LUNCHEON MEETING

held at the

Sheraton-Palace Hotel

Wednesday, August 14, 1974

THE STATE OF NUCLEAR POWER REGULATION

L. Manning Muntzing

CHAIRMAN: Dade W. Moeller

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L. Manning Muntzing
Director of Regulation
U.S. Atomic Energy Commission
Washington, D.C.

In these dramatic days of change in our national leadership it is important that we pause to examine where we stand with the more significant aspects of economic and governmental activity. By taking this opportunity we can gain the perspective needed to guide our actions for the future.

The Atomic Energy Commission's regulatory program for nuclear power requires that the agency reach public interest decisions on proposals made by industry, taking into consideration the views of other interested organizations, including those who oppose the proposals.

To appraise the state of the Regulatory program at this time, we must consider the status of all of the key entities. What are the intentions and matching capabilities of the regulated industry? What capacity have interested organizations, including critics, achieved to define and illuminate the issues through searching inquiry and constructive criticism? And finally, what is the ability of the nuclear regulatory program to handle effectively the issues before it?

Nuclear Industry

Although development of civilian nuclear power technology has been proceeding for more than 20 years, industry's acceptance of nuclear power as a viable commercial technology began less than ten years ago. At that time a proposal was made to build a 500 megawatt plant solely on economic grounds. In the years that followed, there ensued a rush of orders for plants of increasing capacity, ranging up to 1300 electrical megawatts.

For each of the past three years, more than half of all steam generating capacity ordered by utilities has been nuclear, and it appears that this will be true also in 1974. There were only 12 nuclear stations in 1965 which together produced about four billion kilowatt-hours of electricity. In 1973 some 83 billion kilowatt-hours were produced by 40 nuclear units.

As of August 1 of this year, the number of nuclear plants licensed to operate had increased to 48. Construction was going forward on 71 other nuclear units, with 118 more either on order or publicly announced. These 237 nuclear plants built, building or planned represent a total generating capacity of 233,000 electrical megawatts, more than the nation's total generating capacity from all sources ten years ago.

This surge to nuclear power has been occurring at a pace which was not anticipated several years ago. For example, in a Report to the President prepared in 1962 by the AEC, it was predicted that nuclear power capacity would represent only about seven percent of this country's total installed electrical capacity by the end of 1980. It has already, in mid-1974, reached 6.7 percent of the national total and is expected to exceed 10 percent by the end of next year.

The industry's embrace of nuclear power has been based on certain clear advantages in the circumstances of today.

Nuclear power plants are environmentally more acceptable, since they do not pollute the air as do fossil-fueled plants. Insofar as mining, processing and transportation are concerned, the nuclear fuel cycle is less environmentally disruptive than the fuel cycle for coal and oil.

Another inducement to going nuclear has been the fact that the supply of nuclear fuel is relatively more assured than is the domestic supply of natural gas or of environmentally acceptable oil or coal.

Perhaps the primary motive leading utilities to select the nuclear option has been its advantage over fossil fuel plants in electric generating costs. This was already apparent in 1972 when a comparative study by the AEC of 18 utility systems having both nuclear and fossil plants showed nuclear generating costs averaging 8.1 mills per kilowatt-hour as against an average of 10.3 mills per kilowatt-hour for the fossil plants.

All indications are that the economic disparity between nuclear and fossil-fueled plants will become greater in the future. AEC estimated last year that, for 1,000 megawatt plants beginning operation in 1981, generating costs in mills per kilowatt-hour will be about 15 for light water nuclear plants, about 18 for coal-fired plants, and over 33 for oil-fired plants.

While utilities have had these reasons for selecting nuclear power, the choice has been far from unanimous. Those who have adopted nuclear power have done so recognizing that there are also certain deterrents to going nuclear.

Prior to the energy crisis of last winter, a principal problem from the industry's point of view was the regulatory process. In fulfillment of its statutory responsibilities to protect the public health and safety, the environment and national security, the AEC has subjected the design, construction and operation of nuclear power plants to rigorous regulation. Granting this necessity, the regulated industry nevertheless has had valid bases for complaint.

