

PUBLIC EDUCATION ON
NUCLEAR WASTE MANAGEMENT

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ABSTRACT

Two informal surveys made by the author indicate that increasing amounts of public information on nuclear energy and waste management are available from a number of organizations. The production of the book Understanding Radioactive Waste revealed several principles about writing for the public. It is recommended that communication and planning among groups responsible for public information be strengthened significantly, and that greater attention be given to the needs in the schools for education in nuclear energy, energy, science, and technology.

PUBLIC EDUCATION AND NUCLEAR POWER

The success of the nuclear enterprise depends on our ability to continue to safely operate power plants and to handle their wastes. Regardless of our performance record, however, the public will accept nuclear power only if it perceives that it is safe. I think that we all agree that improved facts and knowledge on the part of the general public, and especially its leaders, are essential to that favorable opinion. More broadly, our goal must be the education of the public, implying understanding as well.

I should like to address my remarks today to three related topics. First is an update on the status of public information on waste management. Second is a description of the process by which we developed the book Understanding Radioactive Waste and some of the lessons we learned. Third are some thoughts on broader implications and what I believe we must do, individually and collectively, to further technological education.

THE STATUS OF PUBLIC INFORMATION

It is well known that the implementation of nuclear waste disposal has been hampered by frequent changes in direction that suggest uncertainty to the public. In a similar way, the understanding of nuclear energy, of which wastes is a subtopic, has not been furthered by the several changes in Administration policy. In the early days of the 1950s and into the 1960s, each new accomplishment was described in glowing terms by the Atomic Energy Commission and heralded in the press with awe and pride in our technological growth. The old AEC published about a hundred booklets and pamphlets that schools could use to strengthen the belief that atomic energy was a boon to mankind. John Therault of DOE notes that over twelve million of these were distributed, starting in 1962. However, the late 1960s and the early 1970s brought the anti-military, anti-government, and anti-industry reactions. These were accompanied by the environmental movement and public interest causes that questioned every industrial process and product. The Carter Administration epitomized the culmination of many of these trends. Renewable resources and conservation were promoted vigorously to the detriment of conventional and nuclear sources of energy. Literature supplies dried up or were frozen and no new material was issued. The President stated that

nuclear was an energy source of last resort. Industry had not been required to supply extensive public information and was not ready to fill the information gap. On the other hand, the climate was ideal for anti-nuclear forces to fill the void with books, articles, speeches, rallies, and marches, with all the drama that attracts the press and the public.

Two years ago, I carried out an informal survey by telephone of the status of public information on nuclear wastes and related subjects in behalf of Battelle Pacific Northwest Laboratories and the Department of Energy. In the course of the study, I encountered the 1980 hearings of the Subcommittee on Science and Technology, and the report of Congressman Mike McCormack that most of the earlier AEC material had been destroyed and that DOE information was very limited, by deliberate policy decision. When I called the Technical Information Center at Oak Ridge for material on nuclear energy, I received a letter stating that they did not have any, but listed some 15 references in magazines such as Scientific American, Fortune, and EPRI Journal. They also referred me to the American Nuclear Society, the Atomic Industrial Forum, and the Nuclear Regulatory Commission. However, as I pursued the matter with individual laboratories of DOE, I was more successful. It was clear that there was a relaxation of the earlier strictures against the production of nuclear information.

I found that there was a great deal of effort being expended at the field level to produce informational material, especially at the Office of Nuclear Waste Isolation of Battelle Memorial Institute at Columbus and the Low-Level Waste Program of EG&G/DOE at Idaho Falls. Several industrial organizations such as Westinghouse and the Atomic Industrial Forum had prepared material on radioactive wastes. I got the impression, however, that the overall public information program involving societies, industry, and government needed some improvement. There was no long-range plan in place, not much consideration was given to the ability of the average citizen to understand, little material was available for the primary and secondary schools, the material often was not very interesting, and the medium was not necessarily the one that has the greatest impact. In this connection, let me note a recent study by the National Science Foundation that shows that the source of information on energy among young adults is 50% TV and radio,

20% newspapers, 15% journals, and 5% books. One recommendation in my report that I still regard as important is that such a survey should be expanded to include all aspects of nuclear technology, not just the waste topic, that material from all sources including foreign be included, and that all interested persons be able to become familiar with the material and how to acquire copies.

