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Honorable Nunzio J. Palladino  
Chairman  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Dear Dr. Palladino:

SUBJECT: ADDITIONAL ACRS COMMENTS ON PROPOSED NRC SAFETY GOAL POLICY  
STATEMENT

During its 312th meeting, April 10-12, 1986, the Advisory Committee on Reactor Safeguards continued its review of the issues associated with the promulgation of the proposed NRC Safety Goal Policy Statement. The Committee last commented on this matter in reports to you dated July 17, 1985 and March 19, 1986. We have reconsidered these two reports and reconfirmed their content. This matter was also discussed during an ACRS meeting with the Commission on March 28, 1986. The memorandum from Victor Stello, Jr., Acting EDO, to the Commission dated February 14, 1986 on Safety Goal Policy and the Draft Policy Statement on Safety Goals dated March 18, 1986 served as a focal point for this part of our review.

#### Issuance of Policy

As stated in our report of March 19, 1986, we favor early Commission action to adopt a safety goal policy.

#### Qualitative Goals

As stated in our report of March 19, 1986, we believe the policy statement should include the two qualitative goals as recommended by the EDO in his February 14, 1986 memorandum. We believe that nuclear power plants present substantially less public risk and offer significant environmental advantages over the only real alternative -- coal power plants. However, whether the specific comparison to other viable electric generating technology should be included in the statement of the safety goal policy is a matter which should be directly addressed by the Commissioners.

#### Quantitative Goals

As stated in our report of March 19, 1986, we believe the Safety Goal Policy Statement should include explicitly the two quantitative health objectives as described in the memorandum from the EDO dated February 14, 1986.

#### Performance Guidelines

It is evident that there is no means of observing health effects at the very low levels proposed. However, the health effects to be considered result only from the release of radioactive materials to the environment. The releases realized in connection with the normal operation of reactor plants are below the levels which result in effects even at the very low levels proposed. It is also clear that if the releases which might occur in the event of accidents are small enough, or infrequent enough, the stated objective can be met; in fact, it seems probable that most existing reactors have been

constructed and equipped and are operated in such a way that they already fulfill the requirements necessary to achieve the objective.

No release to the atmosphere on a scale significant in the context being considered can be envisaged except in circumstances in which the fuel of the core is severely damaged. Even in such a case, the capability of the containment (provided precisely for such a purpose) should prevent the sort of release to the atmosphere which would threaten to exceed the goals.

Consequently, conformance with the goals will have to be judged on the basis of the type and frequency of accidents, on the capability of containment, and in some cases on plant location. The focus of implementation of the policy should then be directed to these aspects of existing plants.

We believe the Commission should adopt certain plant performance guidelines as one satisfactory means to assure conformance with the safety goal objectives. These guidelines should be structured so that the principle of defense-in-depth is maintained. We are undecided as to whether these performance guidelines should be part of the policy statement or part of an accompanying directive to the NRC Staff. It may be unimportant and more a matter of style than substance. However, we believe the Commission itself should take responsibility for these guidelines and mandate their use.

We propose that the plant performance guidelines be regarded as fully acceptable surrogates for the safety goal objectives. That is, if it can be shown that the guidelines are met, then it is accepted that the safety goal is met. However, if the guidelines are not met, it might still be possible to meet the safety goals. In that case, explicit analyses to show compliance with the quantitative public health objectives would be required.

There should be two performance guidelines and consideration should be given to development of a third.

The first guideline would be that the chance of a loss of adequate core cooling with consequent severe core damage should be less than  $10^{-4}$  per reactor-year for all but a few small reactors.

The second guideline should relate to containment performance and should be such that the chance of a very large release of radioactive materials to the environment should be less than  $10^{-4}$  per reactor-year.

If feasible, a third guideline should be formulated concerning operational performance.

#### Implementation Plan

We are not satisfied with Section B, "Guidelines for Regulatory Implementation," of the March 18, 1986 draft. The safety goal should be regarded as a figure of merit by which to judge the adequacy of the regulations. The safety goal and the performance guidelines should be used in two ways:

- 1) as a means for judging the acceptability of proposed changes in regulations (such as the resolution of USIs, etc.), and
- 2) in the much more difficult task of assessing whether existing plants, designed, constructed, and operated to comply with past and current

regulations, adequately conform with the intent of the safety goal.

Considerable thought must be given to the second use. The question of whether it is essential that each individual plant, classes of plants, or only the general population of plants must be shown to be in conformance is not easily answered. Another question is whether the essential characteristics of plants that cause them to meet, or not to meet, the safety goals are related to their conformance with regulations or to the inherent characteristics of plant designs.

The Commissioners should be involved in these decisions and should state their intent to review and approve the primary features of proposals of the NRC Staff to implement the safety goal policy. Because of the complexity of the issues and the lack of experience in application, a review should be performed by the Commissioners in two or three years.

The Committee recommends that the Commission include in its policy a statement of intent that future nuclear power plants should be designed and operated even more safely and reliably than existing plants.

Additional comments by ACRS Member Harold W. Lewis are presented below.

Sincerely,

David A. Ward  
Chairman

Additional comments by ACRS Member Harold W. Lewis

I have nothing new to add to my earlier additional remarks, other than to say that this Committee report is closer to my own personal views than have been the previous ones. On the other hand, I have often been asked to provide a statement of just what I would like to see the Commission issue as a Safety Goal Policy Statement, and I have therefore taken the liberty of writing a draft, written as if I were the NRC, which I am well aware is not the case.

