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Interim Report

Advanced Nuclear Reactor Public Opinion Project

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This Interim Report summarizes the findings of our first twenty in-depth interviews in the Advanced Nuclear Reactor Public Opinion Project. We interviewed 6 industry trade association officials, 3 industry attorneys, 6 environmentalists/nuclear critics, 3 state officials, and 3 independent analysts. In addition, we have had numerous shorter discussions with various individuals concerned about nuclear power.

The report is organized into the four categories proposed at our April, 1991, Advisory Group meeting: safety, cost-benefit analysis, science education, and communications. Within each category, some change of focus from that of the Advisory Group has been required, to reflect the findings of our interviews.

This report limits itself to describing our findings. An accompanying memo draws some tentative conclusions.

Safety

Nuclear waste. Virtually everyone we interviewed stressed that nuclear waste disposal is the Number 1 nuclear power issue on the public's mind, and that it is very difficult to discuss public opinion on nuclear power without considering the waste disposal problem.

Without exception, the environmentalists/nuclear critics we interviewed argued that until nuclear waste disposal can be adequately addressed, they will oppose nuclear power, regardless of advances in reactor technology. They argued, further, that DOE's "mishandling" of the Yucca Mountain and defense waste problems are evidence the federal

government cannot properly manage the nation's nuclear enterprises.

Most nuclear critics rejected out-of-hand the suggestion that either fuel reprocessing or a breeder-type reactor (even if designed to produce no excess plutonium) was an acceptable solution to the nuclear waste issue, arguing that the danger of plutonium proliferation far outweighed any possible environmental gains.

One respondent, asked about the success of reprocessing in France's nuclear power program, turned this question around, and replied that France's explicit pursuit of a dual purpose, civilian-military, nuclear development program shows just how closely waste reprocessing is tied to bomb production.

The more sophisticated nuclear critics are aware of DOE's research in transmutation of nuclear waste through laser technology. While supportive of the goal of dramatically cutting waste's radioactive half-lives, the critics were generally skeptical of whether such research would yield a practical, energy-efficient process. Another concern among the critics is that some waste currently classified as low-level, such as discarded reactor cores and containers, should actually be classified as higher level waste.

State officials we interviewed, while generally more open to nuclear power than the nuclear critics, were so preoccupied with siting of low-level waste disposal, reflecting their professional responsibility, that they really had no well-thought out positions on other aspects of nuclear power.

Environmental trade-offs between nuclear and fossil fuel plants. Although such trade-offs are a key concern of this research project, it was difficult to get much opinion on the topic. Most respondents agreed that the public has not yet focused on the implications of the threat of global warming, and therefore does not have any real thoughts on the nuclear-fossil trade-off issue.

Most environmentalists/nuclear critics were extremely loath to accept the global warning/acid rain threat as an argument for nuclear power, and instead see this threat as evidence of the need for more conservation and use of "renewable" energy.

An important exception is Jan Beyea of the Audubon Society, who argues for continued research on advanced nuclear reactors as an insurance policy should the global warming problem become overwhelming, with no other solution apparent. However, as discussed below in the Cost-Benefit section, even Mr. Beyea is pessimistic about ever commercializing advanced reactors.

Safety regulation. As a general proposition, industry feels overregulated by the NRC, the general public would appear to feel reasonably comfortable with the current level of regulation, and the environmentalists/nuclear critics distrust the federal agencies that regulate the nation's nuclear energy industry.

Thus, whether the issue is approving evacuation routes, shutting down Yankee Rowe for container repairs, or approving a new plant's operating license, the nuclear critics do not trust the federal regulatory process. When it is pointed out that in 35 years of operations throughout the Western world there have been no fatal nuclear power mishaps, nuclear critics are fond of saying, "Not Yet".

It flows from this that the nuclear critics are not enthusiastic about any regulatory "streamlining" that would place limits on public participation and public intervention at any stage of the NRC's licensing process.

While some nuclear critics would agree that plant design standardization could help enhance plant safety, they would nevertheless vigorously argue that standardized designs still leave enormous opportunities for errors in site-specific design elements, construction, and start-up testing. They therefore strongly oppose "one-stop shop" combined construction permit/operating licenses. Indeed, one critic even argued that standardized designs are potentially a step backwards, since design errors would proliferate through the standardization process.

