PUBLIC FEAR OF NUCLEAR TECHNOLOGY

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ABSTRACT

Excessive fear of nuclear technology (EFONT) is estimated to affect from 35-50 percent of the U.S. public. EFONT is defined as an unpleasant state of fear with components of stress and anxiety, threat to security, and anger. The cognitive aspect of EFONT involves perception of risks, beliefs, and values which reinforce and perpetuate the fear. EFONT can be reduced through communications and outreach programs by providing basic information, encouraging participation, and targeting misinformation. Risks need to be put in perspective and benefits made explicit. Safety messages should be combined with other information. Understanding and patience are indispensable in dealing with those who are afraid.

INTRODUCTION

Public fear of nuclear power plants and radioactive waste disposal has received much attention as an element in the societal controversy over nuclear power.(1,2) Fear of nuclear technology is taken for granted in media accounts of antinuclear protests and is a frequent theme of antinuclear communications, both print and audiovisual. Even nuclear technologists speak of public fears and possible "nuclear phobias."

Yet, the topic of fear of nuclear technology has not been carefully evaluated in light of clinical and survey evidence that may help to explain it. This paper has two objectives: (1) to analyze the role of fear in attitudes about nuclear technology and (2) to determine what communicators can do to reduce fear so the public can play a responsible and well informed role in decisions about nuclear technology.

Definition of Fear

Fear is an emotion or affective reaction experienced when one encounters an immediate threat to well being. A fear reaction is marked by physiological responses. An immediate threat to one's life causes pupils to dilate, the mouth to dry up, sweating to occur, adrenalin to surge, and heart rate and blood pressure to rise. The body prepares itself to fight or flee. The fear reaction is the affective correlate of these profound physical changes occurring in response to a severe threat.

Most of us have felt the intense rush of adrenalin that accompanies fear, perhaps recognizing it only in the aftermath of a near accident in an automobile, an encounter with a vicious dog, or with an out-of-control person. The fear reaction serves as a powerful and unpleasant emotional signal that genuine threat exists.

Fear reactions occur in a range of intensity, based on how serious and immediate we perceive the threat to be. A small barking dog can prevent us from entering a friend's yard, but a raging elephant will cause us to run for our lives. Since we rarely encounter raging elephants, most situations causing fear responses in adults in our society are mediated by our social learning experience. Most often our social learning of fear operates vicariously (i.e., fearing sharks after seeing Jaws) or by observing and modeling the behavior of others. The first-time air traveler may be quite afraid but boards the plane and sits quietly as others are doing.

The point is, we experience fear in varying degrees of intensity. The intensity is shaped by our perception of precipitating events and by our expectations about the hazards we face and our ability to cope with them. Fear behavior is frequently learned from those around us.

Fear and Its Companions: Stress and Anxiety, Threat to Security, and Anger

Stress and anxiety are less clearly defined than fear resulting from life-threatening events, but they can be accompanied by some of the same unpleasant physiological and emotional responses as fear. The general arousal experience of stress and the anxiety that results from stress can be associated with a wide array of objects and situations. For instance, the organic food craze likely involves general anxiety over the possible health consequences of chemicals in food. Stress can become associated with whole areas of one's life, such as job or school. Moreover, anxiety can become generalized to the point where the precipitating objects or situations are no longer distinct. Many have pointed to the associations of nuclear technology with "the bomb."(3) Anxiety over nuclear weapons can spread to nuclear power, radioactive waste disposal and even food irradiation.

Anxiety over a job situation can lead to fight (aggressive striving to improve or change the situation) or flight (withdrawal from active involvement, or quitting). Anxiety led some residents near Three Mile Island to fight the restart of the undamaged unit, while others moved away.

