, and I will probably become all the more immune to the concern of others as a result. Here then we have a warning that reassures. By urging me to take a precaution I am unwilling to take, the warning provokes me to marshal my psychological defenses on behalf of no precautions at all. But of course I wasn't the target in the first place. Unconcerned individuals -- the people least in need of reassurance -- are both the least likely to obey a precaution and the most likely to be reassured (that is, cemented in their unconcern) by having decided not to act.

5. The recommended precautions are individual. I feel some concern and would like to take the precautions, but they are onerous. I reluctantly decide not to take action, or I decide to take action but fail to follow through, or I postpone the decision while continuing to "endanger" myself or my family. What happens to my level of concern? It might go into denial, or get projected as disapproval of the recommended precautions. But in all probability it increases. I have been warned to take precautions and I wanted to obey, but the recommended precautions don't fit easily into my life. As a practical matter I cannot limit my teenager's mobile phone use to brief "essential" conversations, nor can I move to a place suitably distant from the nearest mobile phone tower. I feel helpless and endangered and angry. Certainly I have not found the experience reassuring.

This fifth situation is the key one, I think. In some ways the most important audience for precautionary recommendations consists of people whose concern is real but not necessarily high enough to overcome other considerations (convenience, lethargy, family amity). Being on the receiving end of precautionary recommendations they end up not taking leaves them no more protected but significantly more unhappy and concerned. A government warning that aims to reassure, then, had better be a warning most concerned people will be able to

implement. Warning concerned people to take actions they are unlikely to take can only worsen their concern.

In the wake of the draft WHO policy statement, for example, the Russian government issued new advice for its citizens "on the safe use of mobile phones." Noting that its recommendations were "based on the precautionary principle of the World Health Organization," it advised that pregnant women, children under the age of 16, and those with various health problems from epilepsy to sleep disorders should not use mobile phones at all. Everyone else should limit call length to a maximum of three minutes, then wait at least 15 minutes before making another call. There is no way these draconian recommendations are going to be widely followed. A study of their psychological effects would be welcome, but in the absence of empirical data, what does theory tell us to expect? Most Russians will ignore the recommendations, or never even know they were promulgated. Some Russians will make a conscious decision not to comply, and then tell themselves that their decision must mean they are not concerned; this is cognitive dissonance leading to reassurance. Some will sink into the apathetic despair of learned helplessness. Some will actually comply. But how are Russians who are already worried about mobile telephone hazards likeliest to respond? They will read the recommendations and feel reinforced in their concern; then they will try to comply but fail; then they will feel discouraged, guilty, and all the more concerned.

6.4 Accompanying Rhetoric

The core problem addressed in this essay is how to reassure people when taking or recommending precautions that are probably technically unnecessary. An obvious question arises: Would it help to say that this is what you are trying to do? Would it hurt? How is the impact of precaution-taking on public concern affected by the rhetoric that accompanies the government precaution or the warning?

6.4.1 "We're doing this to reassure you."

One rhetorical strategy that is often attempted is to state more or less explicitly that the precaution the government is taking or recommending is technically unnecessary, and is aimed more at reassurance than at protection. "We are taking this step to reassure you, not because it's actually needed." This has the virtue of candour, in that it concedes that the action taken is justified neither by the known risk nor by the level of uncertainty, but rather by the public's concern. But it has few other virtues. It risks sounding patronizing and thus arousing outrage of a different sort. It also tends to undermine the legal legitimacy of the precaution; having conceded that a particular regulation is unnecessary, adopted to reassure an over-anxious public, a government would have a tough time defending the requirement in court.

Does it also undermine the precaution's psychological legitimacy? I think so -- though I would love to see a study to test the hypothesis. Telling people you are protecting them (or urging them to protect themselves) only as a way of calming them down seems likely to reduce rather than increase the reassuring effects of the precaution. By conceding that you think the precaution is technically unnecessary, you nearly concede that it isn't the precaution you would take if you shared my concern. That is, a precaution I know is designed to calm me rather than protect me will strike me as less likely to protect me ... and thus is in fact less likely to calm me.

To some extent, any government acknowledgment that it considers a precaution probably unnecessary undermines citizen confidence in the precaution, and thus undermines its ability to reassure. Still, some versions of this rhetoric are probably more damaging to the desired reassurance than others. "We are doing this to reduce your exposure," a government official might say, "even though we think that exposure is probably harmless." Citizens who are concerned about the exposure would probably prefer that the government shared their concern. But at least the government is undertaking to reduce our exposure. When an official says, "we are doing this to reassure you," on the other hand, it isn't clear that what it is doing will actually reduce our exposure (or affect anything else in the physical universe). Paradoxically, then, the rhetoric of reassurance is unlikely to make precautions reassuring.

Of course neither is the rhetoric of alarm. "We are doing this because the risk is substantial" clearly isn't a reassuring thing to say. What conclusion should we draw from the observation that neither the rhetoric of alarm nor the rhetoric of reassurance seems likely to make a precaution reassuring: that it is difficult to make a precaution reassuring.

6.4.2 "We're doing this in an abundance of caution, because the situation is uncertain."

Another rhetorical strategy emphasizes that in the face of uncertainty, caution is appropriate even though it often turns out to have been unnecessary. This is of course the essence of the PP. Unlike statements that the precaution is aimed at reassurance, statements that the precaution is a probably over-protective response to uncertainty are not patronizing; they do not undermine the legal or psychological validity of the precaution.

The question is how public concern is affected by repeated government claims that the precaution it is taking or recommending is very likely over-protective and unnecessary but is nonetheless an appropriate response to uncertainty. It seems logical that each reiteration of this claim should weaken the ways in which a government precaution tends to be alarming (e.g. validation that the risk is substantial) and strengthen the ways in which a government precaution tends to be reassuring (e.g. evidence that the government is taking the issue seriously enough). If the public understands the PP as an appropriately conservative response to uncertain risk, shouldn't explicitly and avowedly precautionary approaches provide reassurance?

On the other hand, considerable research supports the view that uncertainty itself exacerbates concern, and that expert disagreement in particular often yields higher levels of public concern than a risk that all the experts agree is significant. So it isn't clear that telling people a precaution is a response to uncertainty will generate lower levels of concern than telling them it's a response to a known risk. And of course the government's claim that the precaution is probably over-protective would certainly be challenged by activists, who would counterargue that the risk is indeed substantial, that when all the facts are in the precaution in question is likelier to turn out insufficient than excessive. This debate among the experts over whether the risk is probable or improbable and whether the precautions are over-protective or under-protective is itself likely to raise rather than lower the level of public concern.

Of course the impact of rhetoric about the precautionary approach depends some on exactly how it is phrased. One of the most common formulations, "better safe than sorry," sounds like the precaution is quite likely to prove needed; it is presumably more alarming than reassuring, and is therefore favored by activists. Government officials who want credit for being cautious but also want the precaution to reassure people lean toward formulations like "abundance of caution" -- which almost sounds like the previous rhetorical strategy, and is thus paradoxically likely to alarm. It's not easy to find a middle course, a way of explaining the precaution that does not alarm people by telling them the precaution is badly needed and does not alarm people by telling them the precaution is window-dressing. But suppose you do find the middle ground: "When the science is uncertain, it is common sense to take extra precautions, to make sure there's an extra margin of safety in case the risk turns out greater than we think it probably is. We have therefore decided...." Is this formulation, or something like it, likely to reassure?

The question needs to be tested empirically, and to the best of my knowledge it hasn't been. But considerable anecdotal evidence suggests that government insistence that its precautions are precautionary probably does little to make those precautions reassuring.

Recently, yet another government commission (this one in the United Kingdom) issued a report on mobile telecommunications risks. Like many previous reports (including a previous U.K. report), this one concluded that the weight of the evidence does not suggest any adverse health effects. It nonetheless endorsed a precautionary approach, on the grounds that there are gaps in the evidence and a slim but real possibility of adverse health effects therefore remains. In other words, the report adopted exactly the rhetorical strategy we are discussing.

Did it help reassure people? Here are the comments of one journalist who thinks not:

> Modern science provides us with specific conclusions, from existing evidence, that are our best available guide to the world we inhabit. Mentioning an unsubstantiated "possibility ... that there could be health effects from exposure to radiofrequency fields" in a report on mobile phone safety can only lead the media and the public to mistrust your evidence and conclusions. And if you do not believe that your evidence and conclusions deserve to be trusted, then you have no business issuing them in a public report.... If you do not trust in science, then no amount of reports concluding that mobile phones are safe will change your mind about the danger. And reports, which conclude that mobile phones are safe, but then tell you to be careful anyway, are positively guaranteed to undermine whatever trust in science you do have. (Sandy Starr, "Phoney Basis to Panic," Spiked-*risk*, January 22, 2004 -- on the Web at http://www.spiked-online.com/Articles/0000000CA36F.htm.)

Risk assessors and risk managers understand that the only way to assure sufficient protectiveness in uncertain situations is to be over-protective. The term of art for this is conservativeness. As a component of risk assessment and risk management, conservativeness predates the Precautionary Principle and aims at the same goal: over-protectiveness as a response to uncertainty. Risk assessors typically ground their calculations in conservative assumptions at every step in the process, emerging with a risk estimate somewhere between their best guess and their worst-case scenario. Risk managers typically add some further conservativeness in the transition from calculation to action recommendation.

Risk communicators, however, have been singularly unsuccessful in conveying this information to concerned or outraged publics.