Notwithstanding such opposition to regulatory reform from the nuclear critics, many of our respondents observed that the U.S. Congress has been quite receptive to at least limited reform, including "banking" of site approvals, combined CP/OL approvals, and reasonable limits to trivial or mischievous public intervention in the NRC approval process. A number of respondents expressed the view that Congress, in the case of nuclear power, is genuinely looking to the nation's future power needs, and understands the imperative for nuclear energy.

Interestingly, nuclear advocates were not united in the belief that NRC procedural reforms are of great importance to the nuclear industry. One industry attorney argued that the effect on power plant construction time of procedural delays at the NRC had not been a particularly big problem in the last two decades, and another industry attorney said that the state regulatory process was fully as burdensome on the nuclear power industry as the NRC.

Risk evaluation. The risk of nuclear mishaps, of course, underlies much of the debate about safety regulation. Yet different groups have sharply differing perspectives on risk. Regulators, acting under Congressional mandate, attempt to assess risk in terms of likelihood of an event occurring in a given time period, say, 10,000 years.

This approach reflects an engineering frame of mind, and is the approach taken by designers of the materials, parts and processes used in building power plants. Such an approach is central to an industrialized economy, and has been widely adopted, whether the product is an airplane, bridge, pace-maker, or electric power plant.

Nuclear critics, on the other hand, think in absolute terms: Is there any possibility of

a mishap, due, for example, to earthquake, terrorist attack, airplane crash, or whatever, or is there any possibility of malfunction in any portion of the facility?

The general public takes yet a third approach to risk, according to our interviews with experts in public opinion. The public is interested in the practical question, Is this activity safe? They ask this question in the same way they would ask the question, Is it safe to cross the street now? or, Is it safe to take this airplane trip? Abstract concepts like "probability" or "risk" are not particularly meaningful to the public.

These different concepts of safety -- probabilistic, absolute, and practical -- must be born in mind when studying public attitudes towards nuclear power.

NIMBY ("Not in my backyard"). Notwithstanding the substantial federal role in regulating and supporting nuclear power, nuclear power is in large measure a local political issue, as was pointed out by numerous interviewees. Waste disposal sites, power plant sites, and transportation routes for waste disposal are all highly local in their political impact, and there is little in the foreseeable future that will change this fact.

The organization of the environmentalist/nuclear critic movement reflects this fact. Environmental Defense Fund (EDF), for example, has its nuclear expert in Denver. Nuclear Information and Resource Center represents "hundreds" of groups around the nation. And even the Washington representatives of nuclear critic groups agree that their constituents tend to get energized only by developments at the local level, such as permits to operate, extensions of licenses, and waste disposal siting.

This "localization" effect helps explain what some observers consider a paradox: most polls show that Americans favor nuclear power generally, but oppose it in their own neighborhood. In other words, most Americans have no particular emotional or ideological opposition to nuclear power, so long as it does not impact their own neighborhood. In contrast, for example, abortion or school prayer are usually supported or opposed out of strong emotional or philosophical feelings, and are supported or opposed wherever they might be practiced.

Advanced reactors. The effort to focus our interviews on improved safety of advanced reactors was complicated by differing uses of the term "advanced". The key national trade associations for the nuclear power industry -- NUMARC, USCEA and ANEC -- are primarily concerned with light water reactors (LWRs), and they make a point of distinguishing between "evolutionary" and "advanced" LWRs.

In their lexicon, "evolutionary" LWRs incorporate numerous safety improvements but are still gigawatt-sized, and do not incorporate automatic safety mechanisms. "Advanced " LWRs are in the 600 MeW -size range, and do include such automatic safety features as gravity-fed emergency cooling systems.

Other constituencies, however, such as environmentalists/critics and journalist tend

to use the word "advanced" to describe gas-cooled reactors (HTGRs) or liquid metal-cooled reactors (LMRs). They think of HTGRs as relatively small (150 MEW) and modularly constructed.