Stress can also block or freeze behavior, leaving one passive, helpless and fatalistic. In the 1960s when concern about nuclear war peaked, some were digging shelters in their backyards while others, equally concerned, simply wanted to forget about the whole thing. Similar stress reactions have been documented among residents after the Three Mile Island accident. (4,5)

Furthermore, it is important to point out that anxiety over uncertain or unclear situations can cause the same reaction as a clearly identified threatening object. Not knowing what you might be up against is often as intimidating as knowing. In fact, once the unknowns in a situation are revealed, they often turn out to be less threatening than imagined. This pessimism about the unknown is probably a primative survival mechanism.

Threat to security is another aspect of fear. Obviously, a life-threatening situation threatens security, but much more common is threat to one's holdings, position, or opportunity to earn a living. It is also clear that one can feel threatened, anxious, and fearful for one's family, associates, or social group. A threat to others with whom one is identified has much the same effect as a threat to one's self. Survey data(6,7,8) collected during Spring 1986 show that about 65 percent of Americans opposed building more nuclear power plants. Yet other survey data show only one American in five(9,10) feels personally threatened by nuclear power plants. For many, opposition to nuclear technology is apparently altruistic. "I'm not threatened, but others are."

Finally, anger is a frequent aspect of fear. Anger can accompany both fight and flight. A perceived threat to security or a blocking of the path to desired objectives causes frustration and anger. Anger is an aggressive, emotional response generally directed toward the threatening object or situation. Social forces usually curb the individual expression of anger. At a social level, anger may be expressed through participation in groups with a cause, litigation, demonstrations and picketing, or through civil disobedience. Anger is important to the nuclear controversy because of its motivational properties. The objects of the anger--the government, nuclear industry, nuclear technologists, etc.--will be blamed and mistrusted.

To summarize, threatening events can be specific, generalized, or characterized by uncertainty. They can present a threat to life, a less severe threat to safety or health, or a threat to one's own or others' security. Responses range from gut-wrenching fear to mild stress and generalized anxiety. Physiological arousal, sometimes including anger, is part of the experience of both fear and anxiety. Fear- or anxiety-motivated behavior can take the form of fight, flight, or immobility.

Phobias: Another Shade of Fear

Phobic(11) responses are also fear reactions, in fact, intense fear responses to a perceived threat. However, unlike the preceding fear reactions we have been discussing, the phobic individual understands at an intellectual level that his/her response is without basis in reality or out of proportion to whatever risk may be present. That is, in spite of a cognitive awareness that an object or situation does not represent a life threat, a fear reaction is experienced and the physiological responses are activated independent of what one knows to be the true state of things. As we will show in a later section, phobia does not seem to be a very accurate or helpful description of the reaction of most of the antinuclear public. These other emotional reactions--fear, stress, anxiety, anger, and perceived threat--lend themselves more readily to an understanding of the public's negative response to nuclear technology.

Negative Public Response to Nuclear Power

Unfortunately, all the terms we can think of to describe the complex emotional response some people have to nuclear technology are loaded with existing meanings. Therefore, we will simply define a new term, "excessive fear of nuclear technology" (EFONT). It is important here to distinguish between the knowledgeable and healthy respect for radiation that characterizes the behavior of most nuclear engineers and radiation biologists, from the excessive fear we are discussing. Similarly, the herpetologist retains a healthy respect for poisonous snakes, which is quite different from the fear of all snakes that many people display.

Four related components appear to be involved in excessive fear of nuclear technology (EFONT): fear, stress and anxiety, threat to security, and anger. A person with a high level of EFONT is likely to be quite emotionally aroused, perhaps to the point where many stimuli cue reactions associated with the threat of nuclear technology. They may have strong and quite unpleasant emotional associations with considerable physiological involvement. Strong feelings of anger and threat to security are characteristic. Such a person with high EFONT is likely to be active in organizations opposing nuclear power (as well as involved in other nuclear issues like nuclear weapons and nuclear waste disposal). Heated and angry discussion of nuclear topics may be frequent and such topics in media presentations will easily capture their attention. In general, these persons with high EFONT treat the opposition to nuclear technology as a "cause," and supporters of nuclear technology as enemies. High EFONT may or may not be related to other causes or strong belief systems such as environmentalism, liberalism, or pacifism.

