COMMUNICATING RISKS TO THE PUBLIC: PSYCHOLOGICAL DIMENSIONS OF RISK PERCEPTION AND ASSESSMENT

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ABSTRACT

This paper is an attempt to examine the nature and use of risk communication relevant to acceptance of nuclear power. Variables which affect the risk communication, such as personality traits and perceived safety and necessity, are also examined on the basis of some empirical studies conducted in Japan.

1. WHAT IS COMMUNICATION?

From mentalists to behaviorists, over the last half century, an intensive effort has been made to construct a general model of human behavior. Models which can explain human behavior have recently been constructed by a number of behaviorists. Among these are a variety of "cybernetic models" that variably take into account the communication and control aspects of human behavior. In the simplest terms, these models presuppose a series of psychological processes in which one individual's or organization's behavior, in the form of explicit "output" information produced by him or it, is dependent upon the "input" information that an individual or organization may receive from other people or organizations and from the environment. In order to examine their validity and discover their relevance to our problems, let us look briefly at a few of them.

As an initial point of reference, it is useful to keep H. D. Lasswell's classic formula in mind. The scientific study of communication, he says, involves discovering "Who Says What, In Which Channel, To Whom, With What Effect." [1] . There is another type of model, the "cybernetic" one, first introduced by C. E, Shannon and W. Weaver [2] for telephone communication and subsequently adjusted for human communication situations by C. E. Osgood.[3]

On the basis of the theory of these models, we now can make a more formal statement about the nature of human communication behavior. We can assume the existence of various psychological processes of *decoding* and *encoding* between input and output events. *Decoding* here refers to the way in which the individual human (or organization) receives input information from his environment---namely, the internal reaction caused by the input on the subject. *Encoding* designates those processes whereby individual human (or organization) chooses some response, in the form of output, to the environment surrounding and affecting him. What Psychologists term "mediation process" is thus considered as the bridge between decoding and encoding. Even in comparatively simple acts, such as making a speech, an individual's communicating behavior is complex, susceptible to many factors, and it is continuously renewing process whereby he is always adapting to his environment.

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[1] Lasswell, H.D.1948. "The Structure and Function of Communication in Society." p 37.

[2] Shannon, C. E. and Weaver, W. 1949. *The Mathematical Theory of Communication.*

[3] Osgood, C. E. 1963. "Psycholinguistics." p 247.

At this point the term *feedback* is also relevant. Dealing with the complex organization and the mechanisms of government, Karl Deutsch defines *feedback* as:

" a communication network that produces action in response to an input of information and includes the result of its own action in the new information by which it modifies its subsequent behavior."[4]

According to this view, the fundamental building block of the social system is the feedback "*loop*". By this feedback mechanism, individual humans (and organizations) can correct errors and adjust their behavior to the continuously renewing environment.

Furthermore, in view of the present state of communication technology, interpersonal interaction is no longer limited to a face-to-face situation. The whole or part of an encoded message may be quoted in a newspaper, or broadcast by radio and television, or uploaded via World Wide Web (WWW) on the INTERNET, for literally universal "mass consumption". It has indeed become possible for one to watch a real war via CNN. It has also become possible for one to learn about it by downloading the homepages of international news media. Then, as the feedback loops become more complex, the source will need more extended "scanning" devices to gather feedback information. He will continuously need to keep eye on the local and national news media and the homepages on the World Wide Web.

2. RISK ASSESSMENT AND RISK PERCEPTION

It can be generally stated that the risk assessment is:

" the characterization of potential adverse effect of exposure to hazards; (and) includes estimates of risk and of uncertainties in measurements, analytical techniques, and interpretive models. Quantitative risk assessment characterizes the risk in numerical representations." [5]

Probabilistic Risk Assessment (PRA) is an important tool with which one can estimate the degree of innate risk associated with natural, human and mechanical events. The risk probability may be calculated on the basis of the past statistics on the occurrence of the risk events, such as the fatalities caused by cancer in a given population. When such statistics are not available, sophisticated probabilistic estimation may be made. One example of this sort can be found in the *Reactor Safety Study* (WASH-1400) commissioned and published in 1974 by the U.S. Atomic Energy Commission. In this study, relative risk probabilities are calculated for 18 risk event categories, such as AUTOMOBILE and NUCLEAR REACTOR, and compared across them. The estimated risk associated with NUCLEAR REACTOR was the lowest (3×10^{-9}), while one associated with AUTOMOBILE was the highest (3×10^{-4}) of the 18 risk event categories.