There was indeed insufficient guidance provided by the AEC as to the form and content of applications. In addition, codes and other requirements were changed frequently as technology advanced. This necessitated repeated changes in design, leading in turn to unexpected changes in materials and manpower requirements and to consequent

schedule delays. Excessive time consumed in review added further to delays.

In extenuation for these deficiencies, one might say that the AEC was simply not prepared for the sudden rush of nuclear applications. Further, the avalanche of additional work imposed by new requirements under the National Environmental Policy Act greatly complicated the Commission's ability to remedy the conditions about which industry complained. We did do our utmost to respond, however, knowing that regulation which is not timely cannot in the long run be effective. As I will discuss later, we have largely remedied, or are on the way to remedying, most of the prior regulatory deficiencies.

Within the past year, however, a further deterrent to the addition of nuclear plants, possibly more inhibiting than any before, has appeared in the form of financial difficulties. Severe problems in financing large construction programs have led utilities to postpone previously planned expansion of capacity. It is estimated that construction plans for the next five years have already been reduced by over $8 billion, amounting to a deferral of some 65,000 megawatts of capacity. Further cutbacks can be expected.

More than half of the capacity already deferred is nuclear. While nuclear plants have an economic advantage overall because of lower fuel costs, their capital costs are higher than those of fossil plants. A pressing motivation of utilities at the moment is to hold financing to a minimum.

The essentiality of adequate supplies of electricity to maintain our standards of life, public health and safety, national security and other essential values is well known. It is basic to the charter of a public utility that it must provide the services required by the public.

As some have claimed, much of the deferred capacity may not be needed as soon as originally forecast because of a slowdown in consumer demand. Nationwide kilowatt-hour sales this year have been running only about two percent above those of last year, as compared to the seven percent annual increases which have been the rule for many years. Higher rates charged by utilities may account for a part of this slowdown. It may also be in part a welcome indication that a much needed conservation ethic is beginning to take hold.

To rely on a continuation of decreased demand as a rationale for deferrals of capacity expansion may, however, be dangerous in the extreme. There has been insufficient time to study the phenomenon in order to understand its true significance. No one can be sure that it is more than a temporary deviation from a long term trend and that demand increases will not resume their previous course.

It should not be forgotten, moreover, that one of the means most often advocated for achieving independence from foreign oil supplies is by large scale switching from oil to electricity for such applications as heating and transportation. Such increased electrification of the economy will clearly be impossible if the needed

power plants are not in place.

Increasing the possible danger of inadequate electricity is a widespread failure to maintain construction schedules in the field. A principal reason has been a failure of design efforts to keep pace with construction progress. This results in a failure to coordinate adequately efforts on the job site, particularly an inability to order materials and components so that they will be present on the site when needed. Greater design efforts need to be made before construction begins. This should be assisted in the near term by the Commission's outline of the means for replicating earlier designs for use in new facilities.

Compounding the effects of deferred expansion and schedule delays affecting nuclear generating capacity are evidences of a pulling back in other segments of the nuclear industry, particularly in segments vitally affecting the nuclear fuel cycle. Plans for the first private uranium enrichment plant have yet to be settled. The design of new reprocessing and fuel fabrication plants has been delayed. There is also a need for greater efforts in mining and milling in order to increase the availability of uranium resources.

This is a time as difficult as any which the nuclear industry has confronted in recent years. Many tough decisions must be made. A number of old concepts need to be rethought, including those which have shaped forecasting and financing methods. Above all, it should be clear to any reasonable observer that this is no time for any segment of the industry to be in a coasting or drifting mode. Strong initiatives, deliberate planning, and organized efforts are essential if the industry is to maintain the competence necessary to meet its responsibilities to the nation.

Nuclear Critics

Until the late 1960's such intervention as existed in nuclear power plant licensing cases came mostly from those who supported the proposed facility for its economic benefits to the community. Opposition, where it appeared, tended to be limited to the statement of nebulous and generally uninformed fears.

