

**Fear, Trust and the Future
of Nuclear Power**

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Abstract

In addressing the future of a subject so emotionally charged as nuclear power, one cannot ignore the critical role the psychological reactions to it by the public has played and will continue to play in determining that future. For many people, nuclear energy conjures up frightening images of death and destruction. Couple this almost primal fear with the angry perception by the public that its trust in public officials and the nuclear industry has been betrayed, and one wonders whether there can be any future for nuclear power. This paper examines the basis of these irrational fears and the causes of the breakdown in trust that together have conspired to reduce the public acceptability of nuclear power plants. With the resolution of these negative emotions the debate over the future of nuclear power can return to a rational basis of need, economics, and technology.

Introduction

In this committee we are concerned with the option of nuclear energy and in particular what future it may have. Certainly a key factor in determining its future, as is true for any technology, is the continuing development and improvement of its engineering aspects. These aspects contribute to its costs/benefits analysis, both in terms of its economic competitiveness with other means of generating power and its actual safety risks. Here I use the term actual risks to distinguish these quantifiable (if albeit probabilistic) factors from those of perceived risks. (Perceived risk is highly personal and emotional, impervious to penetration by objective knowledge and rational arguments.) That the latter may be a more crucial determinant of this technology's future is rather particular to nuclear energy and something that its advocates, both among scientists and policy makers, have had to come to terms with. This paper is an attempt to address some of the main ingredients that fuel the public perception aspects of the problem, and this will, hopefully, indicate in what directions progress can be made.

There are at least two separate and distinct public opinion and policy issue "hot topics" associated with nuclear power that one may address: nuclear waste disposal and reactor accidents. The former is a natural consequence of the normal functioning of a reactor; the latter occurs when things go wrong. The former falls within the realm of control (assuming the existence and implementation of adequate disposal techniques); the latter represents a loss of control. Despite these differences that would, in most cases, illicit very different psychological reactions, the images that these two issues conjure up

in many people's minds share similar qualities. Because of this similarity in imagery and the resulting public perceptions, I will take the liberty in this paper to address the two topics in a parallel fashion.

Rational Arguments and Irrational Fears

I will not devote much space in this paper to reiterating the rational arguments for and against nuclear power. For myself, as a scientist, its benefits over other currently viable energy sources are favorable. Except for the Chernobyl disaster with its devastating toll on human life and the environment, no reactor accidents of significantly harmful physical consequences have occurred over the history of the industry. Nuclear power is held to a standard of safety which no other industrial technology could possibly meet and remain economically viable. If coal-fired generating plants were required to keep their polluting emissions of radiation and greenhouse gases to as stringent a standard, they could not operate. The deaths and resulting psychological stress inflicted upon coal miners and their families and communities by respiratory diseases and mining accidents would cause coal mining to be outlawed. With the amount of environmental devastation that the world has witnessed as a result of oil spills, tankers would be forbidden to sail. Solar energy is not yet a viable energy source on a large scale. Recycling and renewables may be able to offset some of current demands but may not be able to meet increased needs of a rising world population.

With newer designs for increasingly safe reactors coupled with properly-enforced regulations, the only glaring limitation to the increased implementation of nuclear power is the resulting radioactive wastes. Various solutions have been proposed to handle this problem, and it will take time to prove which may be best, to the satisfaction of both the experts and the general

public. A particularly attractive, although exotic one, is accelerator transmutation of waste, producing short-lived isotopes from long-lived ones by energetic particle bombardment.

But for all of humankind's wonderful ideas and technology, it may be the irrational arguments, the emotional ones, that are the crucial ones to examine. For many people, nuclear energy conjures up fearful images that determine their reactions to the technology more so than any reasoning can justify. Some of this fear comes from a lack of understanding of such a complex technology, but it must be more than just that. People drive automobiles, use electric appliances, fly in airplanes, etc. with some knowledge of the risks involved yet without any reassuring understanding of how these technologies operate. There is some inherent trust that exists between the public and the industries involved that makes the risks acceptable. For the nuclear industry that trust has been lost to a large extent. It is this crippling combination of irrational fear and lack of trust that this paper will examine.