After TMI and Chernobyl nuclear power plant accidents, however, probabilistic risk assessment seems to be losing ground to the increasing anxieties and fears of the lay public who began to "*feel*" what happened in TMI and Chernobyl might happen again at any nuclear power plant. Psychologically, these anxieties and fears are part of the innate *defense mechanism* by means of which people can discover the presence of serious risks in the environment surrounding them so that they can avoid these risks. Sociologically, these anxieties and fears are induced by the content (i.e., both the verbal and the non-verbal signs) of mass communication, particularly by television programs. These anxieties and fears in turn may drive people to act upon the environment surrounding them, which causes anxiety or fears. In order to reduce anxieties and fears, they must psychologically "deny" the present and future presence of a risk object, such as

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[4] Deautsch, K. W. 1963. *The Nevers of Government*. p 88.

[5] National Research Council. 1989. *Improving Risk Communication*. p 321.

NUCLEAR POWER PLANT, in localities near to them. Politically, they would oppose it by voting negatively at local and national elections or at a local referendum.

The most important of all, the lay public "*perceives*" the risk subjectively and act accordingly. Risk perception is subjective in that it is susceptible to variations in the past input information, group attribution, and the personality traits.[6]

Table 1 displays a clear contrast between the characteristics of the two systems of risk estimation --- one represented by "*objectiv*e" probabilistic risk assessment and another, by "subjective" risk perception. Judging the same risk object, such as NUCLEAR POWER PLANT (NPP), risk assessment and risk perception do reach entirely opposite conclusions. Whereas NPP was concluded as "the safest" (10^{-9}) in the Reactor Safety Study commissioned by the U.S. Atomic Energy Commission, as may as 53.3% of the lay Japanese, polled in 1990 by a Japanese government agency, rated NPP as being "not safe", and a great majority of 97.7% felt that NPP ACCIDENT is "scary."

Table 1 Objective Risk Assessment and Subjective Risk Perception

NPP SAFETY

Objective Risk Assessment[1]: $3\times l0^{-9}$ (WASH-1400)

Subjective Risk Perception[2]:

very safe	l.4	(%)	41.2	(%)
fairly safe	39.8			
not very safe	43.3		53.3	
not at all safe	l0.0			

NPP ACCIDENT

Objective Risk Assessment[1]: $3x10^{-9}$ (WASH-1400)

Subjective Risk Perception[2]:

very scary	66.9	(%)		
fairly safe	18.9		97.7	(%)
somewhat scary		11.9		
not scary				2.1

Source : 1. U.S. Atomic Energy Commission. 1974. *Reactor Safety Study* (WASH-1400).

2. Science and Technology Agency, Japanese Government. 1990. *Public Opinion Poll Regarding Nuclear Energy* .

Laypeople's fears of nuclear power plant accident and other nuclear-related hazards are not without ground. Table 2 lists the major sources of fears toward nuclear-related risk events. It appears clear that almost all the sources are related, directly or indirectly, to radiation hazards which could become a serious threat to the health and genetics, if its leak should get uncontrollable. It must be noted at this point that the public opinion toward nuclear-related objects stems from individuals' internal fears associated with various specific risk events, such as radiation. Subjective risk perception thus may be said to be totally irrelevant to objective risk estimation like PRA, which does not take into account the "learning" experience of

[6] Tanaka, Y. 1991. "Risk Perception: Analyzing Images and Fears." pp 213-225.

individuals. Although a modern democracy rests largely upon public opinion for its legitimacy and power. attitudes and opinions individual persons might have are formulated in the main by the past input information which is transmitted through a variety of information channels, such as formal education, interpersonal communication and mass media.

Table 2 People's Concerns About Nuclear Energy

Question: What makes you worry about Nucor energy? Choose as many as you want. (Only the top 5 are listed below.)

(1) Effects of radioactivity on body and off-springs	43 (%)
(2) Nuclear waste management and disposal	39
(3) Radioactive (radiation) leaks by accident	39
(4) Insufficient information about accidents and troubles	31
(5) Invisible radiation behavior	29

Source : Science and Technology Agency, Japanese Government.1990. *Public Opinion Poll Regarding Nuclear Energy.*

The occurrence of any nuclear-related risk event, therefore, forms input information to the individual receiver and changes the receiver's internal state accordingly. The receiver may no longer be regarded as having the same picture of the nuclear-related environment after he has received new information on an accident even if it is of a small scale, and act accordingly on the basis of that renewed perception.