Persons with less severe EFONT are likely to be much less actively involved in nuclear issues. For

them, nuclear issues are less salient. They may sympathize and agree when negative attitudes about nuclear power are expressed, but they are unlikely to be sufficiently motivated to join an antinuclear organization or work in an antinuclear political campaign.

Nuclear topics in the media will get their attention part of the time, especially if they appear dramatic, but they are unlikely to seek out antinuclear materials as do individuals with high EFONT. As previously discussed, some may simply withdraw from the issue. Survey data(12) show that up to forty percent of the public will respond, "it doesn't make much difference to me one way or another" if the structure of the survey question presents this as a legitimate response. Unfortunately, most nuclear survey questions force one to "approve" or "disapprove." High EFONT persons also have a much higher need to buttress their strong negative opinions with information consonant with their belief structure. (We will say more about this later.)

Individuals can fall anywhere between these extremes on the EFONT continuum. Our current estimate is that perhaps 35-50 percent of the U.S. public shows some excessive fear of nuclear technology. DuPont (13) developed a 16-question inventory of fear and found that 25-40 percent of his respondents were fearful of nuclear power to varying degrees. Moreover, 79 percent described themselves as "somewhat" or "very" afraid about "radioactive wastes and their potential to contaminate the soil and water."

Cambridge Reports(14) presented to a national sample in May 1983 several "proposals for meeting the future electric energy needs of America." One of these was "Building more nuclear power plants for electricity generation." The responses were as follows:

	Percent	
strongly oppose	30	antinuclear (56%)
oppose	26	
favor	21	pronuclear (35%)
strongly favor	14	
don't know	10	

Most of the 56 percent antinuclear respondents probably show some EFONT, although there are probably some in this group who oppose nuclear construction for reasons largely independent of any negative emotional associations with the technology. For instance, they may believe that there will be no future increase in energy need, that nuclear power is too costly, or that other technologies are readily available to meet energy needs. It should also be noted that some people with low to moderate EFONT probably support nuclear technology development despite their concerns, just as many of us continue to fly, drive and ski despite some fear of the dangers involved. Fearing nuclear technology and opposing its development are not always related, just as accepting nuclear technology and favoring its development are not one in the same. Some of the more interesting survey findings to emerge from the post-Three Mile Island period are the reluctance of most Americans to shut down nuclear power despite considerable concern for its safety,(15,16) and also the belief by a majority that nuclear power will play a vastly increased role in providing electricity in the future, especially after the year 2000. (17,18)

Surveys have generally shown that attitudes toward nuclear power plant construction in general are more positive than toward nuclear power plant construction in one's local area.(19) By the same token, nearly everyone acknowledges that radioactive waste should be disposed of somewhere (but not in their area). This difference may indicate that a substantial number of people don't experience much EFONT at present (i.e., are not emotionally involved), but stronger EFONT may develop in conjunction with a siting action or other event which makes the technology more personally relevant.

No doubt the four components of EFONT--fear, stress and anxiety, threat to security, and anger--vary from person to person at any given level of EFONT. The high EFONT person most likely has more fear (physiological arousal) and anger (aggression) in the EFONT mix. The low EFONT person experiences anxiety and mild threat to security.

Cognitive Counterpart of Excessive Fear of Nuclear Technology

Strong emotions in the absence of recognizable cause signal emotional disorder. Phobic reactions are such disorders; the phobic "knows" the object of the phobia presents no severe threat. It is on these grounds that we believe few antinuclear persons are phobic in the clinical sense. Almost without exception high EFONT persons justify their emotional response to nuclear technology as appropriate, based on their beliefs about nuclear technology. In other words, they have cognitive support for their emotional reactions. The phobic does not. In fact, the phobic may often feel distress or embarrassment regarding his condition because (a) avoidance of the phobic stimulus is inconvenient or impossible; (b) he feels foolish because of an awareness of the non-real aspect of his reaction.