In low-controversy situations, it is possible -- even easy -- to convince the public that a particular precaution is over-protective. (The usual outcome is that people don't take the precaution.) But in difficult risk controversies, when outrage is high, very few people take notice of the conservativeness of the risk assessment and risk management process. Of course it is arguable, and often argued by PP proponents, that this process as actually practiced isn't as conservative as its practitioners believe, or as conservative as it ought to be. That's not the point. Whether they are right or wrong to do so, people who are concerned reliably tend to shrug off the claim that a government-imposed or government-recommended precaution is conservative. They see the precaution as validation that their concern is justified, and it sets a new floor for new, still more conservative future precautions. If they pay any attention at all to the rhetoric about conservativeness, they are likelier to see it as evidence that the authorities don't believe in their own precaution (and it therefore probably doesn't go far enough to protect us) than as evidence that the authorities are erring on the side of caution (and we should therefore feel reassuringly well-protected).

6.4.3 "We're doing this because you pushed us into it."

This third possible rhetorical approach has considerable merit ... though my clients find it anathema. In fact, it makes my list of top outrage reduction strategies: giving critics the credit they deserve for successfully applying pressure on behalf of precautionary action. Apart from truth (when it is true), giving away the credit has at least two other virtues.

First, it validates that you are actually doing what you say you're doing. Companies and government agencies that have been forced to take actions they'd have preferred not to take often insist that "we're doing this because we care deeply and we believe that it's the right thing to do," viewing this false claim as a sort of consolation prize. But if the reasons given for an action are not credible, the action itself loses credibility as well; when a company says it stopped polluting the stream "because we love fish more than profits," people are likely to believe it didn't stop polluting the stream at all. "Because you pushed us into it" is more credible and therefore makes the action itself more credible.

The second benefit of giving critics the credit is that it tends to reduce the level of conflict. At the simplest level, critics are often infuriated when they campaign successfully for some regulatory action, only to have the regulator snatch away the credit they have earned. Emotions aside, critics (at least professional ones) need victories to bring back to their constituents; it is wiser to give them credit for the ones they have already won than to leave them with an ever-

stronger need to go win new ones. Beyond that, it's hard to maintain a nasty battle against an opponent who insists on offering praise in return. When an agency tells an activist group, publicly, that "this is your achievement more than ours," "no it isn't" sounds silly and "it's not enough" sounds grabby. Not infrequently, the group may find that its best course is to declare victory and go fight its next battle elsewhere.

This strategy has its downsides, however. For one thing, I find it extremely difficult to get clients to adopt it. Companies and governments hate to give credit for precaution-taking to someone else, and especially hate to give it to critics.

Beyond that, the real problem is that you can't easily give away "credit" while insisting that a precaution is technically unnecessary -- so the process of conceding that the critics won this one does leave the impression that it was worth winning ... that the hazard is significant and the precaution is effective. ("You made us do it and we think it's stupid!" won't be seen as giving away the credit.) Even though the battle will probably moderate, onlookers are likely to conclude that concern is justified. In other words, giving away the credit for new precautions is an effective way to reduce the anger component of outrage, to moderate the battle with critics -- especially when the precautions are legitimately useful. But it is a very problematic way to reduce the fear/concern component of outrage, to reassure people -- especially when the precautions are probably unnecessary or ineffective.

I have looked at three rhetorical strategies for making precautions or warnings more reassuring: saying they are aimed at reassurance, saying they are conservative (that is, intentionally over-protective as a response to uncertainty), and saying they are a response to pressure from critics. The third has real value as a way of reducing the level of conflict, but none of the three seems likely to reduce the level of concern.

7. How Government Can Reassure: Proposing a Range of Voluntary Precautions

There is a rhetorical strategy that does help reduce the level of concern, however: proposing a range of voluntary precautions aimed at people with different levels of concern. The best risk communication gives people a choice of things to do. Ideally, your menu of protective responses ranges around a recommended middle. "X is the minimum precaution; at least do X, even if you think the risk is trivial. Y is more protective, and we think wiser; we recommend Y -- but people who think we're over-reacting can get by with just X. Z is more protective still, and we think a little excessive -- but if you're especially vulnerable or especially concerned, if you think we're not taking the risk seriously enough, by all means go that extra mile and do Z."

The X-Y-Z choice does tell people how concerned you think they ought to be, the level of concern represented by protective response Y. But that isn't the focus. The focus is on giving people permission to be more or less concerned than you think they ought to be -- and on prescribing a set of precautions appropriate for whatever level of concern they are experiencing. For those of us who are excessively fearful, you are not trying to "allay" our fears -- which cannot be done directly. Instead, you are helping us manage our fears, by giving us precautions to take that match our level of fearfulness. That allays our fears.

So we have come full-circle, back to voluntary individual precautions. Governments can best help reassure their publics, I think, by telling them what they can do if they are concerned -- and, when appropriate, by facilitating their ability to do it (for example, by providing the information people need to take the precautions they choose). The X-Y-Z approach is respectful of all levels of concern. It empowers those who are concerned; it helps them protect themselves and thus also helps them reduce their concern through decision-making and through action. It does this without exacerbating their concern, either by unduly validating it (it treats the less concerned position as equally valid) or by appearing hostile to it.

Offering people a range of voluntary precautions is not a panacea. In particular, it is more reassuring when precaution-taking can be individual than when the precautions must be collective and individual action must therefore be political. "Here's what you can do if you are concerned about mobile phone towers" is likely to entail organizing activist groups, going to

meetings, putting pressure on companies and municipalities, etc. Even when these political actions are effective (but especially when they are not), they are unlikely to be reassuring. The "social amplification of risk" (of outrage, in my terms) is well established. The nearly universal experience of collective advocacy is an ever-increasing conviction that the advocacy is needed, that the problem is serious.

But at least "here's what you can do if you are concerned about mobile phone handsets" is likely to lead to individual decision-making, followed by individual precaution-taking, followed by a reduction in concern.

By contrast, in the face of existing public concern government precautions ("here's how we are protecting you") and government warnings ("here's how we urge you to protect yourself") seem likelier to backfire, to be alarming rather than reassuring -- even if accompanied by a rhetorical disclaimer ("because people are concerned" or "just to be on the safe side").

Of course alarming people isn't always the wrong thing to do. The ideal level of public concern isn't necessarily the lowest level; it is the level commensurate with the actual risk (short of panic, which is uncommon). When a risk is serious, an alarmed public is appropriate. Those who consider the risk of mobile telephones and telephone towers to be serious have no reservations about a precautionary response -- such a response will protect people and also probably alarm them, and both impacts are desirable ones. But those who consider the risk unlikely though not inconceivable have a problem: A precautionary response will protect people from the unlikely risk (a desirable though unimportant impact) but may also exacerbate their concern about it (an undesirable and arguably more important impact). Certainly taking precautions or issuing warnings about unlikely risks *in order to reduce people's concern about those risks* is an unpromising strategy! It follows that ramping up a governmental PP response depending on the level of public concern is similarly unpromising.

Policy-makers, practitioners, or researchers may eventually find ways of taking precautions or issuing warnings that reliably reduce people's concern, that help resolve risk controversies instead of reinvigorating them at a higher level of protectiveness. If such reliably reassuring precautionary approaches materialize, then a PP response to public concern may begin to make sense. Until then, the PP should be seen as a strategy for protecting people from uncertain risks, not as a strategy for reassuring them about those risks.

8. Three Bottom-Line Recommendations for the WHO

8.1 Commission research on the relationship between government precautions and public concern.

Much to my surprise and disappointment, I have found no psychological studies directly on point. (Burgess's work is certainly on point, but its level of analysis is societal rather than individual.) Rather than assuming that government precaution-taking is a source of reassurance, the WHO should commission work to find out if this is the case -- or, more likely, to find out under what circumstances this might be the case. The weight of theoretical reasoning and anecdotal experience is in the other direction, suggesting that government precaution-taking is likelier to spur concern than to ameliorate it. In fact, I would judge that while it is not proved that government precautions exacerbate public concern, there is ample reason to suspect such a cause-and-effect relationship. Invoking the PP with the goal of reassuring concerned populations, in other words, is itself a technology with unproved but not unlikely negative impacts. Pending further research, therefore, it is time to invoke the PP with respect to this particular use of the PP.

8.2 Distinguish between hazard and outrage.

The new WHO formulation of the PP accepts outrage (public concern) as itself evidence of hazard. In spots it comes close to treating outrage as identical to hazard. This is a conceptual, epistemological, and empirical error. It is true that public concern is, among other things, a clue to hypotheses about hazard that may be worth investigating. But most centrally outrage is outrage. Concern about a risk is real, independent of the hazard. The extent of the concern is

a phenomenon quite different from the extent of the hazard. Distinguishing them is central to coherent risk policy-making.

8.3 Distinguish between hazard mitigation and outrage mitigation.

I believe the WHO is right to see outrage as an important constituent of risk, worthy of attention in its own right. In fact, the WHO definition of health ("a state of complete physical, mental and social well being and not merely the absence of disease or infirmity") clearly encompasses outrage -- to its credit. This establishes that outrage, like hazard, merits mitigation. It does not, however, suggest that hazard mitigation is the best way, or even an acceptable way, to mitigate outrage. The draft WHO formulation of the PP provides a single list of risk management options "ranging from minimal to stringent"; what is needed instead is two lists, one of hazard management options and another of outrage management options.