It may be of interest to note that the most Japanese respondents in the national survey cited above appear to fear *radioactivity* as the major source of nuclear hazard and that as many as 40% answered that they are concerned about "*nuclear waste management and disposal*." It has long been known that high-level nuclear waste contains several nuclides whose half-life is extremely long---over 20,000 years in case of Plutonium, for example. Generally, the Japanese are made aware of the uncertain safety of high-level nuclear waste disposal. They feel that high-level nuclear waste disposal would become a serious threat both to the environment and to the human life in the long passage of time, because so many unknown and unpredictable factors are involved here. Furthermore, there is a cliche in Japanese which says "a mansion without a toilet," meaning that nuclear power has no outlet in the backend. People oppose nuclear power not only because they fear the occurrence of a second TMI and Chernobyl, but because they are concerned about the prolonged risk of radioactive waste which might continue to affect the safety of generations of their off-springs. Their opposition may be regarded as emotional, but it may also be taken as logical psychologically.

3. GROWING NEED FOR THE SCIENCE OF RISK COMMUNICATION

The term "risk communication" was first coined and used in the United States In the 1980's.[7] The need for "risk communication" has arisen from the very fact that our modern life is increasingly surrounded by such hazards as pollutants in the air and In drinking water; pesticide residues in food and milk; threats from radiation and toxic chemicals; or the global climatic anomalies, such as the greenhouse effect, acid rain or ozone hole. The risk communication is therefore considered as a rational step to enhance the accurate knowledge of these risks.

The gist of risk communication may be summarized as follows:

[7] E. g., National Research Council. 1989 . *Op. cit.*

(1) that It should convey the messages containing information, concerns, and opinions about risk;

(2) that it should involve the continuing feedback loops (dialogues) among the source and the receiver; and

(3) that it should be a process of purposive (or persuasive) communication, involving socio-cultural and psychological factors.

In brief, the risk communication may be characterized as: "an interactive process of exchange of information and opinions, among individuals, groups, and institutions, involving messages about the nature of risk or expressing concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management".[8] During the last decade, there was a sharp increase in the number of both theoretical and empirical studies on risk perception and communication, notably in the United States. The emergence of research on risk perception and communication itself may be taken as an indication of the mounting public awareness and concerns about various risks arising from the environmental and other man-made hazards. Comprehensive reviews and summaries of those studies on risk perception and communication can be found in publications by Fischoff (1990), Fischoff *et al*, (1981), Fischoff *et al*. (1987), Morris (1990), National Research Council (1989), and Schwing and Albers (1980). And yet, a model of systematic risk communication, which should take into account major variables involved in the communication processes—that is, the source, the message, the channel, the destination and the effect—may need to be further developed in the future.

4. JAPANESE STUDIES ON RISK PERCEPTION AND COMMUNICATION

Empirical research on risk perception and communication has a relatively short history in Japan. Early in the 1980's, some research began with investigating laypeople's perception of the "nuclear" risks and benefits compared with those of other natural and man-made hazards.[9] In the following sections, some of the major findings of the relevant empirical research conducted by the present author and associates on risk perception and communication will be briefly presented and discussed.

(1) Japanese Housewives' Risk Perception

It is commonly believed that women generally are more sensitive to risks than are men. To test this and other hypotheses, a study was carried out by Tanaka[10] with a total of 500 housewives living in Tokyo, serving as subjects.

(a) Risk/benefit Perception among Japanese Housewives

The 500 female subjects were first requested to rate each of the 9 risk and non-risk objects (AUTOMOBILE. FOOD ADDITIVE, HERB MEDICINE, NUCLEAR POWER PLANT, OIL THERMAL POWER PLANT, SMOKING. SPRAY USING CHLORO-FLUORO-CARBON GAS, TRAVEL BY AIR and VITAMIN) on a set of the two "risk" and "benefit" rating scales. Percent frequency distributions were then computed for each object along the benefit and risk dimensions. Finally, each object was plotted in a two-dimensional space. as shown in Slide l.