In contrast to the phobic reaction, high EFONT persons do not seek to correct their condition. In fact, they may try to recruit others to it and appear, for the most part, to believe that the threat presented by nuclear technology fully justifies their strong emotional response to it.

Our main point here is that cognitive experience is generally consonant with emotional response. We have mentioned the exception of phobias. Another case is where a behavior is out of phase with one's beliefs, e.g., when a person is afraid to speak up in business meetings even though he knows he has a contribution to make. The incompatibility between behavior-belief is referred to as "cognitive dissonance;"(20) it is an uncomfortable, uneasy, and unsettling condition that results in motivation to bring cognitions and behavior into consonance. This presents the opportunity of providing reassuring information to those fearful of nuclear technology. If appropriately done the fear response can be reduced.(21)

The cognitive counterpart to EFONT is a set of beliefs and expectations called the "cognitive set" that match and justify the emotional response. Several findings from nuclear attitude surveys are germane.

- Members of antinuclear environmentalist groups have more correct information about nuclear technology but also harbor more incorrect information or misconceptions than the general public. (22)

Most antinuclear activists probably have medium to high EFONT and the cognitive set to support it. Although a good portion of their information may be incorrect, it both supports their position and insulates them from information that does not support their fears. A prime mechanism for such insulation is to treat as non-credible any information that is sharply discrepant with current beliefs. Another way is to misperceive or actually alter information to fit one's beliefs.

- In general, people are not very definitive or articulate in describing why they oppose nuclear power.(23)

A frequent response is "it's dangerous" (without indicating why), or "it's radioactive". However, when presented with a list of possible concerns, e.g., plant safety, waste disposal, reliability, etc., they check several as being of significant concern. It seems clear that much of the public has moderate levels of EFONT and relatively few beliefs and expectations about nuclear technology. They appear to lack the motivation to aggressively seek information, but may not be strongly resistant to new information. However, they are more receptive to negative information than positive information. It will be somewhat difficult to get their attention since nuclear power is not a highly important issue to them. However, radioactive waste has steadily increased as a nuclear issue.

- A very large fraction of the public is opposed to more nuclear construction pending further study, research, and regulation.(24)

This finding supports the contention that moderate EFONT is accompanied by a vague and general cognitive set. The tendency to "wait for further study" became very strong after TMI; at the same time, only 15 percent of the public favored final shutdown of nuclear plants and abandonment of nuclear power as an energy technology.

Recall the earlier point that uncertainty can block approach just as fear does. Thus, the moderately antinuclear individual with moderate EFONT doesn't know a great deal about the technology, is more ready to believe negative than positive things about it, is not strongly motivated to get involved or seek information, but doesn't want to take any chances with either going ahead or closing it down in the face of inadequate information. Besides, unless the penalties of delay are clearly spelled out, there is no reason not to wait and see.

Social Values and Excessive Fear of Nuclear Technology

Values(25) are stable, long-term orientations toward broad personal/social goals. Formed early in life, they evolve slowly in response to life experiences, but rarely change very much or very quickly. Values form a basis for judging things right or wrong, good or evil, appropriate or inappropriate. Values thus become built-in standards that guide behavior and influence the evaluations we make of social behavior, political events, economic issues, and even developments in technology.

Values contribute to excessive fear of nuclear technology in at least two ways. First, people judge nuclear issues in part according to their compatibility with values that are important to them. Values are central to the cognitive system; they form a standard against which information is weighed when it is considered for incorporation into a person's set of cognitions.(26) If nuclear technology is perceived as supporting the attainment of important values, it will tend to be favored.

Second, if nuclear technology is perceived as a threat or block to the attainment of important values, it is experienced as an assault, an attack on one's sense of self. Reaction to the value threat is likely to include emotional expressions of anger, anxiety, and a sense of threat to security, all of which contribute to EFONT. Even encountering someone with sharply different values can be unsettling. For example, to the person who holds "national security" paramount, the person placing higher value on "a world of peace and beauty" may seem misguided or even dangerous. Survey results(27) show the former value to be characteristic of nuclear engineers, the latter of environmentalists.