The WHO appears to assume that government precautions aimed at reducing hazard can also reduce outrage *en passant*. In fact, it appears to assume that government precautions that only purport to be aimed at reducing hazard -- but are unlikely to do so because the hazard is already small or the precaution is ineffective or both -- will reduce outrage nonetheless. It does not assert these claims as empirical propositions; it assumes them as by-products of its failure to distinguish hazard from outrage at the outset. This essay has treated them as empirical propositions, and has found them unlikely to be true.

Note on sources: I had originally intended to write a more research-based article, replete with footnotes and academic bibliography. But my search for literature addressing the intersection of the Precautionary Principle and public concern (whether or not in the context of EMFs) yielded surprisingly little. I found plenty of "hits" that helped provoke me to think through the issues, but very little relevant research except for the work of Burgess, cited in the text. So the article morphed into an essay, almost a meditation. I have therefore decided to dispense with a formal bibliography; a Google search for "concern, precautionary principle" will bring up most of what I read.

Acknowledgments: Ragnar Lofsted, Lennart Sjöberg, and Peter Wiedemann gave me their comments on a draft of this essay; all three are European risk communication scholars, and all three pointed me to key background readings on the Precautionary Principle. My wife and colleague Jody Lanard commented from her perspective as a libertarian psychiatrist with risk communication expertise. My client also shared a draft with David Black and Adam Burgess, and passed their very useful comments along to me. But by far the most valuable comments came from my client directly. From the very beginning, Dan Lloyd and Neil Gough of Vodafone turned this task into a thoughtful and collegial dialogue of the sort that, back when I was a professor, I used to imagine simply didn't happen in industry. They never challenged my right to write what I think, but they consistently challenged my thinking itself ... and forced me to think more deeply and more carefully. Except for Jody, all the readers of earlier drafts urged me to make the paper shorter and punchier; they are not responsible for my responding to their substantive comments by making it ever more discursive instead.

Addendum I:
Hazard Implications of Outrage Components

By Peter M. Sandman, Ph.D.

Throughout most of the main essay I have treated "outrage" and "concern" as more or less interchangeable concepts. But at the very start, I noted that some of the "outrage factors" that contribute to concern also have an independent impact on what risk response people consider most appropriate. That is, some of the components of outrage are also relevant to hazard, hazard management, and precaution-taking -- not because they make people more concerned but for other reasons.

I originally coined the term "outrage" in the context of my work on environmental controversies, where a major component of the concern was anger and disapproval; the concept is also meant to apply (though the word works less well) in situations where fear rather than anger is the main component.

Psychometric researchers have identified a wide variety of factors that contribute to what I am calling outrage; everyone has his or her own "A List." Mine has 12 factors:

1. Voluntary vs. coerced
2. Natural vs. industrial
3. Familiar vs. exotic
4. Not memorable vs. memorable
5. Not dreaded vs. dreaded
6. Chronic vs. catastrophic
7. Knowable vs. unknowable
8. Individually controlled vs. controlled by others
9. Fair vs. unfair
10. Morally irrelevant vs. morally relevant
11. Trustworthy sources vs. untrustworthy sources
12. Responsive process vs. unresponsive process

It should be noted that risk perception researchers are by no means agreed that this list -- or any list -- is the "right" one. Indeed, the psychometric paradigm has itself been questioned; competing paradigms focus on culture, values, and ideology; on affect; etc. Also, lists like this one are often misused to distinguish the "irrational perceptions" of laypeople from the "rational knowledge" of experts -- as if experts were somehow capable of apprehending risk directly without perceptual distortion (presumably also without values or affect). I don't mean to put forward a theory of risk perception here, only to point to a list of aspects of risky situations that often -- and in my judgment rightly -- influence how people (whether laypeople or experts) judge those situations. In a nutshell, I see nothing wrong with taking a risk more seriously because it is coerced, industrial, exotic, etc. But judging the risk to be technically more dangerous on those grounds is obviously a mistake. That's why I divide risk into its "hazard" (technical) and "outrage" (non-technical) components. The list above is a list of 12 outrage factors.

(For an article by Simon Chapman and Sonia Wutzke applying these 12 factors and several others specifically to Australian mobile phone tower siting controversies, see http://www.psandman.com/articles/chapman1.htm. Entitled "Not in Our Back Yard," the article was initially published in the *Australian & New Zealand Journal of Public Health*, 1997, 21: 614-20.)

I will conclude this essay by looking at the hazard relevance of these 12 outrage factors -- at least of the six that seem to have some hazard relevance.

Uncertainty/Knowable vs. Unknowable

The most obvious area of overlap is uncertainty. As an aspect of outrage, I subsume uncertainty under #7, knowability. Acknowledged uncertainty provokes less outrage than expert disagreement among competing certainties (also part of knowability). But it is clear that when people are concerned, one significant amplifier of their concern is the uncertainty of those in authority. Actually, uncertainty seems to polarize the risk response; those who are unconcerned use the uncertainty as a reason not to take precautions ("the experts aren't sure it's dangerous"), while those who are concerned see the uncertainty as a major part of the problem ("the experts aren't sure it's safe"). Communicating that a risk assessment is uncertain also leads audiences to see the source as more honest but as less competent.

From an outrage perspective, the key response to uncertainty is to acknowledge it and help people learn to bear it. Acknowledging uncertainty is far wiser than a false over-confidence that is likely to be unpersuasive in the short term and that may prove devastatingly mistaken in the longer term -- and that patronizingly assumes the public cannot bear the truth. This is a point worth stressing in the context of the main essay. I agree with the industry position that excessive precautions can exacerbate unnecessary public concern. But excessive confidence that a hazard is sure to prove negligible -- that is, excessive confidence that any precautions would be excessive -- can also exacerbate public concern. Whether or not uncertainty justifies precaution-taking in a particular situation, it surely justifies candour about the uncertainty itself. All too often companies understate uncertainty and overstate the case that the risk under discussion is "absolutely safe." Even more often companies frame their statements to give this impression without quite claiming to be certain -- and then tell themselves they have acknowledged uncertainty adequately. The evidence that this behavior increases public outrage is much, much clearer than the evidence that official precautions increase outrage.

From a hazard perspective, the key response to uncertainty is caution and conservativeness. It is useful here to distinguish different sorts of uncertainty about hazard:

1. Virtually no information is available, or the available information shows widespread disagreement/inconsistency. You know you don't know how big or small the hazard is.

2. A substantial knowledge base points mostly in a reassuring direction; the evidence suggests the hazard is small or even non-existent. But there are still significant unanswered questions, and there are reasons (anecdotal data, perhaps, or coherent theories) to think there might be a significant risk after all.

3. The evidence is strong and overwhelmingly in the direction of safety, and there are no persuasive reasons to suppose otherwise. But it is always possible to think of possible impacts nobody has seen fit to study, and as a matter of definition all science is permanently tentative -- so it is still conceivable that there is a risk.

My client puts mobile telephone and tower EMFs in the third category, and argues that a precautionary response is therefore inappropriate. Some governments and advisory commissions seem to put it in the second category, and therefore recommend a precautionary response. Other governments and advisory commissions seem to put it in the third category, but nonetheless recommend a precautionary response in order to reassure the public -- which is what gave rise to this essay in the first place. And of course some activists put it in the first category, where precautions are obviously called for. It is worth noting that these disagreements about hazard uncertainty are not just disagreements about data; value judgments are also involved. Among those relevant here are the belief that modern technologies are likely (or unlikely) to have health and environmental drawbacks unknown to science and perhaps unknowable by currently available scientific methods, and the belief that the objectivity of scientific research is often (or seldom) compromised by the ideology or self-interest of the researchers and their funders.

Of course both hazard management and outrage management require a serious effort to reduce uncertainty, to learn more. In most cases scientific uncertainty is at least in principle transitory; it is reduced as knowledge increases. Only occasionally is a scientific question enduringly unanswerable.

Uncertainty is a fundamental component of both hazard and outrage, and thus deserves both a hazard management response (precaution-taking) and an outrage management response (acknowledgment).

Worst cases/Chronic vs. Catastrophic

This is the second area where the overlap between hazard and outrage is fundamental. In my approach to outrage, I treat worst-case scenarios as an aspect of #6, the distinction between chronic and catastrophic risks. Risks provoke more outrage when they are concentrated in space and time than when they are spread out in space and time. That is, the same number of deaths -- or the prospect of the same number of deaths -- concerns us more when they all happen on November 13th in Chicago than when they are spread out over the years and around the globe. This distinction helps account for discrepancies in the response to air travel versus car travel, to nuclear power generation versus fossil fuel power generation, etc. This distinction also explains why risk communicators need to take worst-case scenarios seriously, to focus on their high consequence at least as much as on their low probability. The art of communicating about low-probability high-consequence risks is an important part of outrage management.

But worst cases also play a key role in hazard management. It isn't just on the psychological level that very low probabilities of global catastrophes are intolerable. There is wide societal agreement that the awfulness of the worst case is relevant to the level of precaution deemed appropriate -- that a tiny chance of wiping out whole civilizations requires more caution than a sizable chance of killing a few isolated individuals, even if the two multiply out to the same expected annual mortality. This is especially the case when awful worst cases are combined with high levels of uncertainty about probability: It's probably unlikely but we're not sure, and if it happens it could be devastating to life as we know it. This is virtually the paradigm case for application of the PP. Like the knowable-versus-unknowable distinction, the chronic-versus-catastrophic distinction makes an independent contribution both to hazard and to outrage.