Beginning in the late 1960's, opposition became more frequent. During these years, however, intervenors seemed to feel overwhelmed by the process, including the difficulty of obtaining needed information from the AEC and their own lack of scientific expertise. Under the circumstances, intervenors in some cases felt that the only way they could exercise any influence was by using legal strategems to cause delay.

In the last several years we have witnessed a steady and most gratifying improvement in the constructiveness of intervention. During this time intervenors have become better organized and won new support. The Calvert Cliffs lawsuit, culminating in the court decision of July 23, 1971, had of course an immense influence on AEC's regulatory processes insofar as its responsibilities under the National Environmental Policy Act were concerned. This decision greatly

increased the prestige and confidence of intervenors. In my opinion, it added also a sobering note of increased responsibility.

Since 1971 widespread changes have been made in the philosophy, organization and procedures of AEC's regulatory activities. Among the most important changes have been a greater openness and candor in dealing with intervenors and other interested members of the public.

It is probably no coincidence that intervenors have during this period of change in our procedures become notably more constructive in their activities. They tend now to be concentrating their attention on fewer issues in each case, focusing on those which genuinely need to be discussed in order to protect the public and the environment. Intervenors have also demonstrated an increasing willingness to discuss issues informally, foregoing their rights to insist that the matters be considered at protracted hearings. They have shown a tendency, furthermore, to approach these discussions with open minds, and also a willingness to reach agreements in the public interest. Several examples illustrate these gratifying trends:

> In one case where intervenors had initially raised 175 issues, they were willing on the basis of discussions with the Regulatory staff to reduce this number to 13, each one of which was significant.
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> In another case, an intervenor could have delayed the restoration to full power of four reactors whose power levels had been restricted for a period of time. He was, however, persuaded by the staff's technical justification and withdrew his request for a hearing.
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> In two other cases where intervenors had raised important questions they could have insisted on resolving all issues before the plants could begin operation. Under the conditions existing at the time, this would have meant a delay of at least six months. The intervenors were willing to agree to the granting of partial power licenses pending a full hearing so that the startup times were not extended.
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> In another case hearing time was reduced from a possible seven weeks to two days because of a cooperative stipulation of all issues worked out among the applicant, the staff, and intervenors.

Intervenors acting in such a responsible manner cannot be accused of working to the detriment of the regulatory process and against the public interest by causing unnecessary delay in the operation of nuclear power plants. On the contrary, by asking penetrating questions, by alerting people to difficult problems, and by insisting on adequate technical justifications, they have brought about earlier resolution of some problems than might otherwise have been reached and have added to the certainty with which problems have been resolved.

The constructive posture of intervenors is not a universal one, of course. There is still an occasional intervention where belligerence predominates over reason. By and large, however, intervenors have become a positive force in the regulatory process and we hope to obtain increasing benefit from their constructive contributions.

General critics of nuclear power outside the context of individual licensing cases can also play an important constructive role through responsible approaches, since in many instances they receive the attention and have the confidence of large segments of the public. It jeopardizes the national welfare, however, when nuclear critics become so victimized by biased data and inadequate technical advice that they engage in highly emotional campaigns to stop nuclear power altogether.

While a large majority of the committed public favors the expansion of nuclear power, a significant number of people have yet to make up their minds. Those who seek to guide the public have, therefore, a responsibility to pursue a fair and objective discussion of the facts. Unfortunately, this has not been the consistent course on nuclear issues.

Nuclear Regulation

The status of AEC's regulatory program and organization in 1974 is altogether different than it was several years ago. At that time we were so engulfed by backlogs and crises that the bulk of our manpower resources was continually assigned to working on individual problems as they arose. We were like a bucket brigade fighting a forest fire, able at best to react to the latest outbreaks, but with little ability to anticipate or prevent them.