Public Opinion and Nuclear Images

Numerous surveys have been conducted over the years to assess public opinion regarding nuclear power and its associated waste disposal issues. A summary of responses to several opinion surveys from 1976 to 1986 shows a general trend of increasing public opposition to nuclear power in the United States. (1) In particular, an ABC News poll taken shortly after the Chernobyl accident shows that nearly 60 percent of the respondents were apprehensive about the possibility of an American nuclear accident, and an overwhelming majority opposed building more nuclear plants. (2) On the other hand, the results of surveys depend upon exactly what questions are asked. In 1980, a Harris poll found that a majority of Americans were still in favor of nuclear

power but opposed to the construction of nuclear plants in their communities (the “not in my backyard” reaction).(3) Similarly, in April 1991 a telephone survey of 1,000 American adults revealed that, although 52 percent responded in opposition to building more nuclear plants, 40 percent of respondents chose nuclear as the energy source upon which the United States should rely in the coming decade, far surpassing the 25 percent who named oil and the 22 percent who chose coal. (4) The Safe Energy Commission Council (SECC) reports in the December 1991 issue of *USA Today Magazine* that 62 percent of respondents to a national survey oppose building more nuclear reactors. (5) Ann Bisconti of the U.S. Council for Energy Awareness points out that in general only a small percentage of Americans believe there will be a need for more electricity in the next ten years, and that therefore there is little support for new generating plants of any kind. Without a clearly defined need, the majority of those polled prefer conservation over increased energy production. She emphasizes, however, that most Americans expect nuclear energy to play an important role in the future, especially if it will cut greenhouse effect gas emissions and air pollution. (6)

Similarly, a recent overview of the results of the nuclear waste management polls reveals a uniformly negative attitude. (7) In conjunction with these results the article discusses the data produced by four of these polls surveying the images or perceptions associated with underground nuclear waste repositories. The images were grouped into thirteen general categories; the four most frequent single associations were “dangerous”, “danger”, “death”, and “pollution”. The authors suggest that “what these responses reveal are pervasive qualities of dread, revulsion, and anger - the raw materials of stigmatization and political opposition”.

The historical origins of such strongly negative images and attitudes has been investigated by Weart. (8) He points out that beginning in the early part of this century radioactivity has become associated with “uncanny rays that brought hideous death or miraculous new life; with mad scientists and their ambiguous monsters; with cosmic secrets of death and life ... and with weapons great enough to destroy the world”. It is no wonder that after the images of the bombings of Hiroshima and Nagasaki brought home the potential reality of these beliefs it became difficult to separate the peaceful uses of nuclear energy from the awesome weapons of destruction in the minds of the public.

Natural Versus Man-made Disasters

Studies have been done comparing the psychological reactions to natural disasters and to those in which man plays some role. (9) The fact that people, rather than nature alone, bear some responsibility in the latter seems to affect the way that we react to them. In almost all cases it was found that technological calamities can cause more severe and/or longer lasting emotional problems than those occurring naturally. It has been suggested that this is because when people are involved, there can be a loss of trust, a perceived loss of control, and a target available on which to focus blame, all contributing to elevated levels of stress. In particular, when an incident occurs involving toxic substances such as radioactive materials, the long-term risks involved may prevent any natural resolution over time of the chronic stress that can result. This can lead to physiological damage that may exceed that due to the toxic substance itself. For example, the Report of the President's Commission on the Accident at Three Mile Island suggested that psychological, rather than nuclear, fall-out may have the most significant effect on public health:

In spite of serious damage to the plant, most of the radiation was contained and the actual release will have negligible effect on the physical health of individuals. The major health effect ... was ... mental distress. (10)

Medical studies of the local residents indicated, by both psychological and physiological measures, abnormally high levels of stress for years following the incident. Extreme stress symptoms during the emergency period were of short duration, as would be the case for natural disasters. On the other hand, elevated urine levels of catecholamines discovered in studies extending through January 1982 suggest a persistent, low-level form of stress related more to uncertainty than to immediate fear. (11) At present there are no clear indications of the long-term health effects of such a condition.

Anti-Nuclear Activism

Anti-nuclear activists have largely succeeded in using people's irrational fears to their advantage. In the court battles to reopen the undamaged reactor (Unit One) at Three Mile Island, the Nuclear Regulatory Commission was forced to consider the psychological impact it would have on the local residents, thanks to efforts by the People Against Nuclear Power (PANE). Having created mass hysteria in reaction to the proposal to reopen the plant, PANE effectively utilized their results to show how important a role people's *unjustified* fears should play in the decision, since they could not come up with any justified reasons for delaying the reopening. PANE further argued that the citizens around Three Mile Island had lost confidence in the ability of their community institutions to function during a crisis and that the polity would crack under

the stain of a reopened plant. But it was PANE that had spent years since the incident encouraging exactly this loss of confidence. (12)