There appears to be a high degree of consensus about 3 high-risk/low-benefit objects; over 80% of subjects rating FOOD ADDITIVE, SPRAY USING CHLORO-FLUORO-CARBON-GAS, and SMOKING as risky, while only less than 40 % regarding them as beneficial. In a similar fashion, both HERB MEDICINE

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[8] National Research Council. 1989. *Op. cit.*, p 322.

[9] Tanaka, Y. 1985. *Sociology of Nuclear Energy*.

[10] Tanaka. Y. 1990. *Proceedings of the XXXst Annual Congress of the Japanese Social Psychological Association*. pp 38-39. (Text in Japanese)

and VITAMIN can be categorized as low-risk/high-benefit; and NUCLEAR POWER PLANT, OIL THERMAL POWER PLANT and TRAVEL BY AIRPLANE, as medium-risk/high-benefit. AUTOMOBILE proves high-risk/high-benefit, nearly all the subjects perceiving it as risky and beneficial simultaneously. Although no direct comparison between sexes was made in this study, the result seems quite consistent with those of the earlier studies involving males or both sexes.

Such overall similarities may be partly attributable to the overwhelming influence of mass media that serves to shape people's attitudes and behaviors and put then into cultural conformity.

(b) Segmentation of Japanese Housewives as the Communication Audience

By using the same data obtained from 500 Tokyo housewives, correlational analyses were carried out, in order to examine the interrelationships among the attitudinal variables. More than 200 attitudinal variables (question items) were submitted to factor analysis. A total of 29 factors were obtained as the result of this factor analysis. Second, out of those factors, two salient factors---"Social participation" and "Perceived risk and benefit"---were chosen for subsequent "cluster analysis." Cluster analysis was used in this study as a useful method for investigating how 500 housewives can be "segmented" into independent groups on the basis of the subjects' personal attributes (i.e., age, education, working status, etc.) and their attitude components toward "social participation" and "risk and benefit." As the result of this cluster analysis, five meaningful "clusters" were obtained. They are shown in Slide 2 in a two-dimensional representation defined by the "Social participation and "Risk/benefit perception" factors. Each cluster was then named according to the unique attributive and attitudinal characteristics of "component" subjects.

For the reference to the specificity of each cluster, the names of clusters and some typical characteristics of each cluster will be shown in Table 3.

Table 3. Segmentations of Tokyo Housewives

Cluster-1: Conservative Activists (*n* =72; 14%): Mostly in a 30-40 age group; mostly high-school graduates; many are working; interested in participating in anti-nuclear-weapon, anti-nuclear-power, interested in anti-pollution protests; interested in political and economic affairs; and perceiving nuclear energy as dangerous but beneficial.
Cluster-2: Optimistic Silent Majority (*n* =121; 24%): Some in 20-30 and many in 30-40 age groups; mostly high-school graduates; few are working; not interested in environmental problems, political and economic affairs, and nuclear-energy issues; and perceiving nuclear energy as both safe and beneficial .
Cluster-3: Socially Indifferent (*n* =56; 11%): Mostly in a 40-50 age group; mostly high-school or trade-school graduates; not interested in environmental problems, political and economic affairs; not interested in participating in anti-nuclear-weapon, anti-nuclear-power, or anti-pollution protests; and perceiving nuclear energy as not needed.
Cluster-4: Progressive Activists (*n* =56; 11%): Mostly in a 30-40 age group; mostly university, college, and junior-college graduates; only few are working; interested in political, economic. and international affairs; interested in participating in volunteer activities, anti-nuclear-weapon and anti-nuclear-power protests and peace demonstrations; Perceive nuclear energy as both dangerous and not beneficial ; criticizing nuclear power plants as not safely operated; and believing the science does not contribute to enrichment of life.
Cluster-5: Average Silent Majority (*n* =195; 39%): Mostly in a 30-40 age group; many trade-school graduates; few are working; interested in viewing TV's sports programs and reading shopping magazines; not interested in anti-nuclear-weapon and anti-nuclear-power, anti-pollution protests; and perceiving nuclear energy as beneficial.

The foregoing clustering of 500 Japanese women into five segments may illustrate the uniqueness of subjects' attributes and attitudinal systems, characteristic of each group. It may be worth noting that while a great majority of Tokyo housewives appear to accept nuclear power plant to a varying degree, either perceive it safe or feeling it beneficial, a group of highly educated, politically awaken, progressive upper-middle-class housewives of Cluster-4 prove to be strongly anti-nuclear and anti-science. It may be because of their higher education; or it may be because of their liberal political traits resulted from their upper-middle-class family background. Or it may be because of their association with anti-nuclear, environmentalist activists. In any case, housewives in Cluster-4 seem to indicate a need for further examination as to why housewives in more favorable, social and economic conditions would become anti-nuclear and anti-science.