RECENT EFFORTS IN PUBLIC EDUCATION

Let me now report on some of the newer activities in public information on waste management around the country. The survey, conducted in 1983, is not complete, for which I apologize. The Department of Energy has distinctly changed its policy regarding nuclear information, I am happy to say. In the July 1982 Program Summary of the Nuclear Waste Management and Fuel Cycle Programs, they have included a good statement on Public Information as it relates to decision-making and acceptance. DOE has made some valiant attempts to formulate a comprehensive information program, but I gather they have been intimidated by some antinuclear congressmen. Janie Shaheen of the waste program reports that they are again working on a long-range plan that will determine the audience and the nature of the material and medium that is needed for best communication of information, especially at locations where the new Waste Act will impact the people. Vic Trebules tells me that DOE has commissioned Argonne National Laboratory to develop new educational and informational materials, with some of it related to radioactive wastes. Included in the ANL effort are a 28-minute film and a 40-page booklet on the whole nuclear fuel cycle, a series of 8 pamphlets on selected topics such as waste, transportation, safety, etc., a few one-page fact sheets, a permanent exhibit for the Chicago Museum, and a set of nuclear energy modules for junior high school teachers' kits. Stanley Nealey and his associates at Battelle's Human Affairs Research Centers in Seattle have been asked to review the ANL material for suitability from a social sciences standpoint.

The Office of Nuclear Waste Isolation at BMI continues to distribute their attractive fact sheets on spent fuel, wastes, transportation, and disposal, and provides a 25-minute film, a science museum exhibit, a Q&A booklet, and various smaller exhibits. Dianne Cattran of ONWI informs me that the film "NWI: A Progress Report" has had over 3000 bookings. In a recent talk, John Mountain of ONWI stated that an information network was necessary in order to communicate with people throughout the U.S., with information transfer facilitated through close relationships with the local press. However, he notes that the DOE funds available for public information are very meager and urges the private sector to take leadership as a matter of enlightened self-interest.

The Atomic Industrial Forum maintains a Public Affairs and Information Program. It serves both the industry and journalists as a resource of facts and figures. Last year, AIF organized three fact-finding tours of waste facilities for selected people in communications. Carl Walske's op-ed article on the importance of the Waste Act was distributed to 500 newspapers. Paul Turner and Robert Dobkin of AIF tell me that their Public Affairs and Information Program is currently preparing an updated booklet on technological and political aspects of the issues. AIF is quick to respond to misinformation. Late last November, for example, it prepared a refutation of a report by the anti-nuclear Council on Economic Priorities dealing with the transportation of waste.

The Committee on Energy Awareness, an organization supported by the utilities of the country, has prepared a fine bibliography called "The Management of Radioactive Wastes". An update of the May 1982 edition is being developed, according to Eugene Cramer, who is chairman of the Utilities Nuclear Waste Management Group of the Edison Electric Institute. He and his committee have been active in placing copies of the bibliography, my waste book, a slide/tape presentation, and a videotape program produced by Science Software Systems of Seattle, with assistance by Battelle's PNL. Also, Russell Stanford, Program Manager of UNWMMG, sent me some of the useful literature they are supplying groups that are working out low-level waste compacts. You may have read in the December 1982 issue of Nuclear Industry about the appointment of Harold Finger to head the Committee on Energy Awareness and direct a major advertising campaign for electric power, including nuclear and coal. As I understand the situation, the bulk of this multimillion dollar project will have to go for media costs, with only a small fraction for the generation of the material.

The American Nuclear Society has prepared a speaker's kit entitled "Transporting Nuclear Materials", with 26 slides and accompanying facts and text, according to Darlene Schmidt. They also lend a four-panel display called "Nuclear Waste, Questions and Answers".