Morally Relevant vs. Morally Irrelevant

Many risk controversies are not just issues of safe versus dangerous, but also issues of good versus evil. The two considerations tend to merge in people's minds, leading to outrage component #10. Morally relevant risks -- that is, risks that seem to be evil as well as dangerous -- tend to provoke far more outrage than risks that are merely dangerous. For years I have used the example of a sniper who occasionally shoots and kills a passing motorist. The sniper, I have noted, would be unlikely to succeed with an argument that snipers kill far fewer motorists than failure to wear seatbelts, that money spent catching and imprisoning him could be more cost-effectively spent on a seat belt education program. This became a less amusing but even more powerful example when two snipers terrorized the Washington, D.C. area in 2003.

Clearly morality is an important part of outrage. Risks that are also moral wrongs (or morally fraught, thought to be moral wrongs by some of the public) will inevitably provoke more concern than technically comparable risks without any moral relevance. This has many implications for outrage management, the most important of which is the need to acknowledge the moral relevance of the issue at hand. Moral misbehaviors call for apology and atonement, not just mitigation and compensation; morally debatable behaviors call for moral discourse, not just statistical explanation.

Is morality also a part of hazard? I think it isn't. That is, I think risks that are also moral wrongs (or morally fraught) do not thereby deserve a more protective precautionary response. Why then am I discussing the issue of morality at all? I am discussing it because moral issues properly play a paramount role in regulation, even though they should play no role in precautionary regulation. Societies that consider certain behaviors wrong properly seek to

legislate against those behaviors. Centuries of political theory have tried to address when the moral judgments of some should be applied coercively to the behavior of others. I'm not going to enter that thicket; my own thickets are thick enough! But it is self-evident to all, I think, that deterring and punishing wrongdoing is a governmental responsibility. That is, morality -- or at least its secular counterpart, ethics -- belongs on government's plate.

Risks do not become more dangerous and thus more properly susceptible to precautionary government action just because they are wrong or morally fraught. But any behavior that is wrong or morally fraught does thereby become properly susceptible to government action. What the government does to address the risk should be unaffected by whether it is also a misbehavior -- but the government must also address the misbehavior itself.

Issues of right-and-wrong play a fairly minor role in mobile telephone controversies. (The closest approximation is the ongoing battle over the etiquette of using mobile phones in public places.) But another focus of the PP debate is genetically modified foods, and here the issue has a sizable moral and ethical component. Values-based objections to GM foods range from assertions about the immorality of corporate capitalism undermining subsistence agriculture in third world countries to assertions about the immorality of "playing God" by creating species unknown in nature. These objections should have no standing whatever as inputs to PP decision-making, which is appropriately confined to matters of risk. But they should nonetheless have standing as valid concerns -- every bit as valid as risk-based objections. American claims that European resistance to GM foods must either be about consumer health risk or about unfair trade restrictions make no sense to me. One effect of such claims is to force coherent arguments about values to masquerade as much less persuasive arguments about hazard, converting genuine disapproval into ill-considered worry. European governments that want to regulate GM food imports on grounds of their society's disapproval are on solid ground doing so -- much as they might regulate imports of products containing endangered species of animals or products manufactured by slave labor, without any showing that these products might pose a consumer hazard.

I am not arguing that decision-making about risk can exclude values. Risk has its own values questions -- how to value risks to ecosystems, to endangered species, to foetuses, and to future generations, as compared to risks to the health of living human beings; how to value longevity versus quality of life, the lives of the elderly and sick versus the lives of the young and strong versus the lives of vulnerable children; how to value risks to oppressed people in third world countries versus risks to powerful people in first world countries; etc. The most fundamental questions about risk -- how safe is safe enough; how confident is confident enough -- are values questions. But while you cannot divorce risk from values about risk, you can and should divorce risk from values that are not about risk -- and struggle to ensure that neither is ignored, and neither is confused or entangled with the other.

Responsive Process vs. Unresponsive Process

My outrage component #12 is the distinction between a responsive and an unresponsive process. Responsiveness includes such aspects as openness versus secrecy, apology versus stonewalling, courtesy versus discourtesy, and compassion versus dispassion. But the essence of responsiveness is listening seriously to other people's concerns, making a meaningful effort to take their concerns on board. This obviously intersects some of the other outrage components -- a responsive process is likelier than an unresponsive one to share control and be accountable, for example. Arguably, responsiveness is as close to a universal solvent as outrage management comes. This is why public consultation plays such a central role in risk communication, why risk communication is something one does with the ears as much as with the mouth.

So responsiveness is central to outrage management. But what is the role of responsiveness in hazard management? If governments are entitled to regulate a reasonably safe risk because their publics consider that risk morally questionable, can they also regulate it because their publics mistakenly consider it hazardous?

Suppose the population or a significant portion of it is concerned about the risks of mobile telephone towers -- and suppose the government is fairly convinced, though not absolutely certain, that that risk is tiny. If people weren't concerned, the government wouldn't want to take a PP approach. It's probably a mistake for the government to take a PP approach in order to reduce people's concern; the central argument of the main essay is that such a strategy is at least as likely to backfire as to work. But is it defensible, is it perhaps even obligatory, for the government to take a PP approach just because that's what the people want?

This is a fundamental question of political theory: when to defer to a public sentiment that is probably mistaken, and when to act in what the government considers to be the public's interest instead. It is obvious that a government that is perfectly responsive isn't a government at all, just an implementer. It is equally obvious that a government that is totally unresponsive is tyrannical -- and in a democracy will soon be replaced by a more responsive government.

I do not propose to address this issue, except to note again that if a government defers to a probably mistaken public, it shouldn't do so because it expects its deference will help change the public's opinion. You defer to a mistaken public, if you do it at all, because you believe that people are entitled to get it wrong and still have their government be responsive to their demands -- not because you believe that responding will help you persuade them to abandon those demands.

I come back to my fundamental view that the government's best course is to cope well with the public's outrage. An outrage management response to outrage will diminish the pressure for a hazard management response to outrage. A hazard management response to outrage, on the other hand, is not well-calculated to reduce the outrage (since as the main essay argues it is at least as likely to increase it), and not well-calculated to reduce the hazard (since there is probably little hazard there to reduce). But a hazard management response to outrage is responsive government nonetheless.

Voluntary vs. Coerced

Voluntariness (#1) is a major contributor to outrage. Consider two ski trips. In the first, you decide to go skiing; in the second, someone rousts you out of bed in the middle of the night, forces you to ascend to the top of a mountain, straps slippery sticks to the bottoms of your feet, and pushes you down the mountain. The experience on the way down the mountain is exactly the same; sliding down a mountain is sliding down a mountain. Nonetheless, the first trip is recreation and the second is assault with a deadly weapon. The same technical risk is orders of magnitude more acceptable to people when it is voluntary than when it's coerced. Finding ways to ask permission -- to make the risk more voluntary even when it is impossible to make it entirely voluntary -- is thus an important outrage management strategy.

How is voluntariness related to hazard management? Clearly, all governments regulate coercive behavior more stringently than voluntary behavior. This is as true of risky behaviors as it is of other behaviors: We are allowed to take much higher risks than we are allowed to impose on others. What is going on here, I think, is an entirely appropriate government bias against coercion, whether by the government or by others. A desire to permit as much freedom as possible leads governments to be reluctant to act against risks we assume voluntarily; the same desire leads governments to be more willing to act against risks imposed on us by others. It takes a stronger case to justify government coercion against behavior that endangers ourselves than against behavior that endangers others.

Does that mean that it makes sense for governments to take stricter precautions against coercive risks than against voluntary risks? Yes and no. If we take the concept of "precaution" literally, the answer is no. The hazard is what it is (even if we don't quite know what it is), whether it is voluntary or coerced. The case for precaution, for being careful, should depend on the magnitude of the hazard and the magnitude of the uncertainty, not on whether those at risk are volunteers. It follows that a voluntary risk should be no different than a coerced risk in the appropriateness of precaution-taking. The case for being careful shouldn't depend on the voluntariness of the risk.

This argument applies without qualification to government warnings. Warnings are not coercive themselves, so they are equally appropriate whether the hazard being warned against is voluntary or not. But the analysis gets a little more complex when applied to coercive government precautions. The case for government coercion always depends in part on voluntariness; that is, requiring people not to do harm to others others is easier to justify than requiring people not to do harm to themselves. Coercive precautions are no exception: Requiring people not to endanger others is easier to justify than requiring people not to endanger themselves. When it comes to coercive precautions -- that is, regulatory action -- it makes sense to have a more conservative approach to coercive risks than to voluntary ones. It follows, for example, that given the same level of hazard and the same level of uncertainty about hazard, government precautions about mobile phone tower risks are more acceptable than government precautions about handset risks, simply because exposure to tower risks tends to be coerced while exposure to handset risks is voluntary.

Fair vs. Unfair

The final outrage component that raises hazard management issues is fairness (#9). The aspect of fairness that outrage management tends to focus on is the disproportionate distribution of risks and benefits. Even if a technology's total benefits greatly outweigh its likely risks, outrage is likely to be high for those who bear an unfair share of the risks. This is the essence of many battles over "technological oppression" and "environmental justice"; it is also the essence of most NIMBY controversies, including the controversy over mobile telephone towers. Along with voluntariness, fairness explains why towers tend to be a higher-outrage issue than handsets. Extremely wide distribution of towers (hypothetically, a "mini-tower" in every handset and no towers elsewhere) would remedy the technology's fairness problem. Short of that, a variety of compensation schemes might be considered -- though making compensation feel like compensation and not like bribery is essential to achieving the desired outrage reduction. (I am talking here about voluntary compensation, not a court-ordered remedy for a legal breach.)

