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Safety Goals for the Operations of Nuclear Power Plants; Policy Statement; Republication

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AGENCY: Nuclear Regulatory Commission.

ACTION: Policy statement.

SUMMARY: This policy statement focuses on the risks to the public from nuclear power plant operation. Its objective is to establish goals that broadly define an acceptable level of radiological risk. In developing the policy statement, the NRC sponsored two public workshops during 1981, obtained public comments and held four public meetings during 1982, conducted a 2-year evaluation during 1983 to 1985, and received the views of its Advisory Committee on Reactor Safeguards.

The Commission has established two qualitative safety goals which are supported by two quantitative objectives. These two supporting objectives are based on the principle that nuclear risks should not be a significant addition to other societal risks. The Commission wants to make clear that no death attributable to nuclear power plant operation will ever be "acceptable" in the sense that the Commission would regard it as a routine or permissible event. The Commission is discussing acceptable risks, not acceptable deaths.

• The *qualitative safety goals* are as follows:

—Individual members of the public should be provided a level of

protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.

—Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

• The following *quantitative objectives* are to be used in determining achievement of the above safety goals:

—The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of one percent (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed.

—The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of one percent (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.

EFFECTIVE DATE: August 4, 1986.

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SUPPLEMENTARY INFORMATION: The following presents the Commission's Final Policy Statement on Safety Goals for the Operation of Nuclear Power Plants:

I. Introduction

A. Purpose and Scope

In its response to the recommendations of the President's Commission on the Accident at Three Mile Island, the Nuclear Regulatory Commission (NRC) stated that it was "prepared to move forward with an explicit policy statement on safety philosophy and the role of safety-cost tradeoffs in the NRC safety decisions." This policy statement is the result.

Current regulatory practices are believed to ensure that the basic statutory requirement, adequate protection of the public, is met. Nevertheless, current practices could be improved to provide a better means for testing the adequacy of and need for current and proposed regulatory requirements. The Commission believes that such improvement could lead to a more coherent and consistent regulation of nuclear power plants, a more predictable regulatory process, a public understanding of the regulatory criteria that the NRC applies, and public confidence in the safety of operating plants. This statement of NRC safety policy expresses the Commission's views on the level of risks to public health and safety that the industry should strive for in its nuclear power plants.

This policy statement focuses on the risks to the public from nuclear power plant operation. These are the risks from release of radioactive materials from the reactor to the environment from normal operations as well as from accidents. The Commission will refer to these risks as the risks of nuclear power plant operation. The risks from the nuclear fuel cycle are not included in the safety goals.

These fuel cycle risks have been considered in their own right and determined to be quite small. They will continue to receive careful consideration. The possible effects of sabotage or diversion of nuclear material are also not presently included in the safety goals. At present there is no basis on which to provide a measure of risk on these matters. It is the Commission's intention that everything that is needed will be done to keep these types of risks at their present very low level; and it is the Commission's expectation that efforts on this point will continue to be successful. With these exceptions, it is the Commission's intent that the risks from all the various initiating mechanisms be taken into account to the best of the capability of current evaluation techniques.

In the evaluation of nuclear power plant operation, the staff considers several types of releases. Current NRC practice addresses the risks to the public resulting from operating nuclear power plants. Before a nuclear power plant is licensed to operate, NRC prepares an environmental impact assessment which includes an evaluation of the radiological impacts of routine operation of the plant and accidents on the population in the region around the plant site. The assessment undergoes public comment and may be extensively probed in adjudicatory hearings. For all plants licensed to operate, NRC has found that there will be no measurable radiological impact on any member of the public from routine operation of the plant. (Reference: NRC staff calculations of radiological impact on humans contained in Final Environmental Statements for specific nuclear power plants; e.g., NUREG-0779, NUREG-0812, and NUREG-0854.)