One of the foremost regulatory problems three years ago was the time required to reach licensing decisions. In 1970 the regulatory system required an average of 40 months to reach construction permit decisions. Since that time we have increased manpower, restructured the regulatory framework and scheduled licensing reviews using management logic networks. Construction permit decisions are now reached in 19 months, less than half the time required a few years ago. Furthermore, new AEC regulations are expected to reduce the time that the AEC is on the critical path prior to the start of site work to ten months on the average.

Several years ago there were instances when completed plants sat idle because the regulatory process had not been completed. At that time the AEC made it a goal to complete the licensing process at the same time that construction of the plant is completed. For the past year this goal has been achieved. Today there are no indications that finished plants will again sit idle awaiting license decisions.

It is important to note that the significant reductions in the time required for individual licensing reviews have been achieved while maintaining the quality of the reviews. In addition, the past three years has witnessed an obvious, although sometimes erratic, shift towards establishing a more generic approach to nuclear power regulation.

For example, we came to grips with two issues that were emerging time after time in licensing proceedings; namely, the criteria for emergency core cooling systems and the releases of radiation during routine operation of power plants. Both issues involved addressing a problem that had beset nuclear power regulation, a lack of quantification.

A kindred effort has been the study that the AEC began two years ago, under the direction of Professor Norman Rasmussen of the Massachusetts Institute of Technology, in order to quantify reactor safety risks. Early evidence from this study seems to indicate that the melting of a nuclear reactor core--an occurrence which would be the last of a sequence of highly improbable, though not impossible, events--would not cause the extraordinarily wide devastation which critics have postulated. Instead, it would produce fatalities more akin to those resulting from a large aircraft crash. The study's results indicate, moreover, that the likelihood of such an occurrence is less than one in a million per year for each reactor.

Based on the advances achieved in quantification, Professor Bernard L. Cohen, Director of the Nuclear Physics Laboratory at the University of Pittsburgh, has recently put the hazards from nuclear power in perspective. He indicates that, if all of our present electric power were derived from nuclear fission, routine releases of radioactivity would cause about eight cancer deaths per year in this country, and that there would be an accident once in 2,500 years that would kill typically 500 people, an average of 0.2 deaths per year.

Comparing these risks with those which each of us face every day, Professor Cohen estmates the risk from nuclear power as being a little more than the risk involved in driving 100 miles, in going swimming for one extra hour in our lifetime, in smoking one cigarette every eight years, or in being a hundredth of an ounce overweight. Acknowledging that some critics disagree with the estimates derived from the best evidence, Dr. Cohen states: "If the worst fears of the critics should be correct, all these numbers would be multiplied by 25," making the danger of nuclear power equivalent to that of smoking three cigarettes a year or of being one-quarter ounce overweight.

A key advance in nuclear power regulation in recent years has been the movement towards standardization throughout the nuclear power industry. Standardization will not only substantially shorten the time required to bring nuclear power plants on-line, but will also preclude unnecessary changes, since approved standardized designs will not be reexamined for a defined period of time unless significant new safety questions should mandate a change.

Industry has complained about the changes in regulatory requirements imposed on individual projects during their progress through the regulatory cycle. Those changes which caused the greatest impact on industry had significant safety importance and were imposed only after careful consideration by the AEC. Other changes, however, have been less than necessary. We have recognized industry's justified criticism of this seemingly capricious "ratcheting", and have taken steps to control it. For example, we will soon have in force standard

review plans which will document in considerable detail the standards and criteria to be applied in safety evaluations. This approach should help to stabilize the review process and lead to increased consistency. In addition, a Regulatory Requirements Review Committee composed of senior management officials is now functioning to determine which changes in requirements are necessary and to assure that such changes are implemented reasonably.

In 1971 a most apparent flaw in the nuclear regulatory program was the lack of industry-wide standards which did more than provide nomenclature. Since that time a significant body of standards has been developed at an increasing pace. In fiscal year 1974 alone, for example, 150 standards were produced. This compares with 25 developed in FY 1972 and 90 in FY 1973. The existence of this comprehensive body of standards is a key to strengthening quality assurance in the design, construction and operation of nuclear plants. Such a body of standards, taken together with a general leveling off in the design evolution curve, also makes much brighter the prospects for standardization throughout the nuclear industry.