Procedural fairness also makes an important contribution to outrage. People who feel they were properly consulted are likely to find it easier to live with an outcome they dislike than people who feel steamrollered or ignored.

Just as governments have a stake in minimizing coercion, they have a stake also in promoting these two sorts of fairness. This is once again a question of political theory: To what extent is the encouragement of private fairness sufficient to justify governmental coercion? Arguably this is the core question of political theory, the balancing of equity against freedom. What matters for this essay is that the question has nothing to do with risk or precaution-taking. That is, it is good public policy to encourage as much fairness in the society as concerns for freedom permit -- including fair distribution of any risks associated with mobile telecommunications. But it is bad risk policy to assume that unfair risks are more hazardous than fair ones -- and it is therefore bad risk policy to impose more stringent and costly mitigation measures when risks are unfair than when they are fair.

The same may be said for a third sort of fairness: protecting the disadvantaged from further disadvantage. For obvious reasons, the downsides of many technologies are more likely to be visited on the oppressed than on the oppressors. This is less the case for mobile phone towers than for most other technologies. We can't put all our mobile phone towers in the poorest neighborhoods, where we put hazardous waste facilities and slaughterhouses and the like; the towers must go near where the customers are, and the customers are everywhere -- with affluent customers having if anything a greater need for towers than less affluent ones. Even so, tower siting controversies are not immune to differences in local community clout, which in turn are correlated with differences in income, class, and race. Although a tendency to wind up with towers that might otherwise have gone into the wealthier neighborhood a few blocks away is hardly the biggest burden on the downtrodden, the fact that all burdens, little and big, tend to end up on the same shoulders is surely an appropriate focus for government action. But not specifically precautionary action. Whatever one's position on the tradeoff between equity and freedom, risk regulation like all regulation should strive for fairness. But it should be clear that this has nothing to do with precaution-taking.

But there is an aspect of fairness that has a lot to do with risk and precaution-taking: protecting the particularly vulnerable. If "vulnerable" is just code for downtrodden, then we're back to the issues of the previous paragraph. But if "vulnerable" means likelier than others to suffer health effects, then obviously it is a risk-relevant concept. Policies aimed at reducing the EMF exposure of children, for example, are hazard-related precautionary policies if it is believed that children are likelier than adults to be hurt. Such policies can also be justified in hazard terms by the values-based argument (common in the U.S.) that years of life saved is a better metric than numbers of lives saved; it would follow that protecting children is more efficient hazard management than protecting adults.

Note, however, that a commonly suggested mobile telephone precaution, exclusion zones around schools and other "sensitive" sites, may be hard to justify in terms of a precautionary approach to hazard. Some industry sources argue that a tower on top of the school is actually less likely to bathe pupils in EMFs than a tower on top of another building 300 meters down the road. If this is true, then exclusion zones are not a precautionary response to children's hazard, but rather a response to outrage, and to the greater outrage that is aroused where children are involved. As an outrage management strategy, the exclusion zone rises or falls based on whether in fact it reduces outrage (by seeming to protect children) or exacerbates outrage (by suggesting that the hazard is serious ... and perhaps by substituting cosmetic change for real protection).

Naturalness, Familiarity, Memorability, Dread, Control, Trust

The remaining six of my twelve outrage components seem to me to have no hazard implications whatever. Risks provoke more public concern, more outrage, when they are industrial, unfamiliar, memorable, and dreaded than when they are natural, familiar, not memorable, and not dreaded; they provoke more outrage when control is in the hands of others and sources are untrustworthy than when control is in the individual's hands and sources are trusted. But I see no overlap with hazard for these six outrage factors -- no argument to be made for a stronger or weaker application of the Precautionary Principle depending on these six.

Of course these six outrage components -- like all outrage components -- have a significant impact on the demand for precautions. Arguably, in fact, trust is the single most important of the outrage components in building this demand. My government and industry clients sometimes suppose (or pretend) that public concern and the resulting demand for precaution-taking in the face of supposedly reassuring research are entirely based on ignorance, irrationality, or the influence of activists and the media. But in fact concern and the demand for precautions are often grounded in the public's sense that the research and the researchers (and their corporate or government sponsors) cannot be trusted -- that they are biased or incompetent or both. This mistrust, in turn, is grounded in real experience -- sometimes experience of genuinely untrustworthy research, more often experience of being over-reassured, patronized, and misled about exactly what the research says.

Mistrust surely contributes to public concern and to the public's demand for increased precaution-taking. The linkage is rational; if I think the foxes are guarding the henhouse and issuing self-serving assurances that the hens are safe, it makes sense to insist on greater protectiveness. My mistrust justifies my desire for more precautions.

But nobody seriously argues that other people's mistrust justifies actually taking precautions that would otherwise be inappropriate. In fact, the same mistrust that adds to the pressure for additional precautions also renders those precautions less likely to be trusted, and thus less likely to be experienced as reassuring. In other words, if a government is trusted, it is trusted -- it is trusted when it takes precautions (which are therefore experienced as reassuring) and it is trusted when it says the risk is small and no precautions are needed. A government that is not so trusted, on the other hand, will find that neither its precautions nor its assertions that precautions are unnecessary have the desired reassuring effect. There are outrage management strategies for building trust -- accountability is the most important one; we trust you more, paradoxically, when we can check up on you. Precaution-taking is not a way to build

trust (especially if the precautions are likely to prove useless or unnecessary), and it is therefore not an appropriate response to mistrust.

The same may be said for naturalness, familiarity, memorability, dread, and control. Like all components of outrage, these factors reliably affect public concern, and therefore hazard perception and the demand for precautions. But they are seldom if ever advanced as rationales for precaution-taking. I will therefore not discuss them further.

Addendum II: Appropriate Hazard-Related Responses to Outrage

By Peter M. Sandman, Ph.D.

In the main body of this essay, I argue laboriously that a precautionary response to an uncertain but probably low-hazard risk is not a reliable way to reduce people's concern about that risk, and that making the extent of the precaution contingent on the extent of the concern is therefore unwise. The argument has been laborious in part because I haven't found much evidence one way or the other, and in part because the argument is counter-intuitive. Taking people's concerns seriously has to be better policy than ignoring their concerns. And how better to take their concerns seriously than to respond with appropriate precautions?

My usual answer to this question is to prescribe a range of things governments and companies can do to respectfully address the concern itself, and the outrage that underlies it -- rather than the hazard to which it is attached (unless of course the hazard is serious, in which case both outrage and hazard require separate mitigation strategies). Among the scores of outrage management responses to public outrage that I typically recommend, six are on my generic "short list" of key strategies:

1. ***Stake out the middle, not the extreme.*** In a fight between "terribly dangerous" and "perfectly safe," the winner will be "terribly dangerous." But "modestly dangerous" is a contender. If you deserve a B-, activists can get away with giving you an F instead; you can't get away with giving yourself an A.

2. ***Acknowledge prior misbehavior.*** The prerogative of deciding when you can put your mistakes or misjudgments behind you belongs to your stakeholders, not to you. The more often and apologetically you acknowledge the sins of the past, the more quickly others decide it's time to move on.

3. ***Acknowledge current problems.*** Omissions, distortions, and "spin control" damage credibility nearly as much as outright lies. The only way to build credibility is to acknowledge problems -- before you solve them, before you know if you will be able to solve them -- going beyond mere honesty to "transparency."

4. ***Discuss achievements with humility.*** Odds are you resisted change until regulators or activists forced your hand. Now have the grace to say so. Attributing your good behavior to your own natural goodness triggers scepticism; attributing it to pressure greatly increases the likelihood that we'll believe you actually did it.

5. ***Share control and be accountable.*** The higher the outrage, the less willing people are to leave the control in your hands. Look for ways to put the control elsewhere (or to show that it is already elsewhere). Let others -- regulators, neighbors, activists -- keep you honest and certify your good performance.

6. ***Pay attention to unvoiced concerns and underlying motives.*** Unvoiced concerns make the most trouble. Bring them to the surface subtly: "I wonder if anyone is worried about...." And remember to diagnose stakeholder motives other than outrage and hazard: ideology, revenge, self-esteem, and greed are sometimes present and worth looking for.

To this generic list I should add three other recommendations of special relevance to the Precautionary Principle and precaution-taking:

7. ***Acknowledge uncertainty.*** Sounding more certain than you are rings false, sets you up to turn out wrong, and provokes adversarial debate with those who disagree. Say what you know, but emphasize what you don't know ... and the possibility that some of what you "know" may turn out wrong.

8. ***Don't over-reassure.*** When people are unsure or ambivalent about how worried they should be, they often become (paradoxically) more alarmed if officials seem too reassuring. This can lead to anger and scepticism as well, and to loss of essential credibility if the truth turns out more serious than predicted.

9. ***Legitimize people's fears.*** Instead of leaving people alone with their fears, help them bear their fears by legitimizing them, and even sharing some of your own. Even technically inaccurate fears can be legitimized as natural, understandable, and widespread.

In short, I have never claimed that outrage should be ignored. Rather, I believe that the most common response to outrage other than ignoring it -- mitigating the hazard -- is usually the wrong response.

My efforts to promote an outrage management response to outrage, rather than a hazard management response, has sometimes led me to imply that outrage has no implications whatever for hazard management. This goes too far.