The objective of the Commission's policy statement is to establish goals that broadly define an acceptable level of radiological risk that might be imposed on the public as a result of nuclear power plant operation. While this policy statement includes the risks of normal operation, as well as accidents, the Commission believes that because of compliance with Federal Radiation Council (FRC) guidance, (40 CFR Part 190), and NRC's regulations (10 CFR Part 20 and Appendix I to Part 50), the risks from routine emissions are small compared to the safety goals. Therefore, the Commission believes that these risks need not be routinely analyzed on a case-by-case basis in order to demonstrate conformance with the safety goals.

B. Development of this Statement of Safety Policy

In developing the policy statement, the Commission solicited and benefited from the information and suggestions provided by workshop discussions. NRC-sponsored workshops were held in Palo Alto, California, on April 1-3, 1981 and in Harpers Ferry, West Virginia, on July 23-24, 1981. The first workshop addressed general issues involved in developing safety goals. The second workshop focused on a discussion paper which presented proposed safety goals. Both workshops featured discussions among knowledgeable persons drawn from industry, public interest groups, universities, and elsewhere, who represented a broad range of perspectives and disciplines.

The NRC Office of Policy Evaluation submitted to the Commission for its consideration a Discussion Paper on Safety Goals for Nuclear Power Plants in November 1981 and a revised safety goal report in July 1982.

The Commission also took into consideration the comments and suggestions received from the public in response to the proposed Policy Statement on "Safety Goals for Nuclear Power Plants," published on February 17, 1982 (47 FR 7023). Following public comment, a revised Policy Statement was issued on March 14, 1983 (48 FR 10772) and a 2-year evaluation period began.

The Commission used the staff report and its recommendations that resulted from the 2-year evaluation of safety goals in developing this final Policy Statement. Additionally, the Commission had benefit of further comments from its Advisory Committee on Reactor Safeguards (ACRS) and by senior NRC management.

Based on the results of this information, the Commission has determined that the qualitative safety goals will remain unchanged from its March 1983 revised policy statement, and the Commission adopts these as its safety goals for the operation of nuclear power plants.

II. Qualitative Safety Goals

The Commission has decided to adopt qualitative safety goals that are supported by quantitative health effects objectives for use in the regulatory decisionmaking process. The Commission's first qualitative safety goal is that the risk from nuclear power plant operation should not be a significant contributor to a person's risk of accidental death or injury. The intent is to require such a level of safety that individuals living or working near nuclear power plants should be able to go about their daily lives without special concern by virtue of their proximity to these plants. Thus, the Commission's first safety goal is—

Individual members of the public should be provided a level of protection from the consequences of nuclear power plant operation such that individuals bear no significant additional risk to life and health.

Even though protection of individual members of the public inherently provides substantial societal protection, the Commission also decided that a limit should be placed on the societal risks posed by nuclear power plant operation. The Commission also believes that the risks of nuclear power plant operation should be comparable to or less than the risks from other viable means of generating the same quantity of electrical energy. Thus, the Commission's second safety goal is—

Societal risks to life and health from nuclear power plant operation should be comparable to or less than the risks of generating electricity by viable competing technologies and should not be a significant addition to other societal risks.

The broad spectrum of expert opinion on the risks posed by electrical generation by coal and the absence of authoritative data make it impractical to calibrate nuclear safety goals by comparing them with coal risks based on what we know today. However, the Commission has established the quantitative health effects objectives in such a way that nuclear risks are not a significant addition to other societal risks.

Severe core damage accidents can lead to more serious accidents with the potential for life-threatening offsite release of radiation, for evacuation of members of the public, and for contamination of public property. Apart from their health and safety consequences, severe core damage accidents can erode public confidence in the safety of nuclear power and can lead to further instability and unpredictability for the industry. In order to avoid these adverse consequences, the Commission intends to continue to pursue a regulatory program that has as its objective providing reasonable assurance, while giving appropriate consideration to the uncertainties involved, that a severe core damage accident will not occur at a U.S. nuclear power plant.