In addition to the direct results one sees upon public opinion generated by the anti-nuclear hysteria, these activists produce another very potent weapon to prevent the opening of new nuclear plants: delay. The nuclear industry in America has become overburdened financially, making nuclear power not as attractive economically as originally envisioned. Some of the blame for this must go to management and the regulatory process. But much to blame for this situation are the anti-nuclear activists, who gloatingly point to nuclear power as being uneconomical when it was they who contributed greatly to making it that way. With their guerrilla tactics in the street and delay tactics in court they have caused the opening of any new nuclear plants in the last decade in America to become financially unsound for the utilities. By causing the licensing process to drag out in the courts, the utilities get heavily into debt by having an expensive plant on their hands that just sits there without producing any return on their investment. And it is not uncommon for these delay tactics to be unofficially sanctioned by the local authorities involved. For example, the Long Island Lighting Company decided to sell their Shoreham nuclear plant valued at \$5.3 billion to the State of New York for one dollar in exchange for a tax deal to help them recoup their losses generated by delays. The main cause for the delays was the refusal by the state and county authorities to develop emergency evacuation plans as required for licensing. Here was a case where social policy in a democracy was made not by the legislature (Shoreham was not declared unsafe to operate), but by default due to purposeful lack of proper action. (13)

Information and Public Trust

There appeared two short personal testimonies in the *National Catholic Reporter* concerning the Three Mile Island incident that illustrate how deeply the damage to the public's confidence and trust in the government can run. Linda Braasch (14) writes:

It has been two years since the accident at Three Mile Island. I cannot forget the total violation I felt when I realized my trust in our government and the nuclear industry has been betrayed.

She continues on to describe that she was carrying her unborn son, Scott, at the time of the incident and since that time lives in constant apprehension of what long-term effects it may have on him and others. There follows the finger of blame for not being dealt with fairly and openly by officials:

How could they lie! ... Our psychological well-being will not be healed until the human side of Three Mile Island is recognized and dealt with on a government level.

Mary Hartnett expresses similar feelings of being deceived:

No one knows how much radiation escaped, as sensitive monitors went off scale or were faulty. Of course the NRC and Metropolitan Edison tell us there wasn't enough radiation to worry about. I don't believe anything they tell us anymore. They have become so proficient at evading the truth, omitting facts and just plain lying that we will never take their for anything - everything must be proven to us. No longer will we lie asleep feeling secure while an incredible, technological monster sits belching and producing all types of radioactive waste to pollute forever our cozy and industrious community. (15)

The waste management polls cited previously also indicate a clear distrust of the government (in this case the DOE) to disclose promptly and fully any information on accidents or serious problems (68 percent of respondents).

Such an erosion of trust in these circumstances may come about in at least two ways. The first is when public officials do not convey information in as complete and timely manner as the seriousness of the situation warrants. The second is when discrepancies exist between the data provided by public officials and information that the news media supplies due to lack of responsible reporting on their part.

That the consistency and completeness with which information is conveyed in a crisis is crucial to one's reaction to it can be illustrated by the results of a survey of the evacuees of Three Mile Island. (16) While Pennsylvania's Governor Richard Thornburgh issued a recommendation during the height of the crisis that pregnant women and preschool children within a five-mile radius leave the area (an estimated 3500 individuals), instead some 200,000 were fearful enough to evacuate - sixty times the number warranted by the advisory. A large portion of the evacuees reported that their reason for leaving was confusing information given by officials and news media. It seems that the anxiety level was raised considerably by unconfirmed reports preceding the governor's advisory. Erroneous news reports about the amount of radiation released and a supposedly imminent full-scale evacuation eroded officials credibility among the press, whose skepticism and confusion were transmitted to the public.

During the Chernobyl reactor accident the amount of intentional or unintentional misinformation was extraordinary. Neighboring countries detected a problem and requested (in some cases demanded) information before

the Soviet government could decide what to tell them (or their own citizens, for that matter). According to Hoffman (17), part of this ambiguity was due to the fact that Chernobyl occurred in midst of Gorbachev's *glasnost*, and the formulation of a new Soviet information policy was not yet complete. Therefore, there was considerable disagreement in the central government as how to handle the flow of information. As a result, different pieces of data and contradicting interpretations were disseminated to both domestic and foreign audiences. Meanwhile, the Western radio stations transmitted speculative information and misinformation (mostly originating from alarmed Soviet citizens such as ham radio operators) to the Soviet public. Given the seriousness of the Chernobyl accident, the Soviet people's anxieties, anger, and loss of trust could only be heightened by the paucity and timing of the information they were given and the conflicting statements they received from public officials and the news media.