The examples cited above show that many people and groups are seeking to meet the perceived needs of the public for information. The work is not coordinated, of course, because the organizations are independent, and there does not seem to be much communication between groups. If this observation is correct, it would appear that some effort should be addressed to organizing our forces toward some agreed-on goals and strategies. I wonder whether we have any evidence that the material being produced reaches a significant portion of the American public, whether it is favorably received, and whether it is causing any measurable change in attitude. In any case, I believe that we should all know what each other is doing in this area, necessitating continual update on the status and nature of public education material that is available. As a stronger recommendation, I support Stan Nealey's belief that a comprehensive long-range information plan should be developed, in which each organization plays its part, the audiences are well defined, the appropriate media, level, and topics are determined, with a systematic evaluation of the effectiveness of the material produced.

THE PREPARATION OF UNDERSTANDING RADIOACTIVE WASTE

Early in 1979, Jack Robinson of Battelle Pacific Northwest Laboratories sent me a copy of his program for Waste Management System Studies. Included was a commitment to consider both technical and social aspects. I was prompted to propose that a document be written that might be titled "Issues, Ideas, and Answers in Nuclear Waste Management". Jack responded favorably, and we laid out the topics to be covered and the general scope within the headings. At the university, my graduate students and I started the collection of reference material, and the writing was begun early in 1980. By late 1981 we had completed several drafts, experienced many reviews, and issued a report PNL-3570 entitled "Understanding Radioactive Waste". The material was reprinted in book form in March 1982 by Battelle Press, Columbus. The Contents of the book appear in Table I. The key assumptions made initially and the principles deduced in the course of the project are as follows:

1. An informed public will make better decisions. Teachers and young people especially need factual information.
2. A complex technology must be explained to the layman in ordinary language, in an interesting manner.
3. Some appreciation of nuclear processes and facilities such as reactors is needed in order to appreciate the waste problem.
4. The writing style must involve simple words and active voice rather than complicated words and passive voice of typical technical literature.
5. A generous supply of diagrams and photographs is needed to attract and hold the reader's attention.
6. A document that is to be used by the public should be reviewed by members of that public. Our material had the benefit to review by teachers, several students, nuclear waste experts, an environmentalist, and liberal arts majors.
7. Finally, and very importantly, the presentation should be unbiased, reflecting neither pro-nuclear or anti-nuclear views.

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Table I. Contents of Understanding Radioactive Waste

Since the issuance of the book about one year ago, some 8000 copies have been sold. The Utility Nuclear Waste Management Group obtained and distributed 2000 copies to utilities which in turn supplied books to schools and libraries in their service areas. Appreciation is extended to Eugene Cramer for his leadership of this program.

The book has served as basis for some lectures and workshops. One successful example was at the annual meeting of the Science Teachers Association of New York State, with sponsorship by several utilities in the region. I had a strong impression that the teachers were eager for nuclear energy information that they felt was authoritative and unbiased. The book was also a resource for a series of educational videotapes on radioactive wastes mentioned earlier. As a part of an information program of our local utility, Carolina Power and Light Company, copies of the book were distributed to all schools in our county. Before the gift could be accepted, it was necessary that the school system Media Committee review the material. They thought so highly of the book that they suggested that I submit it for placement on the recommended list of the whole North Carolina school system. As a part of our program to make known the availability of the information, Jack Robinson and I have submitted a paper entitled "The Writing of Understanding Radioactive Waste" to The Science Teacher, the official publication of the National Science Teachers Association. A revision of the book is being prepared, based on suggestions by reviewers and the passage of the Waste Act of 1982 by Congress last December. John Graham of the American Nuclear Society was very helpful in keeping me informed about progress on the legislation. Also, a number of people in the Department of Energy have kindly provided the latest information available on policy and plans in the national waste program.

THE ROLE OF EDUCATION

Two years ago at this conference, a very significant paper was presented by the educator Beth Ledbetter. She emphasized that our young people were growing up with a strong anti-nuclear attitude, engendered by television, movies, and schools, where factual information was lacking. I asked her recently if she had any new thoughts that I could convey to the present conference. She said that the energy material coming into the schools is still basically anti-nuclear. The most recent problem she says is the inability or unwillingness of the media to distinguish between nuclear power and nuclear weapons. I told her that the American Nuclear Society had a committee chaired by Chauncey Starr looking at this problem, and that I would keep her informed. All this raises the question, "How can we get the word to all teachers and all children?" It appears that we should be developing primary and secondary school textbooks on energy and environment, with audio-visual material, seeking to contribute the correct facts and ideas.