III. Quantitative Objectives Used To Gauge Achievement of The Safety Goals

A. General Considerations

The quantitative health effects objectives establish NRC guidance for public protection which nuclear plant designers and operators should strive to achieve. A key element in formulating a qualitative safety goal whose achievement is measured by quantitative health effects objectives is to understand both the strengths and limitations of the techniques by which one judges whether the qualitative safety goal has been met.

A major step forward in the development and refinement of accident risk quantification was taken in the Reactor Safety Study (WASH-1400) completed in 1975. The objective of the Study was "to try to reach some meaningful conclusions about the risk of nuclear accidents." The Study did not directly address the question of what level of risk from nuclear accidents was acceptable.

Since the completion of the Reactor Safety Study, further progress in developing probabilistic risk assessment and in accumulating relevant data has led to a recognition that it is feasible to begin to use quantitative safety objectives for limited purposes. However, because of the sizable uncertainties still present in the methods and the gaps in the data base—essential elements needed to gauge whether the objectives have been achieved—the quantitative objectives should be viewed as aiming points or numerical benchmarks of performance. In particular, because of the present limitations in the state of the art of quantitatively estimating risks, the quantitative health effects objectives are not a substitute for existing regulations.

The Commission recognizes the importance of mitigating the consequences of a core-melt accident and continues to emphasize features such as containment, siting in less populated areas, and emergency planning as integral parts of the defense-in-depth concept associated with its accident prevention and mitigation philosophy.

B. Quantitative Risk Objectives

The Commission wants to make clear at the beginning of this section that no death attributable to nuclear power plant operation will ever be "acceptable" in the sense that the Commission would regard it as a routine or permissible event. We are discussing acceptable risks, not acceptable deaths. In any fatal accident, a course of conduct posing an acceptable risk at one moment results in an unacceptable death moments later. This is true whether one speaks of driving, swimming, flying or generating electricity from coal. Each of these activities poses a calculable risk to society and to individuals. Some of those who accept the risk (or are part of a society that accepts risk) do not survive it. We intend that no such accidents will occur, but the possibility cannot be entirely eliminated. Furthermore, individual and societal risks from nuclear power plants are generally estimated to be considerably less than the risk that society is now exposed to from each of the other activities mentioned above.

C. Health Effects—Prompt and Latent Cancer Mortality Risks

The Commission has decided to adopt the following two health effects as the quantitative objectives concerning mortality risks to be used in determining achievement of the qualitative safety goals—

- *The risk to an average individual in the vicinity of a nuclear power plant of prompt fatalities that might result from reactor accidents should not exceed one-tenth of one percent (0.1 percent) of the sum of prompt fatality risks resulting from other accidents to which members of the U.S. population are generally exposed.*
- *The risk to the population in the area near a nuclear power plant of cancer fatalities that might result from nuclear power plant operation should not exceed one-tenth of one percent (0.1 percent) of the sum of cancer fatality risks resulting from all other causes.*

The Commission believes that this ratio of 0.1 percent appropriately reflects both of the qualitative goals—to provide that individuals and society bear no significant additional risk. However, this does not necessarily mean that an additional risk that exceeds 0.1 percent would by itself constitute a significant additional risk. The 0.1 percent ratio to other risks is low enough to support an expectation that people living or working near nuclear power plants would have no special concern due to the plant's proximity.

The average individual in the vicinity of the plant is defined as the average individual biologically (in terms of age and other risk factors) and locationally who resides within a mile from the plant site boundary. This means that the average individual is found by accumulating the estimated individual

risks and dividing by the number of individuals residing in the vicinity of the plant.

In applying the objective for individual risk of prompt fatality, the Commission has defined the vicinity as the area within 1 mile of the nuclear power plant site boundary, since calculations of the consequences of major reactor accidents suggest that individuals within a mile of the plant site boundary would generally be subject to the greatest risk of prompt death attributable to radiological causes. If there are no individuals residing within a mile of the plant boundary, an individual should, for evaluation purposes, be assumed to reside 1 mile from the site boundary.