This addendum, therefore, is devoted to those aspects of outrage that do justify a hazard-related response, and also to those that are widely thought to justify such a response. This isn't a rebuttal to the argument of the main essay, that it is wrong to take precautions simply because people are concerned, or to take stronger precautions because people are more concerned. But it does qualify and complicate that conclusion.

At the end of the main essay, I endorse one hazard-relevant response to outrage: Offering people a range of voluntary individual precautions to match their varying levels of concern. I will discuss three others here: research, education, and labeling.

Research as a Response to Outrage

First of all, public concern (outrage, sometimes fear or anger) is itself a kind of data about hazard. It's not very good data about hazard -- the correlation between how concerned people are about a risk and how endangered they are, is notoriously low. But the correlation isn't negative. Although concern is a poor predictor of technical risk, it still has some predictive ability and shouldn't be ignored. The fact that people are concerned, in short, doesn't in itself justify greater precaution-taking. But it does justify more careful investigation of the hazard.

This isn't just a matter of good science, though it is that; it is also a matter of courtesy, and almost of right. When I was a university professor, students occasionally showed up in my office to question their grade on an examination or paper. The correlation between these complaints and actual errors of grading was, I believe, quite low. Nonetheless, every student's concern that I might have mis-graded his or her work was reason enough for me to take another look. Similarly, it is sound public policy to study more carefully the risks that many people are worried about, simply because they are worried.

For reasons of outrage management, research that is triggered by public concern should be collaborative and accountable rather than unilateral; if the finding is negative, you want it to be credible and therefore reassuring. But that's outrage management. The hazard issue here is simply that outrage-provoking risks merit a more thorough investigation than risks that provoke only apathy. (As I write, this kind of approach is being tried by the World Health Organization in northern Nigeria, where high outrage and mistrust about a low-hazard risk -- polio vaccination -- has had devastating consequences for children. In this case, interestingly, the WHO is addressing public concern via a collaborative, accountable second look, not via additional vaccination precautions.)

More importantly, people who are concerned or outraged are important sources of data -- not just their outrage itself, but the experiences that aroused it. By definition these experiences are atypical; outraged people are a non-random sample. But also by definition their experiences are especially relevant. Something or some combination of things happened that aroused their concern, their outrage. Ignoring what they can tell you is bad outrage management, bad public policy, and bad science. It is of course "unscientific" to take precautionary action based solely on anecdotal data from concerned citizens, as if such anecdotes had the same evidentiary value as methodologically sound, peer-reviewed research; but it is equally "unscientific" to ignore anecdotal data as a reason for reconsidering prior research and as a source of hypotheses for further research.

Some scientists have responded to this assertion by pointing out that often they can see the origins of people's outrage in factors irrelevant to the assessment of hazard. Outrage about mobile phone tower risks, for example, may arise from people's aesthetic objections to the towers, or from their sense that their property rights have been infringed upon, or from the organizing efforts of neighborhood activists, or from media attention. Claims about health risk may be visibly derivative, instrumental, "manufactured." This is quite often true -- although not as often as the defenders of an embattled technology tend to imagine. But even claims that are derivative may embed useful data and meaningful hypotheses. Even if my "real" concerns are not about health, as I talk myself into my new health concerns I try to integrate my health-related experience and the health-related experience of my neighbors. The safety claims of industry, after all, are often similarly derivative, grounded in the profit motive. The safety claims of government may be derives from a desire to reassure and a fear of panic. That is a reason for not taking these claims at face value, but surely it is not a reason for ignoring them altogether.

Like most risk communication consultants, I have noticed that the scientist's characteristic open-mindedness, tentativeness, and voracity for data of any sort tend to disappear when amateurs are questioning the validity of that scientist's conclusions. The scientist's normal approach to anecdotal information is to see it as a rich source of hypotheses worthy of more rigorous investigation. The scientist's normal response to anomalies -- individual reports or data points that don't fit the established generalizations -- is to get a little excited about the possibility that closer examination of the apparent exception might yield a more complex theory, conceivably even a whole new phenomenon to explore. The scientist's normal reply to claims that the generalizations themselves may be wrong is to concede that they may indeed be wrong, to solicit more detail on the challenger's objections, and to look again.

As human beings, scientists sometimes fall short of these goals, but in their interactions with each other they genuinely try to live up to them. But when faced with a citizen activist -- especially an activist who trusts anecdotal evidence more than statistical generalizations, and most especially an activist who is questioning the scientist's competence and integrity -- scientists are all too likely to lose track of these core scientific values. When there is a lot of public outrage at the experts, likelier than not there will be a lot of expert outrage at the public as well. Just as the public's outrage makes it hard for people to take on board the experts' information suggesting that the hazard is probably low, the experts' outrage makes it hard for experts to take on board the public's information suggesting that maybe they ought to look again ... and suggesting where to look. At the very least, the experts' outrage may make it hard for them to respond respectfully and compassionately to the public's outrage.

I am not arguing that when citizen critics and experts disagree, the citizens are likelier to be right. If we've got to dichotomize, then I think it is more often the experts who are right. But occasionally when the citizens do have it right, it takes the experts longer than it should to notice because of their own defensiveness. And more than occasionally there is right on both sides -- and it takes the experts longer than it should to integrate the citizens' knowledge into their overall theory, again because of their own defensiveness.

Bottom line here: Public concern in itself justifies a more thorough investigation of the hazard, and especially of the public's experiences that have provoked that concern. And experts should notice their disinclination to take citizen experience seriously enough, and should bend over

backwards to compensate for it. Anecdotal data provided by emotional or hostile people is still data; when scientists treat this data with contempt, they are being emotional, hostile, and unscientific.

Public Education as a Response to Outrage

This point is too obvious to belabor, but it at least needs to be mentioned: Public education is an entirely defensible hazard-related response to outrage. When people believe they are at great risk, and their government believes their risk is probably minimal, the government is surely entitled to explain the basis for its opinion as clearly, completely, and convincingly as it can. Arguably it has a moral obligation to do so.

That said, I must immediately add that the efficacy of education as a response to outrage is greatly overrated. It does sometimes happen that people are reluctantly concerned about a risk (perhaps in response to the urgings of others) and highly desirous of being reassured; under those circumstances education does quite well. But the more usual situation is that concerned people quickly become attached to their concern and highly resistant to any effort to talk them out of it. They'd rather be right than safe -- or, rather, they see the educational message more as an offensive effort to prove them wrong than as a welcome effort to prove them safe. This phenomenon is independent of which side is technically in the right -- assuming we have a way of determining which side is technically in the right. It is also counter-intuitive. At first glance, we would expect people to welcome the good news that they are not endangered after all. Instead, they tend to hold fast to their conviction that the risk is substantial and that those who say otherwise are either mistaken or corrupt.

Consider the typical public meeting about a hot risk controversy. Hundreds of outraged citizens are gathered to protest the risk. At the front of the room is an expert, carefully explaining why the risk is negligible. The expert would do better to listen more and explain less -- that is, to make outrage reduction a higher priority than education. But he or she is going the education route. "We have done a quantitative risk assessment on this situation," the expert announces, "and we have determined that the odds of it making anyone in this room ill are less than one-in-a-million." What happens? It is vanishingly infrequent for a roomful of angry citizens to respond, "Oh, now I get it!" and go home happy. Instead, the room erupts in ever-increasing outrage. Someone stands up in the back and shouts, "You're lying! We're all going to die of leukaemia!" -- and there is tumultuous applause. What does it take to applaud the idea that you're going to die of leukaemia? Outrage. When people are outraged enough, they momentarily want to die of leukaemia; at least they want to believe they are going to die of leukaemia, so they can hang onto their outrage at you.

Under those circumstances, it is going to be very hard to "educate" them that they're unlikely to die of leukaemia. And if you somehow manage to accomplish this task, they will very likely start worrying about birth defects instead. That is, outraged people resist information that undermines their outrage -- but if forced to accept such information, they don't become less outraged; they just find new reasons for their outrage. (Married couples are very familiar with this phenomenon).

It is certainly true that outraged people are prone to misperceive hazard data. But it's important to understand the direction of the causality. It isn't mostly that people are upset because they think the risk is serious. It's much more that people think the risk is serious because they are upset. Teaching them that the risk isn't serious is thus a less effective way to manage the problem than finding ways to upset them less -- that is, an outrage management response to an outrage problem.

Education is a long shot when the task is to reassure already concerned people. Its appeal to scientists, to experts generally, and to all those in authority is obvious: It affirms the wisdom of the educator. "Explaining to the public what sound science teaches us about this risk" is bound to appeal to the custodians of sound science -- even if what they propose to explain sometimes conveniently leaves out aspects of the truth they fear might actually alarm people. It is nonetheless amusing to watch proponents of "data" ignore the data that education seldom succeeds in calming concern. They try anyway, predictably they fail, and then they get irritated

at that stupid public. Scientists understand when they are at home that "educating" angry spouses or alienated teenagers rarely works, no matter how high the IQ of the student. But in the policy arena they keep setting themselves up to fail, and to blame the public, when they try to "educate" angry, frightened, distrustful people. As a response to outrage, in short, education is rationalist but not rational. It takes a certain Spockian irrationality to keep assuming that data are a useful rejoinder to outrage.