Public survey results affirm these preceding two points that if nuclear power is seen as supporting one's values it will be favored, and if it's seen as blocking important values it will be opposed. A nuclear attitude questionnaire(28) split a 1978 sample from Washington State into pronuclear, neutral, and antinuclear subsamples. Both pronuclear and antinuclear subsamples listed the same top three values--family security, freedom, and a world at peace--from a standard list of 18. Respondents were also asked to list (a) values they thought nuclear power helped them to attain, and (b) values they thought nuclear power kept them from attaining. The results were clear-cut. Pronuclear respondents were three times more likely to list these top three values as more attainable with nuclear power development, than were antinuclear respondents. By contrast, antinuclear respondents were six times more likely than pronuclear respondents to say that nuclear power development would block attainment of family security, freedom and a world at peace.

The antinuclear subsample, as well as an environmentalist subsample, in this same study showed that the very nature of nuclear technology was seen as a threat to important values.

To the antinuclear and environmentalist subsamples in this study, nuclear waste was seen as "one of the most serious threats facing the world." These subsamples also did not believe that technology could solve remaining nuclear safety problems. Clearly many were quite fearful.

The objective of the nuclear technology communicator in dealing with this situation is not to change values but to provide information that shows how nuclear technology will help attain important values. This is the same challenge faced by any technology or product in our society.

Risk Perception and Excessive Fear of Nuclear Technology

Obviously, most people who see nuclear technology as a highly risky undertaking will not support it. It is also obvious that a feared technology is likely to be seen as risky. Yet, a closer examination of how risk perception is biased by fear may lead to a better understanding of how to approach this difficult situation.

In making risk judgments the human mind does not operate like a computer. A computer would "logically" multiply the probability of occurrence of an event by the magnitude of its consequences to yield an expected utility. For instance, the Washington State Lottery

gives odds of about 3,500,000 to 1 of winning $1,000,000 on a $2 wager. The expected utility for each dollar wagered is thus about 14¢. The lottery does well despite this questionable investment risk.

Three characteristic biases operate to affect our judgments about risk: event recall, probability distortion and persistence of belief.(29) The first bias operates to make events that are easy to recall seem more frequent. The accident at Three Mile Island is rare but memorable; so is winning the lottery. To people already fearful of nuclear technology, any event however insignificant in its consequences will make the threat more salient, easier to recall, and thus seem more likely to occur.

"Probability distortion" occurs because uncertain events tend to be put in two categories: "likely" or "unlikely." For those fearful of nuclear technology bad outcomes are viewed as quite likely to occur. Thus, a national poll(30)taken several weeks after the Chernobyl accident showed that 92 percent had heard or read of the accident and 70 percent of that group thought it "somewhat likely" or "very likely" that such an accident could happen in the United States. Similarly, national polls(31)taken shortly after the Three Mile Island accident showed that 96 percent knew about the event. Moreover, 69 percent of the antinuclear respondents believed that more accidents were likely, against only 35 percent of pronuclear respondents. Among pronuclear respondents, 52 percent felt TMI was a freak accident which would not be repeated.

Risk estimates are biased by "persistence of beliefs" because risk perception is a cognitive process that involves assessment of the magnitude of the hazard and a judgment of the probability that it will affect one. The psychological process of judging risk is a subjective one, particularly when reliable information about the hazard is not easily accessible to the individual. This is clearly the case with nuclear power, a complex technology about which the general level of public knowledge is low.(32,33)

We tend to structure the way new evidence is received, making it consistent with beliefs that we already hold. Evidence contrary to our beliefs is seen as unrepresentative, unreliable, or erroneous.(34) Consequently, beliefs change slowly, making it difficult to reconcile divergent opinions. An example of this phenomenon is the interpretation of the Three Mile Island accident by some as proving that reactors are unsafe, and by others as proving that multiple safety and containment systems are effective. Nelkin(35)has also shown that technical debates can highlight areas of ambiguity and tend to be interpreted by the public as support for pre-existing issue positions. Since fear heightens attention to the feared object and tends to freeze behavior, excessive fear of nuclear technology would tend to exacerbate the biases we have just described.