In applying the objective for cancer fatalities as a population guideline for individuals in the area near the plant, the Commission has defined the population generally considered subject to significant risk as the population within 10 miles of the plant site. The bulk of significant exposures of the population to radiation would be concentrated within this distance, and thus this is the appropriate population for comparison with cancer fatality risks from all other causes. This objective would ensure that the estimated increase in the risk of delayed cancer fatalities from all potential radiation releases at a typical plant would be no more than a small fraction of the year-to-year normal variation in the expected cancer deaths from nonnuclear causes. Moreover, the prompt fatality objective for protecting individuals generally provides even greater protection to the population as a whole. That is, if the quantitiative objective for prompt fatality is met for individuals in the immediate vicinity of the plant, the estimated risk of delayed cancer fatality to persons within 10 miles of the plant and beyond would generally be much lower than the quantitative objective for cancer fatality. Thus, compliance with the prompt fatality objective applied to individuals close to the plant would generally mean that the aggregate estimated societal risk would be a number of times lower than it would be if compliance with just the objective applied to the population as a whole were involved. The distance for averaging the cancer fatality risk was taken as 50 miles in the 1983 policy statement. The change to 10 miles could be viewed to provide additional protection to individuals in the vicinity of the plant, although analyses indicate that this objective for cancer fatality will not be the controlling one. It also provides more representative societal protection, since the risk to the people beyond 10 miles will be less than the risk to the people within 10 miles.

IV. Treatment of Uncertainties

The Commission is aware that uncertainties are not caused by use of quantitative methodology in decisionmaking but are merely highlighted through use of the quantification process. Confidence in the use of probabilistic and risk assessment techniques has steadily improved since the time these were used in the Reactor Safety Study. In fact, through use of quantitative techniques, important uncertainties have been and continue to be brought into better focus and may even be reduced compared to those that would remain with sole reliance on deterministic decisionmaking. To the extent practicable, the Commission intends to ensure that the quantitative techniques used for regulatory decisionmaking take into account the potential uncertainties that exist so that an estimate can be made on the confidence level to be ascribed to the quantitative results.

The Commission has adopted the use of mean estimates for purposes of implementing the quantitative objectives of this safety goal policy (i.e., the mortality risk objectives). Use of the mean estimates comports with the customary practices for cost-benefit analyses and it is the correct usage for purposes of the mortality risk comparisons. Use of mean estimates does not however resolve the need to quantify (to the extent reasonable) and understand those important uncertainties involved in the reactor accident risk predictions. A number of uncertainties (e.g., thermal-hydraulic assumptions and the phenomenology of core-melt progression, fission product release and transport, and containment loads and performance) arise because of a direct lack of severe accident experience or knowledge of accident phenomenology along with data related to probability distributions.

In such a situation, it is necessary that proper attention be given not only to the range of uncertainty surrounding probabilistic estimates, but also to the phenomenology that most influences the uncertainties. For this reason, sensitivity studies should be performed to determine those uncertainties most important to the probabilistic estimates. The results of sensitivity of studies should be displayed showing, for example, the range of variation together with the underlying science or engineering assumptions that dominate this variation. Depending on the decision needs, the probabilistic results should also be reasonably balanced and supported through use of deterministic arguments. In this way, judgements can be made by the decisionmaker about the degree of confidence to be given to these estimates and assumptions. This is a key part of the process of determining the degree of regulatory conservatism that may be warranted for particular decisions. This defense-in-depth approach is expected to continue to ensure the protection of public health and safety.

V. Guidelines For Regulatory Implementation

The Commission approves use of the qualitative safety goals, including use of the quantitative health effects objectives in the regulatory decisionmaking process. The Commission recognizes that the safety goal can provide a useful tool by which the adequacy of regulations or regulatory decisions regarding changes to the regulations can be judged. Likewise, the safety goals could be of benefit in the much more difficult task of assessing whether existing plants, designed, constructed and operated to comply with past and current regulations, conform adequately with the intent of the safety goal policy.