Risk education has a somewhat better record on the other side of the debate. Arousing concern isn't an easy task either. The natural state of humankind vis-à-vis risk is apathy, and certainly insufficient concern about serious hazards is at least as widespread and as serious as excessive concern about small hazards. Activists wishing to get people concerned about risks usually need stronger weapons than education; they look for ways to arouse outrage instead. Still, education can help over the long term; a differently educated next generation will see the risk differently. From smoke alarms to HIV/AIDS, from drunk driving to obesity, the record demonstrates that overcoming apathy is extremely difficult, that it is not impossible, and that education can help.

Persuading people to abandon their concern is just as difficult as persuading them to abandon their apathy. It, too, is not impossible -- but there is slim ground for optimism that education can help much. At best, education is fairly effective at "inoculating" relatively unconcerned people, making them more resistant to others' efforts to arouse their concern. Teaching angry or frightened people that you were right all along and they are safe after all is almost a lost cause.

Still, you have something of an obligation to try. Outraged people are entitled to full information, whether it helps ameliorate their outrage or not. Certainly denying them full information on the grounds that they won't believe it anyway can only make a bad situation worse. A few pointers:

- Education works best when it is two-sided -- that is, when it addresses the other side's arguments (or anticipates them if they haven't been made yet) and acknowledges that those arguments have some merit.

- Education works best when it is respectful of people's concerns and the forces and emotions behind those concerns. Calling people hysterical, panicky, or irrational never, never helps.

- Education works best when it is two-way -- people are likelier to be willing to learn from you if they see that you are willing to learn from them as well.

- Education works best when it is candid. Leaving out or shrugging off facts that might arouse still greater concern is tempting but ineffective as well as unethical. People can sense the difference between being enlightened and being conned.

- Education works best when it acknowledges uncertainty. Like leaving out awkwardly alarming facts, over-confidence is a tip-off that your goal is more persuasive than educational.

- Education works best when it is grounded in the "mental models" of the audience. Concerned people aren't usually ignorant; they are well-informed, but some of what they know may not be true ("well-misinformed?"). You can't just tell them what you know. You need to start with what they know.

Except for the last, these pointers amount to mixing some outrage-reduction into your education program. They can be summarized as saying that education works best when it isn't aimed simply at teaching people about the hazard, but at reducing their outrage as well.

Labeling as a Response to Outrage

Public education is the least controversial hazard-related response to outrage; it may not work, but it feels just fine to the people who believe the hazard is trivial and the outrage, therefore, is unjustified. More thorough investigation is a less congenial response ("why should we have to

study the problem more when we think we already know the answers?"), but in the end it goes down well enough, since the outcome is expected to be still more evidence that the hazard is trivial. Even offering people a menu of voluntary individual precautions is fairly acceptable; those who believe the hazard is trivial have to grit their teeth a bit when they explain what concerned people can do to protect themselves, but they don't usually disagree in principle with letting concerned people protect themselves, however unnecessarily.

Where I expect I may lose my client's support is in my advocacy of labeling. But I believe the logic is inescapable: If people have a right to take precautions that others consider unnecessary, then they are entitled to the information they need to do so.

Note the distinction here between labels and warnings. Warnings explicitly suggest that the risk is serious; they are likelier to increase concern than to diminish it, and are therefore an inappropriate hazard-related response to outrage in situations where the actual hazard is thought to be low. Labels only say here's something you may want to know; they are likelier to diminish outrage than to increase it, and are therefore an appropriate hazard-related response to outrage however low or high the actual hazard is believed to be.

The risk controversy where labeling has played the biggest role is genetically modified foods. At one extreme, some European authorities want to require labels on foods that contain or might contain genetically modified ingredients, so that consumers (and retailers) can avoid such foods if they choose. At the other extreme, some U.S. jurisdictions not only do not require labels on foods with GM ingredients; they actually forbid labels on foods without such ingredients. Dairy companies wishing to certify that their milk contains "no added BGH" --a GM ingredient -- have been told they may not do so. Even though the label is accurate, it has been judged misleading on grounds that it carries the implication that added BGH is a health risk.

In this controversy I am on the Europeans' side. I am comfortable with requiring labels that inform people where GM ingredients may be present, and I am enthusiastic about allowing competitors to entice people to products that guarantee no such ingredients. I don't think requiring (much less permitting) the labels implies that the government believes there is a health risk. At most it implies that the government recognizes that some people believe there is a health risk, and wishes to give them the information they need to act on that belief. Even that overstates the case. People may and often do have non-health reasons for wishing to avoid GM products. There are moral objections to genetic modification, and other sorts of values-based objections (impact on third world farmers, for example). Among the labeling precedents are, of course, kosher and halal labels that testify to the food's adherence to religious standards. Governments permit these labels and even police their accuracy without necessarily endorsing the religious injunctions they enable people to obey.

Similarly, wood products may carry labels that rainforests were not denuded; tuna products may carry labels that dolphins were not netted; carpet products may carry labels that child labor was not employed. Consuming products whose manufacture may have damaged rainforests, killed dolphins, or employed children is not dangerous to the consumer. Governments that permit these sorts of labels, even governments that police their integrity or indeed require their presence, are not necessarily claiming that consumption poses a hazard to the consumer. They are not even claiming that damaging rainforests, killing dolphins, or employing children is a social evil. (A government that considered these activities evil would presumably wish to outlaw the products involved, rather than merely requiring their manufacturers to disclose the facts.) Governments that permit, police, or require labels are claiming only that some consumers believe there are hazards or social evils involved and therefore want to be able to avoid the associated products, and that enabling them to do so by providing accurate information is a social good.

Labels concerning whether foods are "vegetarian" or "organic" are also instructive examples. Many governments set standards for what foods can claim these attributes, and police the labels accordingly. They do so without endorsing -- and without giving the impression of endorsing -- the view that vegetarian or organic foods are necessarily healthier to eat. In many cases, in fact, the standards go beyond the health claims of even the most devoted advocates. In some jurisdictions, for example, food with very small amounts of animal content cannot be

labeled "vegetarian." Even vegetarians do not argue that consuming small amounts of animal content threatens their health. They wish to avoid doing so for other reasons -- sometimes religious, sometimes ideological, sometimes viscerally emotional. They rely on the government to police the label without for a moment inferring that the government endorses the preference.

In each case, if public concern is so high that accurate labeling damages the sales of some products, so be it. Democracies give people the true information they need to act on their own values, including their own risk concerns.

But labeling isn't just the right thing to do. It is also a way to reduce people's concern. That's why it is on my list of appropriate hazard-related responses to outrage.

Some years ago I worked on the labeling issue with a lawn pesticide industry client. Some jurisdictions were requiring applicators to post signs, so passers-by could (if they chose) avoid walking on or near lawns to which pesticides had recently been applied. Some applicators were even posting such signs voluntarily, often at the behest of their customers, who were seeking an amicable compromise with pesticide-avoiding neighbors. It turned out that the signs were a win-win. Fearful or vulnerable people -- those who had or thought they had or thought they might have an adverse reaction to recently applied pesticides -- could heed the signs and walk elsewhere. Others read the signs and chose to ignore them. The applicator and the customer continued to apply pesticides, but not secretly. Industry fears that the signs would exacerbate people's concern proved unfounded. They enabled people to act on their concern, and thus they reduced it.

The lawn pesticide industry nonetheless opposed signposting, and especially mandatory sign-posting. Industry lobbyists argued that the signs implied risk, and thus unfairly and inappropriately raised concern. As far as I know this is still their position -- and it is still, in my judgment, an unwise position.

The relationship between labeling and outrage is admittedly a complex one. We know that mandatory labeling usually leads to "voluntary" reductions in whatever has to be on the label. This has been the nearly universal experience of labeling, from toxic ingredients in consumer products to fat and carbohydrates in foods, from smokestack emissions to worst-case accident scenarios. For those who believe the hazard noted in the label is serious, these reductions represent a real improvement. Whether the reductions lead to a parallel reduction in concern is, of course, the preoccupation of the main essay; in many cases, I believe, the answer is no. But the labels themselves almost certainly lead to reduced concern, because they give people information they want and information they can use to take action they believe to be self-protective.

In other words, labels have at least two outrage-relevant impacts. Their direct impact is to facilitate individual precaution-taking (avoiding the labeled hazard), which tends to reduce outrage. Their indirect impact is to facilitate increased pressure for societal precaution-taking (reducing the labeled hazard); this probably does not reduce outrage, and may even increase it. On balance, requiring companies to give appropriate information about unlikely but possible hazards probably does more good than harm, whereas requiring companies not to do the conceivably risky thing in the first place probably does more harm than good. As a hazard-related response to outrage, government labeling requirements aren't perfect, but they are surely better than government precautions.

For the mobile telephone industry, a label-friendly policy would mean putting radiofrequency (RF) information on the outside of telephone packaging instead of inside -- so consumers who wished to do so could use RF as a purchase criterion. I understand that the data relating RF to hazard are scanty; I understand that even if mobile telephone EMFs turn out to be hazardous, it's anyone's guess which RF levels will be most hazardous. I understand, in short, the case that this information is useless, that anyone who tries to use it is by definition being misled. Despite all of this, I believe that people are entitled to have this information if they want it -- and to have it easily, not after the purchase is a done deal and not by searching a website. More importantly, I believe that giving them this information will diminish concern, not increase it, both because it demonstrates the industry's candor and responsiveness and because it enables

concerned people to exercise control. I would have no quarrel, therefore, with a government requirement for RF packaging labeling. Such a requirement would be an appropriately precautionary hazard-related response to outrage.