In addition to these biasing effects on probability estimates, risk perceptions are also affected by the qualitative elements of the risk itself. A number of different dimensions have been proposed by various investigators looking at a variety of potential hazards.

Slovic and his co-workers(36,37)have proposed three broad categories or dimensions on which risks are evaluated: dread, familiarity, and exposure. The "dread" category involves (a) the extent to which an event can be controlled, (b) a gut reaction versus a risk that can be lived with and thought about reasonably calmly, (c) the likelihood that its consequences will be fatal, and (d) the degree to which the risk is faced voluntarily. Survey data show nuclear weapons and nerve gas are highly "dreaded."

"Familiarity" with a risk refers to whether or not a risk (a) is observable, (b) is known (or unknown) to those exposed, (c) has immediate rather than delayed effects, and (d) is known to science. Risk events typically seen as unfamiliar are solar electric power and DNA research, whereas handguns and motor vehicles are seen as familiar risks. Finally, "exposure" refers to how many people are exposed to a risk. Alcoholic beverages and caffeine have high exposure, while solar electricity and space exploration have low exposure. This last factor also might be seen as another aspect of familiarity.

Fishhoff et al.,(38) found that many people rate nuclear power (along with crime, nerve gas, warfare, and terrorism) high on the "dread" dimension. These other activities, however, were not seen to be as new or unfamiliar as nuclear power. A major factor in triggering EFONT is the dreaded nature of nuclear technology. This dread and unfamiliarity is a frightening combination: science fiction writers and horror movie producers have often exploited the theme of a powerful, unknown, evil force. This theme is a touchstone of much of the popularized antinuclear literature in circulation.

To conclude, risk judgments are likely to involve inherent simplifying biases and dimensions of risk that rely on feeling (dread), information (familiarity), and a sense of who and how many will be affected (exposure). Furthermore, the human information processing system vis-à-vis risk is not very sophisticated, as evidenced by the characteristic biases involved in estimating risk probabilities. Perceptions many members of the public have about nuclear technology will undoubtedly trigger excessive fear. Yet risk perception is a cognitive process based on information. Quite clearly, not enough balanced information is reaching the public. This conclusion is confirmed by our past research on media treatment of nuclear issues.(39,40,41)

To summarize, the intent of our analysis thus far has been to develop a better understanding of individuals who have come to fear nuclear technology to a greater extent than their own personal experience or exposure to nuclear hazards would seem to warrant. Such excessive fear (EFONT) includes components of stress and anxiety, threat to security and anger. We estimate that perhaps 35-50 percent of the adult population of the United States experiences some degree of EFONT.

We have described the cognitive correlates of EFONT and the effects such excessive fear has on reception of new information. We have also shown how social values and EFONT are related. Finally, we have shown how risk perception and fear of nuclear technology interact.

Approaches to the Reduction of Excessive Fear of Nuclear Technology

It must be made clear before going further that there are no sure-fire, proven-effective, methods for speeding up the natural process by which society comes to lose its fear and suspicion of a new technology and accepts it as beneficial, or at least necessary. Automobiles, elevators and water fluoridation systems must prove themselves acceptably safe and superior to the alternatives. We also wish to define public acceptance

of nuclear technology, not as a condition where everyone "likes" it or sings its praises; but rather as a condition where nuclear development, including effective disposal of radioactive waste, is allowed to proceed to meet the broad needs of society. The analogy is only approximate, but consider airport security systems. No one particularly "likes" them, but they are broadly accepted as necessary.