However, in order to do this, the staff will require specific guidelines to use as a basis for determining whether a level of safety ascribed to a plant is consistent with the safety goal policy. As a separate matter, the Commission intends to review and approve guidance to the staff regarding such determinations. It is currently envisioned that this guidance would address matters such as plant performance guidelines, indicators for operational performance, and guidelines for conduct of cost-benefit analyses. This guidance would be derived from additional studies conducted by the staff and resulting in recommendations to the Commission. The guidance would be based on the following general performance guideline which is proposed by the Commission for further staff examination—

Consistent with the traditional defense-in-depth approach and the accident mitigation philosophy requiring reliable performance of containment systems, the overall mean frequency of a large release of radioactive materials to the environment from a reactor accident should be less than 1 in 1,000,000 per year of reactor operation.

To provide adequate protection of the public health and safety, current NRC regulations require conservatism in design, construction, testing, operation

and maintenance of nuclear power plants. A defense-in-depth approach has been mandated in order to prevent accidents from happening and to mitigate their consequences. Siting in less populated areas is emphasized. Furthermore, emergency response capabilities are mandated to provide additional defense-in-depth protection to the surrounding population.

These safety goals and these implementation guidelines are not meant as a substitute for NRC's regulations and do not relieve nuclear power plant permittees and licensees from complying with regulations. Nor are the safety goals and these implementation guidelines in and of themselves meant to serve as a sole basis for licensing decisions. However, if pursuant to these guidelines, information is developed that is applicable to a particular licensing decision, it may be considered as one factor in the licensing decision.

The additional views of Commissioner Asselstine and the separate views of Commissioner Bernthal are attached.

Dated at Washington, DC, this 30th day of July 1986.

For the Nuclear Regulatory Commission.

Lando W. Zech, Jr.,

Chairman.

Additional Views by Commissioner Asselstine on the Safety Goal Policy Statement

The commercial nuclear power industry started rather slowly and cautiously in the early 1960's. By the late 1960's and early 1970's the growth of the industry reached a feverish pace. New orders were coming in for regulatory review on almost a weekly basis. The result was the designs of the plants outpaced operational experience and the development of safety standards. As experience was gained in operational characteristics and in safety reviews, safety standards were developed or modified with a general trend toward stricter requirements. Thus, in the early 1970's, the industry demanded to know "how safe is safe enough." In this Safety Goal Policy Statement, the Commission is reaching a first attempt at answering the question. Much credit should go to Chairman Palladino's efforts over the past 5 years to develop this policy statement. I approve this policy statement but believe it needs to go further. There are four additional aspects which should have been addressed by the policy statement.

Containment Performance

First, I believe the Commission should have developed a policy on the relative emphasis to be given to accident prevention and accident mitigation. Such guidance is necessary to ensure that the principle of defense-in-depth is maintained. The Commission's Advisory Committee on Reactor Safeguards has repeatedly urged the Commission to do so. As a step in that direction, I offered for Commission consideration the following containment performance criterion:

> In order to assure a proper balance between accident prevention and accident mitigation, the mean frequency of containment failure in the event of a severe core damage accident should be less than 1 in 100 severe core damage accidents.

Since the Chernobyl accident, the nuclear industry has been trying to distance itself from the Chernobyl accident on the basis of the expected performance of the containments around the U.S. power reactors. Unfortunately, the industry and the Commission are unwilling to commit to a level of performance for the containments.

The argument has been made that we do not know how to develop containment performance criteria (accident mitigation) because core meltdown phenomena and containment response thereto are very complex and involve substantial uncertainties. On the other hand, to measure how close a plant comes to the quantitative guidelines contained in this policy statement and to perform analyses required by the Commission's backfit rule, one must perform just those kinds of analyses. I find these positions inconsistent.

The other argument against a containment performance criterion is that such a standard would overspecify the safety goal. However, a containment performance objective is an element of ensuring that the principle of defense-in-depth is maintained. Since we cannot rule out core meltdown accidents in the foreseeable future, given the current level of safety, I believe it unwise not to establish an expectation on the performance of the final barrier to a substantial release of radioactive materials to the environment, given a core meltdown.