These findings seem to pose an interesting problem for the pursuit of effective risk communication. As has been pointed out previously, the audience of risk communication are never homogenous, differing in their personal attributes, values, beliefs, and attitudes toward a wide variety of things and people. Effective risk communications, therefore, should take into account those differences in the segmented audience and encode the message accordingly, so that it may outreach and satisfy the information need of the greatest majority of the audience.

(2) Fears and Personality Traits

In a study conducted on the efficacy of drugs and ADR (Adverse Drug Response), Tanaka *et al*.[11] examined correspondence between *fears* and *personality traits*, based upon the data obtained from a total of 630 male and female university students. To measure the varying intensity of fears toward different objects of judgment, subjects were asked to rate ADR, SICKNESS. DEATH, EARTHQUAKE and NUCLEAR ACCIDENT on a five-point "*fearful-not fearful*" scale. They were simultaneously asked to check a battery of personality test items. Data were then submitted to multivariate analyses to examine the covert structure or interrelationships among these variables.

First, by way of using the factor analytic method, a total of 14 meaningful factors were obtained. The most salient 8 factors are shown in Slide 3 in order of their factor salience. Secondly, on the basis of the factor analytic result, factor scores were computed for each variable and for every subject, and among each dimension. Then, the data were submitted to multiple regression analysis, to examine correspondence between *fear*s and *personality traits*. In this analysis, the intensity of fear toward each object of judgment was taken as the dependent variable to be predicted from the factor scores of personality variables. In all cases examined, highly significant ($p<.001$) multiple correlations were obtained, even if the magnitudes of correlations were not very impressive. Those significant correlations appear to indicate that the intensity of fears toward a certain object may be predicted in part from one's own *personality* traits.

The result of this multiple regression analysis will be summarized in Table 4 where, for each event, only those statistically significant ($p< .05$) independent *personalit*y variables are listed. Salient personality variables to elicit fears appear to change from one risk event to another. In the case of NUCLEAR ACCIDENT, a significant ($p < .001$) multiple correlation was obtained and, out of the 8 personality variables, the following 3 three variables—"health-attentiveness," "food-safety-consciousness." and "rejection of technology"—were found to be the best predictors of fears. In other words, laypeople fear NUCLEAR ACCIDENT, and would most likely oppose NUCLEAR POWER, because they are innately inclined to be "attentive to health," "sensitive to food safety" and "reject technology."

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[11] In Shimizu, N., *et al*. Eds. 1990. *Improving Drug Safety: The Assessment, the Management and Communication of Therapeutic Benefits and Risks of Pharmaceutical Products*, pp 64-84.

It may be recalled that the Japanese remained relatively calm and detached at the first news of Chernobyl accident, until housewives were shocked to learn by government and mass media disclosures that some foodstuffs imported from Europe (mainly, dried spices) had been radioactively contaminated.

Table 4. Predicting Fears from Personality Characteristics.

ADR : The more the people are "health-attentive" and "aggressive," the more they are inclined to fear ADR .

Illness : The more the people are "medication dependent," "inventive," and "health-attentive," the more they are inclined to fear SICKNESS.

Death : The more the people are "health-attentive" and "aggressive", the more they are inclined to fear DEATH.

Earthquake: The more the people are "mysticism-believing," "food-safety-conscious" and "health-attentive," and the less they are "inventive" and "accepting technology," the more they are inclined to fear EARTHQUAKE.

Nuclear Accident: The more the people are "food-safety-conscious" and "health-attentive," and the less they are "accepting technology, " the more they are inclined to fear NUCLEAR ACCIDENT.