In most countries the main source of mobile telephone controversy (though not of EMF exposures) is the tower, not the phone. So if labeling can help reduce outrage, then tower "labeling" is more important than handset labeling. I would therefore support efforts to make sure people are told when a tower is proposed for their neighborhood. Forewarning gives people a chance to oppose the siting; if their opposition fails, it gives them a chance to consider moving. Similarly, people who are looking at neighborhoods should be able to find out, easily, where the towers are, so they can make a housing choice with this factor in mind. Information about a tower's maximum power, average power, and the like is similarly helpful, notwithstanding the absence of data relating these factors to potential health hazard. Information about tower emissions reaching a particular location (my bedroom, my child's school, whatever) is better still -- again despite the absence of data on the health implications of a particular field strength. Industry policies that encourage this sort of tower "labeling" voluntarily are fine. In my judgment, so are regulations that require it.

The case for tower labeling is admittedly weaker than the case for handset labeling (even though the outrage and thus the need is greater). Since it is much harder for the individual to control the outcome, labeling will yield more frustration and less outrage reduction in the case of the towers than in the case of the handsets. The individual who is concerned about mobile phone EMFs but nonetheless wishes the benefits of mobile phone ownership can rely on labels to choose a telephone that seems likeliest to minimize the hazard. The individual who is similarly concerned about tower EMFs can rely on "labels" to help characterize the hazard, but may discover that there is little he or she can do to minimize it effectively. Nonetheless, people should be entitled to know where the towers are or will be, and what sorts of EMFs the towers are producing. Over the long haul, I believe, granting them this right will reduce their outrage more than rubbing their noses in a tower they can't stop or easily evade will increase their outrage.

The prior outrage management experience of the electric power transmission industry is particularly relevant here. In the 1980s and 1990s, controversies over the health impact of transmission line EMFs were commonplace in the U.S. and many other countries. A number of my clients adopted a policy of offering to visit the home of any concerned customer with a Gaussmeter, in order to be able to provide customer-specific data on the effects of the transmission line (and of various home appliances as well) -- not data on health effects, of course, but data on physical effects, on delivered field strength. Almost invariably, the experience of walking around the house or apartment with a utility engineer and a Gaussmeter was a reassuring one for the customer, independent of the numbers.

Finally, note the distinction between labels and consultation -- and the relationship between labels and consultation. Consultation is a powerful tool of power-sharing and accountability, and therefore of outrage reduction. Although hazard issues obviously predominate in most consultations, the benefits of consulting do not result chiefly from the transmission of hazard information. Outrage is reduced when people have a voice, period. Labeling, on the other hand, is giving people the hazard-related information they need to act on their own risk beliefs. Consultation is impossible without labeling; people can't participate in the tower siting decision if they don't know the decision is pending. Labeling is possible without consultation -- you can tell people what you're doing without asking for their input.

But of course labeling increases the demand for consultation, so in practice the two tend to go hand-in-hand. In fact, the two supportable positions on this issue are the candid position (tell people what you're proposing and pay attention to their input) and the secret position (tell people as little as you can so they won't have any input until it's too late). The second strategy works quite well in the short term, until it backfires badly. The first is the long-term strategy for building support and managing outrage.

The above discussion of labeling provoked an interesting dialogue with my clients at Vodafone, who as predicted were unenthusiastic about mandatory labeling, and especially mandatory

"labeling" of towers. (Vodafone does not manufacture handsets, and it does voluntarily provide considerable tower information.) Among the issues they raised were these:

- Concern that it is far from clear what characteristics of mobile phones and towers to label. In the case of phones, for example, labeling proponents usually want to identify the peak emission of the handset. But actual handset emissions vary with distance from the nearest available tower. A handset with a higher peak emission, therefore, only operates at its peak when it is far from any tower -- so far that a handset with a lower peak emission would be unable to complete the call. At a distance within the capability of both handsets, both emit at the same level.

The problem of figuring out what to measure is real, but hardly unique to mobile telecommunications. In the U.S., for example, hospitals and surgeons have objected to "labeling" their success rates at various procedures by pointing out that such labels penalize those who take on more difficult cases. Food manufacturers have pointed out that fat content labels ignore distinctions among kinds of fats with radically different risk profiles; the solution was to specify several different fat levels, and more recently the debate has refocused on the different kinds of carbohydrates. I concede that it is easier to figure out what to measure when a real hazard has been identified; you measure whatever correlates well with the hazard. When the hazard is only hypothetical, you need to measure what somebody believes might be correlated with it. Still, uncertainty about the value of information is not a good reason for withholding it from people who believe it to be valuable. Companies should of course be free to provide additional information -- including information about why they consider some data to be valueless or potentially misleading. The solution to misleading information, in short, is more information.

- Concern that an accurate tower "label" might need to be complex and highly technical, and that this sort of information might tend to provoke even more outrage from citizens unable to comprehend the complexities and suspecting that they are just an industry smokescreen.

I think there is some basis for this concern; people do become suspicious when explanations get hyper-technical. This should constitute a valuable incentive for companies to work at making the information clear. It is also a good reason to provide the requisite information at several different levels of complexity. What works best is if citizens can start with something general and reader-friendly, then slowly work their way as deeply into the technical details as they wish. The need to give people complex information is not an excuse for skipping the simple introduction; the need to give people a simple introduction is not an excuse for leaving out the complexities. And once you are committed to providing both, it will quickly become apparent that the simple introduction must still seem balanced and fair even after the complexities have been mastered.

- Concern that labels reflecting the extent and range of emissions are more difficult and less outrage-reducing than labels that are binary (the undesired ingredient is present or absent).

Again, there is truth here. The research is clear that people value risk elimination enormously more than risk reduction. But many effective labels are not binary -- consider food labels, which show how many grams of fat, how many calories, etc. I do share with my client a mistrust of qualitative categories: "low-fat" and "low-calorie" are slippery concepts, easily abused. I'd much prefer labels with numbers to any effort to define what "high," "medium," and "low" EMF emissions levels are. The solution for GM foods has been to define as "GM-free" a specified, very low level of GM content. The rationale for this was that most products cannot be guaranteed not to have a stray molecule or two of GM content, but those that come close should be allowed to ignore the tiny, theoretical contamination. This is a little unfair to the GM industry, I think, because it turns a real quantitative difference into a false dichotomy. Again, I'd prefer making everybody label the maximum percentage of GM ingredients to be found in the product. Let people get used to the reality that zeros are hard to come by, but the choice between big numbers and small numbers is theirs to make. Of course there isn't any convincing evidence that lower levels of GM content or of EMF emissions are less hazardous than higher levels. But some people believe this may be the case. That's why

regulating the label is good public policy and good outrage management, while regulating GM content or EMF emissions is not.

- Concern that required labeling of mobile phones and towers is unfair unless other EMF sources -- cordless telephones, radios, televisions, vacuum cleaners, etc. -- are similarly labeled. Beyond unfairness, mightn't this one-sided labeling be misleading to the public, encouraging them to see risk in some venues but not in others?

I don't see the issue here. Governments should require labels in two situations: when people can use the information to take effective action, even if they don't especially want to be told; and when people want the information, even if it isn't clear that it is actually useful. EMFs from mobile telephones and towers apparently meet the second criterion, though probably not the first; at the moment, EMFs from vacuum cleaners meet neither. (If there isn't much demand for mobile phone and tower labeling either, then I wouldn't bother doing it.) Of course there is -- or at least there should be -- nothing to stop a mobile telecommunications company from providing comparative EMF information, so long as it is accurate: "Here are the emissions data for our phone, and here for comparison are average emissions of some other appliances." Risk communicators have long debated the pros and cons of comparative risk information. Does telling people that your product contains less GM content or emits less EMF than someone else's product do you good in the marketplace? Or does it damage both products by making the issue more salient and thus arousing more concern across the board? Opinions differ. But you're certainly entitled to try it if you think it will do you more good than harm.

- Concern that mandatory labels may imply that the government considers the information useful, which in turn implies that the government considers the hazard significant.

Fair enough. I said earlier that governments can require labels on grounds that the public wants to know, without necessarily endorsing that the information is important. This is certainly true sometimes; government policing of kosher and halal labels don't imply government endorsement of Jewish and Muslim dietary laws. But it remains true some that people may tend to see a labeling requirement as evidence of a serious hazard. It is profoundly unlikely that a label is capable of arousing concern in those who are otherwise unconcerned. (If only it were that easy to overcome apathy!) But a label, especially a mandatory label, might tend to confirm the concern of some who are already concerned. The solution here, I think, is for the government to be explicit about its reasons for requiring the label. (This is only a partial solution, of course.) "We know that many people are worried about X," a government can say, "even though there is no convincing scientific evidence at this time that X is a serious hazard. We believe that people are entitled to make their own judgments about their exposure to X. So we are requiring labels." Whether X is GM foods or mobile phone EMFs, this is a credible and respectful position for a government to take. Technically unnecessary labels need not backfire the way I believe technically unnecessary precautions do. "We are protecting you even though there is no risk" tends to sound patronizing or self-contradictory. "We are informing you so you can make your own decisions" sounds fine.

It is comparatively easy to build a case for mandatory labeling when the hazard is known to be serious, or even when there is very little research and the hazard is genuinely unknown. But if you're confident the hazard is trivial, why require labels to inform people who believe it is not? I have two answers to this question -- the empirical claim that labeling tends to reduce outrage, and the value judgment that people are entitled to accurate information even if they plan to use it in ways you consider unwarranted. My client questions the truth of the first and the wisdom of the second.