General Performance Guideline

While I have previously supported an objective of reducing the risks to an as low as reasonably achievable level, the general performance guideline articulated in this policy (i.e., ". . . the overall mean frequency of a large release of radioactive materials to the environment from a reactor accident should be less than 1 in 1,000,000 per year of reactor operation.") is a suitable compromise. I believe it is an objective that is consistent with the recommendations of the Commission's chief safety officer and our Director of Research, and past urgings of the Advisory Committee on Reactor Safeguards. Unfortunately, the Commission stopped short of adopting this guideline as a performance objective in the policy statement, but I am encouraged that the Commission is willing at least to examine the possibility of adopting it. Achieving such a standard coupled with the containment performance objective given above would go a long way toward ensuring that the operating reactors successfully complete their useful lives and that the nuclear option remains a viable component of the nation's energy mix.

In addition to preferring adoption of this standard now, I also believe the Commission needs to define a "large release" of radioactive materials. I would have defined it as "a release that would result in a whole body dose of 5 rem to an individual located at the site boundary." This would be consistent with the EPA's emergency planning Protective Action Guidelines and with the level proposed by the NRC staff for defining an Extraordinary Nuclear Occurrence under the Price-Anderson Act. In adopting such a definition, the Commission would be saying that its objective is to ensure that there is no more than a 1 in 1,000,000 chance per year that the public would have to be evacuated from the vicinity of a nuclear reactor and that the waiver of defenses provisions of the Price-Anderson Act would be invoked. I believe this to be an appropriate objective in ensuring that there is no undue risk to the public health and safety associated with nuclear power.

Cost-Benefit Analyses

I believe it is long overdue for the Commission to decide the appropriate way to conduct cost-benefit analyses. The Commission's own regulations require these analyses, which play a substantial role in the decisionmaking on whether to improve safety. Yet, the Commission continues to postpone addressing this fundamental issue.

Future Reactors

In my view, this safety goal policy statement has been developed with a steady eye on the apparent level of safety already achieved by most of operating reactors. That level has been arrived at by a piecemeal approach to designing, constructing and upgrading of the plants over the years as experience

was gained with the plants and as the results of required research became available. Given the performance of the current generation of plants, I believe a safety goal for these plants is not good enough for the future. This policy statement should have had a separate goal that would require substantially better plants for the next generation. To argue that the level of safety achieved by plant designs that are over 10 years old is good enough for the next generation is to have little faith in the ingenuity of engineers and in the potential for nuclear technology. I would have required the next generation of plants to be substantially safer than the currently operating plants.

Separate Views of Commissioner Bernthal on Safety Goals Policy

I do not disapprove of what has been said in this policy statement, but too much remains unsaid. The public is understandably desirous of reassurance since Chernobyl; the NRC staff needs clear guidance to carry out its responsibilities to assure public health and safety; the nuclear industry needs to plan for the future. All want and deserve to see clear, unambiguous, practical safety objectives that provide the Commission's answer to the question, "How safe is safe enough?" at U.S. nuclear power plants. The question remains unanswered.

It is unrealistic for the Commission to expect that society, for the foreseeable future, will judge nuclear power by the same standard as it does all other risks. The issue today is not so much calculated risk; the issue is public acceptance and, consistent with the intent of Congress, preservation of the nuclear option.

In these early decades of nuclear power, TMI-style incidents must be rendered so rare that we would expect to recount such an event only to our grandchildren. For today's population of reactors, that implies a probability for severe core damage of 10^{-4} per reactor year; for the longer term, it implies something better. I see this as a straightforward policy conclusion that every newspaper editor in the country understands only too well. If the Commission fails to set (and realize) this objective, then the nuclear option will cease to be credible before the end of the century. In other words, if TMI-style events were to occur with 10–15 year regularity, public acceptance of nuclear power would almost certainly fail.