Elsewhere Chernobyl had similar effects on public attitudes. In Great Britain many communities considered installing their own radiation monitors because they didn't believe that the government would tell them the truth about leaks. In Greece a citizens group was formed, made up of scientists, doctors, and other professionals, to measure radiation levels in produce, again because they did not trust what officials told them. (18)

Most people would generally agree that the news media have the important responsibility of conveying vital information to the public. But a press that is skeptical, not fully informed, and overzealous can inflate concern in an unwarranted fashion rather than ease it. The conclusion of the President's Commission on the Accident at Three Mile Island concerning the media coverage and public information during the emergency was that " a combination of confusion and weakness in the sources of information and lack

of understanding on the part of the media resulted in the public being poorly served." Anne Trunk, a local resident serving on the Commission, notes that with regard to media reports,

Too much emphasis was placed on the "what if" rather than the "what is." As a result, the public was pulled into a state of terror, of psychological stress. More so than any other source of news, the evening national news reports by the major networks proved to be the most depressing, the most terrifying. Confusion cannot explain away the mismanagement of a news event of this magnitude. (19)

Another report on Three Mile Island, issued by a U.S. House of Representatives subcommittee on Science and Technology, was especially critical of the way the media covered the incident, asserting that the coverage contributed substantially to public misconceptions about the dangers of the accident and the risks of nuclear power in general. (20)

John Kemeny, head of the President's Commission, criticized the treatment by the media of scientific issues in general. He cites their love of controversy and insistence on providing equal space to both sides of an issue, even when that may not be appropriate for scientific subjects. Regarding the debate over nuclear power in particular, Kemeny does not "blame the American people for being totally confused. With that kind of reporting, the reader is left with the feeling that one cannot trust scientists because they obviously cannot agree amongst themselves." (21)

The Future

The fact that nuclear energy conjures up images of danger, sickness, and destruction in the hearts of many members of the general public represents a rather formidable barrier for the future of nuclear power: fear. Erikson stresses the reality of this concern:

The one thing we cannot afford to assume as we consider how to deal with this new species of trouble is that the fear it evokes is either a passing whim or a fever that can be cooled by the kinds of calculations that experts make. This dread has its own reasons. It must be respected. (22)

Couple this almost primal fear with the perception by the public that it has been deceived by public officials and the nuclear industry, and one wonders whether there can be any future at all for nuclear power. Alvin Weinberg has been quoted as saying that it is much easier to "scare" people than to "unscare" them (23); it is perhaps a much more serious proposition to regain trust once that trust has been perceived to have been betrayed. And in this case the two are inexorably connected. The strength of the feelings of anger and betrayal are indicative of the depth of human fears that the images of nuclear energy invoke.

The future of nuclear power depends upon whether or not the public's confidence can be regained. There are several facets one can identify to accomplishing this goal. The first is the continuing development of technology. Weinberg (24) points out that the only course of action that the nuclear industry, as technologists, can take to attempt to change public attitudes is to design and demonstrate inherently safe reactors. That is, develop a reactor whose safety depends not on mechanical or human intervention (which have

the potential for failure, as was seen in Three Mile Island and Chernobyl) but on immutable physical principles. In that article he discusses several of the newer reactor types that have vanishing safety risks. This, together with safe disposal of nuclear wastes, is certainly a highly desirable goal and one that the nuclear industry has continually striven for. After all, an inherently safe reactor is something tangible that can appeal to the intellect of any reasonable person. But there's the catch: reasonableness. The emotional barriers of fear and distrust will not be overcome by technology alone. For even if one can develop the perfect reactor, the public has to place enough trust in the government and the industry to allow it to be built.

In order to counter the fear, the light of knowledge, or education is required. While it is debatable what level of knowledge is necessary for the layman to become comfortable (conceptually) with nuclear technology, with a topic as mysterious and controversial to the public as this some raised level of awareness is probably necessary. The U.S. Council on Energy Awareness believes that increased public knowledge about the high standards of the nuclear industry and its regulatory process, coupled with comparisons between it and other forms of power production and estimates of future needs will gradually increase the acceptability of nuclear energy.

Finally, recovering the public's trust will require time; specifically a period during which both public officials and the news media provide truthful, timely, and consistent information on nuclear issues and incidents. This means a period of time for both of these potential information sources to demonstrate responsibility, trustworthiness, and accountability. It is only after all of these ingredients have come together can one have any real confidence in stating that nuclear power has a place in the future of the world.

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