The situation in the schools alluded to by Beth Ledbetter is symptomatic of an even greater issue that is beginning to get some national attention. Let me go back in history to set the stage for the problem that we face today. Many of you recall the era of the late 1950s, when the challenge of the Russian 'Sputnik' prompted the United States to initiate a major educational endeavor, to upgrade science and mathematics in the schools. Great amounts of Federal money were expended on new programs. But as the U.S. space program became successful and faded, and anti-technology attitudes grew, the urgency of continuing the support waned. To illustrate: in 1959, 46% of NSF's funds went into science education; by 1981 it had dropped to less than 7%. Of course the total NSF program dollars have increased, but the present expenditure on science education is still only half what it was at the peak, and this is disregarding inflation.

The high schools in recent times face increasing economic problems accompanied by shortages of qualified teachers, especially in the physical sciences and mathematics. Great numbers of teachers have left the schools for better-paying jobs in industry. Perusal of a 1982 National Science Foundation document entitled "Science and Engineering Education: Data and Information" reveals some interesting and often disturbing facts. There was a critical shortage in the 1981 supply of secondary science and mathematics teachers in 43 of the 47 states reporting. Public school teachers have become disenchanting with the profession. A survey asked if they would enter the teaching field, knowing what they do now. Whereas in 1961 half said they would, by 1981 only a fifth said they would. Fewer and fewer students elect to prepare for teaching in these subjects. The numbers of BS degrees in mathematics education, for example, has dropped from over 2400 to less than 800 in a period of 10 years, in spite of the increase in total college degrees. This can be correlated with corresponding reductions in faculties in the colleges.

Recently, the best the high schools can do is to provide some preparatory work for the college-bound student, especially in science and engineering, often utilizing teachers who are not qualified in the subjects taught. The lack of interest in science on the part of the average student and the inadequate teaching staff means that only an elite group is educated in the subjects on which our new technology is based. Data are available on this situation. Whereas 79% of seniors in high school take Algebra I, only 8% take precalculus or calculus, which says that the average student gets only a smattering of math in high school. However, there is little demand for more science and math on the part of the students. Possible reasons are that they do not like the subjects, or find them too difficult, or are not inspired by their teachers.

There are many discouraging statistics about the situation in higher education as well, with engineering school faculty shortages, inadequate laboratory equipment, and a decline in domestic graduate students. The picture is gloomy when we consider the fact that the ability of the United States to maintain leadership in research and development depends on the continued production of technically capable people at all levels.

What to do about the situation is of real concern. Some enthusiasts believe the microcomputer can stimulate much interest and help change public school education from being, as one speaker called it, "joyless, uncreative, cruel, mean-spirited, and competitive". Others, such as NSF's blue-ribbon commission, which has identified the principal concern as "declining achievement and participation at a time of increasing national need", believe that the identification of examples of excellent teaching programs and wide-spread publicity about them will have a beneficial effect.

I think it will take a national commitment to effect a significant change. Student interest in mathematics, science, and technology is a function of the intellectual climate and the opinions held by family and peers. Ignorance of science and its importance on the part of the public is self-perpetuating in that it discourages the next generation from electing science in school and becoming sufficiently knowledgeable about it to give political support as adults. As a consequence, adequate funds for education are not forthcoming at the local, state, or national level. The only thing that can

counteract that cycle is the general understanding that it is a matter of national survival.

Nuclear power has suffered in reputation for the well-publicized reasons -- anti-nuclear actions, economic difficulties, and Three Mile Island, but it has also been caught in the general national problem of declining status of intellectual endeavors, including technical. The implication is that we must not restrict our attention to developing public information on radioactive wastes, or even to nuclear power, but more broadly to science and technology.