Following the amendment of the antitrust section of the Atomic Energy Act more than three years ago, widespread uncertainty existed concerning the regulatory position on antitrust issues. Elimination of this uncertainty has given applicants the opportunity to shape their policies without agonizing perturbations. Thus far, antitrust reviews have delayed a licensing decision in only one instance, and even in that case it has been possible to authorize site work.

Despite the fact that the licensing logjam has been broken and significant progress made toward standardized approaches and generic rather than ad hoc resolutions of regulatory questions, consistent and critical review of the overall regulatory picture is still needed to ensure that maximum effectiveness and efficiency are maintained.

In this connection certain problems and challenges must receive increasing attention.

The time required from conception to operation of nuclear plants can still be improved. Various regulatory changes, including use of limited work authorizations, should cut about two years from the ten years which has typically been required for designing, reviewing and building nuclear plants. However, legislation now pending before Congress is needed to achieve a target of six years. What the proposed legislation would accomplish basically is to provide for hearings at earlier and more meaningful stages, to encourage greater use of nuclear plant standardization, and to make possible the use of predesignated sites for nuclear power facilities. The use of predesignated sites can be particularly important in helping to resolve environmental issues before resources are irretrievably committed and in assuring better advance planning of land and water use.

The siting of nuclear facilities involves some particularly difficult issues. In a number of cases in the past few years, siting problems have led to major changes in plant designs and in some cases to complete rejection of sites. These situations have had significant

adverse effects on schedules and costs--results that better guidance and criteria could have mitigated. A set of general site suitability criteria will be issued in the near future to provide guidance in determining whether a proposed site is suitable for a nuclear power plant. Also high on the list of siting priorities is the development of regulatory guidelines for nuclear energy centers which may house several reactors as well as supporting fuel cycle facilities.

The inherent hazards associated with the use of radioactive material as a commercial fuel raises concerns over safety in the transportation of the fuel, the management of radioactive wastes, and the need for safeguards to prevent plant sabotage and diversion of material for unauthorized uses. We are confident that these difficult problems can be resolved safely, but they require early attention.

The transportation of radioactive materials in this country has produced an excellent safety record. Nonetheless, given the expected increase in the number of such shipments in the years ahead, expanded efforts will be required to maintain this record.

A draft environmental impact statement on the management of wastes is in preparation which discusses waste storage technologies in considerable detail. In connection with this statement, certain regulatory policy changes will be made in order to meet future problems in this field.

Projections of increasing quantities of special nuclear material in commercial operations and the increase in terrorist activities have led the AEC to reexamine its programs for plant and materials protection. Strengthened requirements for physical protection of plants and for materials accounting have been implemented, and during the next year long term goals will be developed for the coming period when a large increase in the use of plutonium is expected.

As we reflect on the achievements of nuclear regulation over the past few years, we can feel confidence in our ability to move forward, particularly within the structure of an independent nuclear regulatory commission.

Conclusion

The ultimate measure of the activities of all the entities involved in nuclear power in the country is the fact that, despite all the dire prophecies of impending disaster, we have now had more than 200 reactor-years of operating experience without injury to any member of the public. A prime reason for this extraordinary safety record has been the ability of the nuclear industry, the critics of nuclear power, and the regulatory framework to respond and evolve in step with the demands imposed by advances in technology and expanding requirements.

The nuclear industry has to be recognized as one which has achieved rapid growth in an atmosphere of high public visibility, stringent quality control and rigorous regulatory requirements, a combination of factors rarely experienced before in industrial history.

Opponents of nuclear power, by and large, deserve credit for their ever more constructive contributions to regulatory processes and to public discussion of the issues.

Finally, it is important that all members of the public perceive that there has evolved in the past few years a philosophy of regulation that is neither for or against nuclear power--a philosophy that fosters a tough but fair approach to regulation predicated solely on the public interest.