Honorable Nunzio J. Palladino

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I believe that detail beyond that contained here should not be in a Commission Policy Statement, but rather in Staff documents. Obviously, one may choose different numbers from those in the sequel, but the pattern of the statement is the substance of the following.

In the Atomic Energy Act of 1954, as amended, the Congress directed that the development of the peaceful uses of atomic energy be a national objective, and later directed the Nuclear Regulatory Commission to assure that such development proceed without compromise to the public health and safety or to

the common defense and security. The former has become the major preoccupation of the Commission, and we believe that the objective has so far been met. Nonetheless, just as a certain measure of risk is inevitable in the use of any technology, and in particular in any energy-producing technology, it is present for nuclear power, and the question of just how much risk is acceptable (what is commonly termed "how safe is safe enough?") must be answered. We have no guidance from the enabling legislation, and feel that we should set forth some principles, preferably quantitative, to help our Staff understand and implement our objectives, and to help the public judge them. This document is our statement of those principles, but it must be emphasized that they are just that -- principles -- and are not a new set of regulatory criteria that must be met by each licensed plant. They are rather a set of standards by which we and others may judge the effectiveness of our regulatory program.

As a cardinal principle, we intend to keep the risk from nuclear power so low that the risk of nuclear power does not play an important role in national decision making about energy choices. There are clearly other relevant factors -- environmental impact, cost, esthetics, land use, etc. -- but the limitation of risk is our responsibility.

A principle of this kind suffers from some inherent difficulties. In the first place, it is not quantitative, so it lacks specificity. It must be made quantitative before it can be judged, but then the second problem arises, which is that any quantitative assessment of risk, in the current state of the art, is beset with large uncertainty. Thus, we do not expect that a quantitative goal can be used as a threshold objective or regulatory tool, at least in the foreseeable future.

Nonetheless, it is useful to say what we mean. We mean that the probability of a large and unacceptable release of radioactivity from a nuclear power plant should be held, on the average, below one chance in a million per plant year. We will put that number in perspective below, in terms of current risks in life in America, but it means specifically that, with our prospective population of about a hundred nuclear power plants in operation, there is an overwhelming probability that such an unacceptable event will not occur in our lifetimes, or those of our children, or those of their children, and on and on for hundreds of generations. Presumably, the technology will evolve and improve over time, so that future Nuclear Regulatory Commissions will be able to do even better.

What remains is to ask how we can test whether we are achieving our objective. The tool for such a determination is probabilistic risk assessment, which can help enormously in this task, but which still involves large uncertainties, particularly in the "bottom line" assessments required here. Even so, we need to deal with the bottom line in order to measure our effectiveness so that it is, as a matter of expediency, necessary to break the task down into manageable pieces which are subject to analysis, still with uncertainty. We believe that we are now meeting our objective by, very roughly, maintaining a probability of core-melt (molten core on the floor of the reactor building) of less than a chance in ten thousand per year, with a chance of less than one in a hundred that such an event will lead to a major release of radioactivity outside the containment building, which is, after all, designed to provide just such protection. This division, part of our overall philosophy of defense-in-depth, is of course arbitrary and may change with time and knowledge, but this is the way we see the protection divided at this time.

It is useful to put the risk to which we have limited ourselves here into perspective, by comparing it to other risks in our society. Obviously, such a comparison cannot be precise, but it should serve to provide a measure of the way in which we rate that due to nuclear power, in familiar terms. Nuclear risk, since it involves the occurrence of a highly improbable accident, will, of course, always be more difficult to calculate. For example, the major damage to the health and safety of the public in the event of a radiation release of the sort we have described is in the late somatic effects, in other words cancer. In the United States every year approximately 400,000 people die of cancer from various causes. That is a number which has been going up for some cancers, notably lung cancer for known reasons, and down for others, but the age-adjusted rate has not changed dramatically in recent years. If, in the event of a truly catastrophic nuclear accident, a thousand people were to succumb to cancer over the next few decades, as a result of the radiation released, a probability of one in a million per year would mean, for the entire country, an average mortality rate of one tenth of a person per year, for a population of a hundred nuclear plants. This should be compared with the 400,000. If the population in the vicinity of the plant (those most directly affected) were, say, 100,000, this would contribute less than one one-thousandth of one percent of their cancer risk. By the same token, accidents from other causes (half of them related to motor vehicles) lead to about 100,000 immediate fatalities per year, and here too the contribution from nuclear power will be comparably low.

It is worth noting that current estimates for the rate at which coal, the only presently viable competing technology, causes fatalities are far higher.

As stated, we do not intend that these objectives be taken as new regulatory hurdles, but believe that the numbers we have chosen are reasonable. It is our intent to maintain this high level of safety, and as a first step, we will ask our staff to assure us, on an annual basis, that it is being maintained. The EDO should provide us in the near future with a plan describing how they will do that.

References:

1. Memorandum dated February 14, 1986 from Victor Stello, Jr., Acting Executive Director for Operations, to the Commission, Subject: "Safety Goal Policy," with enclosed Summary Paper on Safety Goals for the Operation of Nuclear Power Plants
2. Memorandum dated March 24, 1986 from Victor Stello, Jr., Acting Executive Director for Operations, to the Commission, Subject: "Safety Goal - Response to Memorandum from S. Chilk to V. Stello dated March 6, 1986," with enclosed Draft Policy Statement dated March 18, 1986 and NRC/PUC Interaction

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