We offer the following suggestions as guidance to communicators on behalf of nuclear technology who must somehow reach out effectively to those who are afraid.

1. Diagnose and partition your audience.

An early objective for the communications planner should be to develop methods for estimating the extent of EFONT among important audience segments. Objective, field tested methods are unfortunately not available, but the experienced communicator can make a useful estimate.

2. Allocate your resources.

People with very excessive fear are not likely to change as a result of public communications. Moderately excessive fears can probably be overcome given appropriate circumstances. DuPont,(42)for instance, has shown that fear of nuclear technology can be reduced when subjects in an experiment read a strongly reassuring pronuclear brochure. Such subjects showed considerable receptivity by agreeing to be subjects in such an experiment. They also showed tacit acceptance of the credibility of the communicator by reading the brochure. Strongly fearful people are not similarly accessible and cooperative in the usual field setting. Therefore, it is not productive to concentrate your efforts on the strongly fearful. Communications resources are better allocated when aimed at those with low to moderate EFONT.

3. Be responsive to those who show interest.

We have shown how fear can block approach to the feared situation, and how stress can lead to withdrawal and a desire to "forget the whole thing." Yet technology development activities, especially siting actions, are socially intrusive. They force involvement, and thus interest. Be ready to respond to these information needs when they occur.

4. Encourage active participation.

Bandura(43)has shown that perceived inefficacy in coping with potentially aversive events and situations gives rise to both fear and avoidance. Translation: if you don't think you can successfully cope with something you fear it and stay away from it. A primary rationale for providing information about nuclear technology is to enable the public to play an informed, responsible and effective role in the process of making decisions about technology deployment. Promoting public participation in siting, emergency response planning and regulatory development is based on sound psychological principles as well as *political* imperative. Such participation will lead over time to an improved base of public knowledge, a sense of being able to affect outcomes and reduced fear of the technology.

5. Provide basic descriptive information.

As we have shown, the nuclear technology communicator, faced with a fearful public, is hard pressed to devise approaches to the direct reduction of fear. Therapists employ a variety of approaches to reduce fear in their clients, but people with moderate to high levels of EFONT are not seeking to modify their beliefs.

Yet, the survey data show that many who exhibit negative nuclear attitudes show a striking lack of basic information. Their cognitive set, beliefs and expectations regarding nuclear technology, is small. The technology is a mystery, and the few things they "know" about the technology are negative. From their perspective fear is justified and avoidance is prudent.

This situation calls for basic descriptive information. Direct approaches to changing attitudes by describing the benefits to society that nuclear technology brings will be ineffective for many until the knowledge base--the cognitive set--is significantly enlarged.

For the most part, existing nuclear information programs, including those of the U.S. Department of Energy, are on the right track in their approach of providing basic descriptive information. However, much more must be done to improve the generally poor knowledge base of the great majority of the public.

6. Identify and target misinformation.

Obviously, a lot of wrong information gets tossed around on any controversial issue. Good judgment must be applied in how to counter it. Talk show veterans know how easy it is to be put on the defensive by outrageous charges. Also, approaches that imply your intellectual superiority and the others' ignorance will be angrily rejected as arrogant.

Recognizing these pitfalls, there are many opportunities to counter misinformation, for example, question and answer formats for communications materials. Knowing that many believe that high level radioactive waste is in liquid form,(44)questions in a brochure can pose this concern directly. A long recognized principle of persuasive communication is to clearly demonstrate your understanding of the views of the other. Recognizing the existence of misinformation and setting the record straight should be a (carefully considered) part of every communications program.

7. Put risks in perspective.

This advice is difficult to follow because the factors that govern comparative risk judgments are not completely understood. We have described previously the biasing effects of fear and some of the limitations of the risk judgment process.