And while the Commission's primary charge is to protect public health and safety, it is also the clear intent of Congress that the Commission, if possible, regulate in a way that preserves rather than jeopardizes the nuclear option. So, for example, if the Commission were to find 100 percent confidence in some impervious containment design, but ignored what was inside the containment, the primary mandate would be satisfied, but in all likelihood, the second would not. Consistent with the Commission's long-standing defense-in-depth philosophy, both core-melt and containment performance criteria should therefore be clearly stated parts of the Commission's safety goals.

In short, this pudding lacks a theme. Meaningful assurance to the public; substantive guidance to the NRC staff; the regulatory path to the future for the industry—all these should be provided by plainly stating that, consistent with the Commission's "defense-in-depth" philosophy:

(1) Severe core-damage accidents should not be expected, on average, to occur in the U.S. more than once in 100 years;

(2) Containment performance at nuclear power plants should be such that severe accidents with substantial offsite damages are not expected, on average, to occur in the U.S. more than once in 1,000 years;

(3) The goal for offsite consequences should be expected to be met after conservative consideration of the uncertainties associated with the estimated frequency of severe core-damage and the estimated mitigation thereof by containment.[1]

The term "substantial offsite damages" would correspond to the Commission's legal definition of "extraordinary nuclear occurrence." "Conservative consideration of associated uncertainties" should offer at least 90 percent confidence (typical good engineering judgment, I would hope) that the offsite release goal is met.

The broad core-melt and offsite-release goals should be met "for the average power plant"; i.e., for the aggregate of U.S. power plants. The decision to fix or not to fix a specific plant would then depend on achieving "the goal for offsite consequences." As a practical matter, this offsite societal risk objective would (and should) be significantly dependent on site-specific population density.

The absence of such explicit population density considerations in the Commission's 0.1 percent goals for offsite consequences deserves careful thought. Is it reasonable that Zion and Palo Verde, for example, be assigned the same theoretical "standard person" risk, even though they pose considerably different risks for the U.S. population as a whole? As they stand, these 0.1 percent goals do not explicitly include population density considerations; a power plant could be located in Central Park and still meet the Commission's quantitative offsite release standard.

I believe the Commission's standards should preserve the important principle that site-specific population density be quantitatively considered in formulating the Commission's societal risk objective; e.g., by requiring that for the *entire* U.S. population, the risk of fatal injury as a consequence of U.S. nuclear power plant operations should not exceed some appropriate specified fraction of the sum of the expected risk of fatality from all other hazards to which members of the U.S. population are generally exposed.

I am further concerned by the arbitrary nature of the 0.1 percent incremental "societal" health risk standard adopted by the Commission, a concept grounded in a purely subjective assessment of what the public might accept. The Commission should seriously consider a more rational standard, tied statistically to the average variations in natural exposure to radiation from all other sources.

Finally, as noted in its introductory comments, the Commission long ago committed to "move forward with an explicit policy statement on safety philosophy and the role of safety-cost tradeoffs in NRC safety decisions." While this policy statement may not be very "explicit", as discussed above, it contains nothing at all on the subject of " 'safety-cost' tradeoffs in NRC safety decisions." For example, *is* $1,000 per person-rem an appropriate cost-benefit standard for NRC regulatory action? While I have long argued that such fundamental decisions are more rightly the responsibility of Congress, the NRC staff continues to use its own ad-hoc judgment in lieu of either the Commission or the Congress speaking to the issue.

In summary, while the Commission has produced a document which is not in conflict with my broad philosophy in such matters, I doubt that the public expected a philosophical dissertation, however erudite. It is a tribute to Chairman Palladino's efforts that the Commission has come this far. But the task remains unfinished.

[1] Interestingly enough, the Commission has adopted proposed goals similar to the above core-melt and containment performance objectives—without clearly saying so. Taken together, the Commission's: (1) 0.1 percent offsite prompt fatality goals; (2) proposed 10^{-6} per-reactor-year "large offsite release" criterion; (3) commitment "to provide reasonable assurance . . . that a severe core-damage accident will not occur at a U.S. nuclear power plant," though they may be ill-defined, can be read to be more stringent than the plainly stated criteria suggested above.