(3) Predicting "Acceptance" from "Perceived Safety" and "Perceived Necessity"

In still another study, Tanaka *et al.*[12] examined correspondence between acceptance and the perceived risk and benefit for several objects associated with electric power generation. A total of l,495 persons (410 high-school boys and girls, 520 male and female university students, and their 565 parents) served for this study as subjects. They were asked to rate SOLAR POWER PLANT, GEO-THERMAL POWER PLANT, OIL-THERMAL POWER PLANT, HYDRO POWER PLANT and NUCLEAR POWER PLANT, each on "acceptance," "safety" and "necessity" scales. Table 5 summarizes how subjects accept these power plants and perceive their safety and necessity. It is clear that NUCLEAR is perceived as the least safe, the least necessary and the least accepted. Such public perceptions, however, prove to contradict the fact that, as of 1995, as high as 33% of electricity output in Japan is accounted for by nuclear power, 21% by oil-thermal and 10% by hydro. Contributions by solar and geo-thermal are still totally negligible. Thus, public perceptions may well be taken as a projection of wishful thinking.

Table 5. Acceptance and Perceived Safety and Necessity of Various Power Plants

	Acceptance	Perceived Safety	Perceived Necessity
Solar	93(%)	90(%)	94(%)
Geo-thermal	91	86	88
Oil-thermal	64	48	62
Hydro	86	81	89
Nuclear	32	11	46

Our next interest lied in finding whether "acceptance" can be significantly predicted by "perceived safety" and "perceived necessity." For this purpose, multiple regression analysis provided a useful analytical

[12] Tanaka, Y. Ed. 1996. *The Japanese and Advanced Technology*. pp 31-51.

method. The result of this analysis is summarized in Table 6. All the multiple correlations (*R'* s) were found significant beyond the .001 level---evidence that the degree of "acceptance" can be predicted from the two predictors, "perceived safety" and "perceived necessity", in every case examined. It was also found that a fairy large amount of the variance (R^2) can be "explained" by the two predictors alone in each case.

Furthermore, when ß-weights, the amount of contribution to prediction, are compared between the two predictors, the ß for perceived safety is larger for Solar, Geo-thermal, Oil-thermal and Hydro, indicating that "perceived safety" is a better predictor. On the other hand, the ß for perceived necessity is large for Nuclear, suggesting that "perceived necessity" is a better predictor for acceptance.

Table 6 Predicti of Acceptance from Perceived Safety and Perceived Necessity

	R^2	ß for Perceived Safety	ß for Perceived Necessity
Solar	.55	.54	.33
Geo-thermal	.50	.51	.33
Oil-thermal	.47	.48	.36
Hydro	.40	.45	.33
Nuclear	.53	.36	.56

These results seem to imply that people would accept Solar, Geo-thermal, Oil-thermal and Hydro because they perceive them first as being safe and second as being necessary, whereas people would accept Nuclear because they perceive it first as being necessary and second as being safe. It should be recalled that only 32 % of subjects accept NUCLEAR POWER PLANT. Then, whether or not people may accept NUCLEAR would heavily depend upon their perception of the necessity of NUCLEAR. In view of a successful risk communication for nuclear power, it may be suggested that more information, objective and easy to understand, should be encoded in the message in such a way that it serves for enhancing the people's perception of the necessity of nuclear power as well as of its safety.

5. CONCLUSIONS

In conclusion, risk perception and communication in the nuclear domain involves wide areas of disciplines, ranging from the nuclear sciences to the social and behavioral sciences. Although further studies will be needed in this respect, it is still important to note that solutions of many current nuclear problems seems to rest largely upon the social and behavioral sciences. This is simply because nuclear power today is embedded so deeply in society that laypeople's choice is among the most decisive factors for the future of nuclear power. The present paper is an attempt to stimulate new ideas and encourage further discussions on this subject among nuclear specialists. In view of successful risk communication, the following recommendations may be made for further examination and discussion on the subject.

(1) Personality traits affects the acceptance of nuclear power. Therefore, encode appropriate information in the message in an objective manner, so that it may reduce people's concerns about radioactive contamination of food and harmfulness to health, and invite people to familiarize with modern science and technology.

(2) Perceived necessity and perceived safety affect the acceptance of nuclear power. Therefore, encode appropriate information in the message in an objective manner, so that it may enhance the perception of both necessity and safety, and invite people to come and talk with the people working at a nuclear power plant.

(3) Successful outreach depends heavily upon the availability of appropriate channels of communication. Mass media are not the only media suitable for risk communication. Therefore, use both E-mail and World Wide Web which provide a more flexible channels for conversational communication between the source and the receiver who alternate their roles forming a complete feedback loop. Improve these new channels and make the message accessible to all people interested. Then, encode appropriate information in the message in a humane manner so that it may attain the empathy of unspecified audience and enhance their interest in energy.

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