The LWR-oriented constituencies generally argue that LWRs are a proven technology and have a reasonably well-functioning infrastructure that provides parts and service, in contrast to HTGRs and LMRs. They point out that the NRC has said it will not require full prototypes of advanced LWRs to approve new safety systems, but will require such prototypes for HTGRs and LMRs. Such prototypes could be extremely expensive, running up to $1 billion.

The LWR advocates are generally rather skeptical of HTGRs and LMRs, and like to point to the operational difficulties of the HTGR at Fort St. Vrain in Colorado early in the 1980s, and the difficulties or high costs of HTGRs in Europe. One such interviewee cited the industry gossip that General Atomics, the U.S.'s only HTGR manufacturer, is known for excellent science and terrible engineering. One nuclear critic, loathe to be supportive of advanced reactors whatever their supposed safety advanced, argued that the HTGR's carbon core would be far more flammable than the LWR core.

Notwithstanding this battery of criticism, advanced reactors, and, in particular HTGRs, have captured the imagination of many observers of nuclear power, at least one of whom spoke to us in enthusiastic terms about the HTGR. Indeed, the nationally prominent nuclear critic, Robert Pollard of the Union of Concerned Scientists, sees the HTGR as a substantial step forward in nuclear reactor safety.

The HTGR offers the prospect of major advantages in both safety and economics. In case of an emergency, the reactor's gas coolant is carried to the core by automatic and natural forces of convection. And the carbon moderator transfers heat from the core faster and slows the nuclear fission process faster than the LWR moderator in case of emergency.

Furthermore, the HTGR can be built in economically efficient units as small as 150 MeW, which by their nature are easier to control, and therefore safer, than larger units. Also, smaller units can be built in factories, where they can inspected prior to installation, thereby saving time. Finally, their smaller size makes them cheaper and quicker to build, avoiding the massive up-front capital costs that have plagued gigawatt-sized reactors.

Cost-Benefit Analysis

The public's attitude towards nuclear power's cost-benefit trade-off is not overly favorable, we were told by many interviewees, both pro- and anti-nuclear. It was suggested by several that the public's overall attitude towards nuclear power is: With all its real and alleged dangers, why build more nuclear plants unless there is an obvious need for them,

as might be evidenced by brown-outs, excessive dependency on foreign energy, or soaring electricity rates? Yet, the reasoning continues, today power is fairly reliable, the U.S. seems to have reasonably secure sources of energy, and rates are fairly stable.

If anything, nuclear plants sometimes seem to drive up power rates. (This is because most state Public Utility Commissions refuse to permit the gradual phasing in of nuclear construction costs through Construction Work in Progress charges, so when a nuclear plant comes on line, utilities tend to impose sudden rate hikes to start paying off construction costs.) Certainly, in the public's mind, the promised era of "power too cheap to meter" is a long-forgotten fantasy, and the public is in no mood to pay a premium for nuclear power simply to protect the "nuclear option".

Indeed, nuclear advocates must work energetically simply to make the case that nuclear power is cheaper than coal-derived power. Their task is made more difficult by state PUC retrospective "prudency" hearings finding nuclear power plants to have been unjustifiable investments.

Perceptions of the cost-effectiveness of advanced nuclear reactors take two conflicting directions. On the one hand, a number of interviewees pointed to the fact that smaller, modularly-constructed advanced reactors could be more closely tailored to shifts in demand for electric power, and would avoid the huge up-front capital costs of LWRs.

On the other hand, many interviewees pointed to the fact that advanced reactors are untested and would require long, and costly, periods for breaking in, including the expense of developing a network of parts and service suppliers. A number of interviewees suggested that the only practical way to commercialize an advanced reactor like the HTGR would be through federal investment, for example, by making the New Production Reactor an HTGR, or through a major investment by TVA. One respondent suggested that only through a federal tightening of safety standards to a level that only HTGR could meet, could the HTGR become commercializeable.

The two prominent nuclear critics who said some positive things about the HTGR, Bob Pollard and Jan Beyea, were quite pessimistic about the economic prospects of HTGR. Mr. Pollard says, "We can build a safer reactor [the HTGR], and we can build an affordable reactor, but we cannot build a safe, affordable reactor."

And Mr. Beyea writes, "New, 'inherently safe' reactor designs have the theoretical potential to eliminate most of the meltdown risk, but ... it is questionable whether they compete economically with other energy sources for avoiding carbon-dioxide emissions, especially if they are built to reassure the public on safety and quality assurance."