However, some advice does seem warranted. For one thing don't "put down" others for their perceptions. Some technologists enjoy pointing out what seems to them like contradictions in risk behavior. For instance, pointing out that people drive cars and smoke cigarettes, while fearing air travel and shunning butter, probably wins few friends and influences fewer. Risk comparisons among alternative energy technologies are more appropriate. Another point: strictly speaking, people don't accept risks as such. They may accept a risk/benefit package and they may accept risk management. Less emphasis on the safety of the technology per se and more on the people who take responsibility for safely managing it would engender greater public confidence, and counter the fearful stereotype of a huge, complex, impersonal technology likely to lurch out of control.

8. Don't ignore benefits.

No risk, however small, will seem acceptable if it does not have compensating benefits. Those who see no benefit will feel threatened and angry. Communications professionals know this and do a good job on the whole of presenting benefits. For instance, the U.S. Committee for Energy Awareness wisely emphasizes the domestic availability of nuclear energy. By doing so they tap a widely held public value.

The benefits of radioactive waste disposal are more complicated to present, especially since the risks and benefits pose geographic inequities. (45,46) In other words, "They get the power and we get the shaft!" Mitigation of impacts and compensation are important to emphasize. While it is true that you can't, strictly speaking, "buy off" someone's fear, it is also true that we all expose ourselves to risk and overcome fear to engage in activities we feel hold important benefits for us. The communications professional needs to give this area careful thought.

9. Consider social values.

We have shown how a threat to one's values provokes anger and contributes to EFONT. This is an area where clear guidance is difficult, but the communications professional must carefully consider how information will fit into the value systems of the groups to be reached. Recognizing diversity of values is a start. Linking nuclear power development to economic growth will backfire with those who feel growth is not desirable.

Avoiding threats to values is another important objective. We have emphasized above the need to feature effective risk management as a means of remaining consonant with the high value placed on public health and safety.

10. Emphasize safety in combination with other aspects of the technology.

The automobile industry has learned that you can't sell cars on safety alone. While safety is a primary message that should have a role in nearly all communications relating to nuclear technology, it will often not be a successful message by itself. In fact, exclusive emphasis on safety can backfire by making event recall (of safety problems) more salient.

We recognize that this advice regarding safety emphasis borders on being contradictory. It points out the difficulty we face in responding to information needs without triggering even greater fear. It also emphasizes our point that there are no quick and easy ways to overcome EFONT. A communications program will need to be extensive and well rounded to be effective.

11. Recognize that some may give only grudging acceptance.

Clearly, not everyone will come to recognize nuclear technology as a beneficial thing. However, the survey data indicate that despite concerns many people feel nuclear power is a necessary energy supply technology and even that it is bound to develop further. Many purchase life insurance because it is seen as a necessary obligation. It is responsible to do so. Radioactive waste disposal is also necessary and a social responsibility.

The implications of this for nuclear communications involve both tone and substance. For many, the technology simply can't be "sold," but it may achieve grudging acceptance. The tone and substance of nuclear communications should reflect this reality.

12. Approach fear with understanding and patience.

Fear is stubborn and self perpetuating. It does not yield to ridicule and intolerance. Behavior modification, a primary therapeutic approach to the reduction of disabling fear, proceeds in small and gentle steps to associate the feared object or situation with reassuring positive images and behaviors which are incompatible with the fear response.

Once again, we are not dealing with a clinical disorder in the case of EFONT and we are not in a therapeutic situation. What we can do, however, is avoid blaming, putting down, or treating as stupid those who are fearful. Experienced communications professionals know the value of empathy, but may lose perspective out of frustration or simply by being pounded on too long by critics. In any case, leading critics are unlikely to be afraid of nuclear technology. They should not be confused with those who are fearful and whose fear may be reduced by providing information and reassurance.

The challenge of communicating effectively with those who are excessively fearful of nuclear technology is a difficult one. There are no easy solutions, and as Alvin Weinberg(47) has pointed out, it is more difficult to "unscare" than to "scare" the public. Yet there is no alternative to the acceptance of this challenge. Effective public involvement in technology policy decisions cannot be achieved if fear rules the day.

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