Technical literacy and science education

Our interviewees tended to confirm the concern of our Advisory Group that there is widespread public ignorance about nuclear power, in particular about how a nuclear reactor operates, and about the nature of radiation. For example, according to one survey only 8% of Americans think it is physically impossible for a nuclear power plant to explode like an atomic bomb. And one interviewee told us of the high school science teacher who asked, "If my home used nuclear power, would I get radiation in the house every time I turned on an electric light?"

Attitudes toward radiation show similar confusion, we were told. For example, people tend to believe that there is "good" radiation and "bad" radiation: Good radiation is "natural", while bad radiation comes from nuclear power plants.

Several respondents pointed to the mystery that seems to surrounds radiation in the public mind -- for fairly good reason. Radiation cannot be directly sensed -- by touch, sight, sound, smell, or taste -- and it emanates from a source, the atom, which is also undetectable by direct human sensation. The fear associated with this "glows-in-the-dark" image of radiation is severely aggravated by the fact that radiation can cause cancer.

By contrast, nuclear power's main competition, coal, is easy to see and feel, and is familiar to anyone who has every used a coal furnace, looked in a railroad coal car, or wandered by an industrial coal yard. Coal seems like an "old shoe" to most people, hardly an energy source that could get "out of control".

While our interviewees generally agreed on the problem of public ignorance about nuclear power, there was no consensus at all about what should be done to correct the problem. Some respondents were pessimistic that any major good could be accomplished through education, and one suggested the following dilemma for a science education program: If the program is narrow enough to focus on issues of concern to the nuclear industry, it will not attract attendees, while a more general course would not provide sufficient focus on the problems of specific concern to the nuclear industry.

On the other hand, some respondents thought public education could be helpful, and one mentioned a program which had worked fairly well. One respondent suggested the use of "comparison" statements, such as pointing out that a typical nuclear plant produces less radiation in a year than is experienced by a traveller on a single transcontinental airplane flight. Other respondents pointed to the usefulness of public tours of nuclear plants; graphics and 3-D model portrayals of how a reactor works; and a mini-course on nuclear energy.

A number of respondents observed that the nuclear power issue, like most public policy issues, interests only a small percentage of voters, namely, those who are directly affected by it. These respondents drew the conclusion that efforts to educate the general public on nuclear power would be wasted.

Communications

Several interviewees observed that public opinion on nuclear power is extremely sensitive to the exact use of words in opinion surveys. Several pointed out that certain words associated with advanced nuclear reactors, such as "passively safe" and "modular construction" could have negative connotations, and that the phrase "inherently safe" would not seem credible to many people.

A USCEA survey we were provided shows how sharply public opinion can diverge on the topic of advanced nuclear reactors depending on language used. The public was asked which of the following terms describing advanced reactors "means something good to you", and responded as indicated:

Term	Means something good
"Safer"	49%
"Naturally safe"	44%
"Inherently safe"	26%
"Walkaway safe"	26%
"Passively safe"	10%
"Transparently safe"	9%
None	12%

Another concern of our Advisory Group was that certain terms associated with nuclear power seem to evoke strong negative connotations. "Meltdown" is an obvious example. While acknowledging this dilemma, respondents pointed out that the problem is not limited to the issue of nuclear power.

As the 1988 presidential campaign's focus on the "L" word demonstrates, and as the bandying about of "homelessness", "pollution", "competitiveness" and other such terms demonstrates, a word that at one time was emotionally neutral can become a highly charged symbol in the hands of political combatants. Respondents tended to feel that this communications problem was part of the more general problem of technical education, discussed above.

Images of nuclear power are not, of course, limited to individual words. One respondent pointed out that the popular TV show "The Simpsons" has a strong anti-nuclear message, and another respondent suggested that the shape of nuclear reactor facilities can create unpleasant associations in people's minds. Correctives to these problems were not discussed.

Conclusions. An accompanying memo draws some tentative conclusions about public opinion from this Interim Report. I believe it is appropriate at this stage to evaluate this Interim Report, and the accompanying Conclusions memo, and then sharpen the lines of our queries, before continuing with our interviews.

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