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Mr. Samuel Chilk
Secretary of the Commission
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attn: Docketing and Service Branch

Dear Mr. Chilk:

Attached please find American Electric Power's comments on the proposed rulemaking concerning the "Consideration of Degraded or Melted Cores in Safety Regulation" published for comment on pages 65474 to 65477 of the Federal Register on October 2, 1980. We thank the Commission for this opportunity to comment upon this important topic.

Very truly yours,

for R. W. Jurgensen
Assistant Vice President and
Chief Nuclear Engineer

RWJ:dfs

Attachment

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American Electric Power Service Corporation
Comments on Proposed Rulemaking for "Consideration of Degraded or Melted Cores in Safety Regulation"

Before addressing the particular questions listed in the proposed rulemaking published on 10/2/80 in the Federal Register some general comments are in order. The imposition of new requirements on operating power plants must be based on a proven degree of safety improvement. Many aspects of the degraded core topic are not understood well enough to allow such determination to be made. Second, the design of the present generation of nuclear power plants is such that they contribute considerably less to the overall risk to the public than any other alternative electric power production facilities. Therefore increasing the cost of nuclear plants to the point in which they are no longer economically viable actually decreases the level of public safety. Stifling of the nuclear option could indeed cause the use of less societally attractive energy production solutions. This fact must be considered during the rulemaking process. While reactor safety is a very important goal, all aspects of the regulatory requirements being studied must be judged on their ultimate impact on the public health and safety.

The goal of all government regulation should be to judiciously balance the public's benefits with the attendant risks of the technology under consideration. Addressing the problem merely from the risk point of view on the basis of seemingly plausible, untested statements and at the behest of the political pressures is not in the best interest of society.

Opening the rulemaking proceedings to every conceivable issue, as the proposed rule does, is justifiable only on the basis of marginal arguments as opposed to those which are of direct importance to public health and safety. Such broad approach, motivated perhaps by compliance with prevailing political positions, can be tolerated only by the establishment of a few fundamental rules during the proceedings which account for both the inability to fully address all possible technical questions and for the costs, merits, relative probability of use, and true cost/benefit analysis of every solution.

Our comments on the individual proposed questions, are:

Comments on Individual Questions

1. The basic premise of this question; that is, that there are predictable consequences after a loss of core cooling, is not well founded. The core degradation process is certainly not understood to the point that analytical predictions can be used to make design changes which specifically address mitigation of the process.

   Most discussions in this area have been prejudiced by worst estimate analysis which resulted from our lack of basic understanding. A similar approach must be avoided during the rulemaking proceedings.

   Just as the first integral tests at LOFT are providing evidence that the PWR system is self-mitigating in large LOCA scenarios, a more thorough understanding of the behavior of the degraded (under cooled and deformed) core may indicate self-mitigating phenomena at work (perhaps TMI is an example). In any event, before design modifications can be prescribed, such knowledge must be available.

   In the interim, the thrust of the nuclear safety effort should be in the prevention of these events to a reasonably high level of certainty. An established safety goal of quantitative risk is the only path which will assure this result. Understanding the event sequences which could lead to a degraded core and preventing those that dominate the total risk is the sensible path given the current state of knowledge. The present "defense-in-depth" approach provides an adequate interim prevention philosophy.

2. The post-TMI analysis efforts of the nuclear industry have added substantial knowledge and understanding of this particular sequence. The design and operating changes implemented at all plants have reduced that particular sequence to the role of an insignificant

contributor to nuclear plant risk. Therefore there is little impetus to require explicit reanalysis of the TMI sequence as part of a plant's SAR. In fact the explicit prescription of event sequences to be analyzed as part of a plant's safety analysis led in part to the operator "mind set" that caused the TMI initiating sequence to become a major accident rather than an anticipated and benign event.

3. As the response to Question 1 indicates, design changes and emergency operating instructions for the express purpose of mitigating specific core degradation scenarios are premature at this time. The rulemaking should reflect the actual state of knowledge and recommend reviews which are meaningful and informative. The safety record of electric generation with nuclear reactors proves that a strategy of preventing the onset of the problem while gaining a basic understanding of the actual phenomenology is a safe and appropriate path to follow.

4. See the comments to Questions 1, 2 and 3. More specifically, no in principle, as it would add another level of complexity without a commensurate increase in safety.

5. Probabilistic risk assessment techniques plus sound engineering judgment should be used to evaluate potential accident events in order to identify the operator and equipment failures which dominate the risk of particular sequences. Redundancy in number and design of equipment and systems should be required in proportion to the incredmental risk reduction of the additional equipment. The ultimate level of risk reduction must be consistent with an established quantitative safety goal.

6. Each design must be capable, to a very high degree of certainty, of adequately retaining the post-accident radioisotopic concentrations inside the containment. The level of contamination reduction should be based on acceptable levels of offsite doses.

Therefore, acceptance criteria for offsite doses must be set and post-accident dose reduction systems should be designed to satisfy the criteria. Vented containment systems are one alternative which could be studied alone or in combination with other systems or perhaps not at all. The design of any accident mitigation systems must be such that its impact on total safety should be addressed.

7. Post-accident hydrogen control is a complex topic that is ill-served by quick but not well established remedies. The phenomenology of hydrogen generation and control must be adequately understood in order to provide adequate assurance that the systems are accomplishing their design function. The criteria for hydrogen control should not be exclusively based on containment design. The evolution of hydrogen in the reactor/containment system ensemble must be considered. The selection of bounding hydrogen generation sequences remains an unsolved problem. It is however not an unsolvable problem if one is willing to accept a best estimate degraded core scenario produced by a series of multiple failures and operator errors chosen through a relative risk analysis aided by intelligent engineering judgment.

   The hydrogen control systems must be designed using a consistent safety methodology. In short, the impact on safety including the disruption of other functions due to the use of the systems, operational hazards associated with its installation or presence must be assessed. If a post-accident hydrogen reduction system is necessary, a key design criterion must be that the operation of such a system will not deleteriously affect other critical accident mitigation systems. This concern must be especially noted in assessing systems which ignite hydrogen in an unspecified location and in an uncontrolled manner.

8. This question should be addressed as a subtopic of the issues discussed in Question 7. The N_2 - rich atmosphere of an inerted PWR containment represents a risk for the workers that have to perform maintenance

inside containment. This personnel safety risk needs to be compared to the risk of a hydrogen explosion causing fatalities.

9. The design of systems (passive or active) for retarding core degradation processes is premature until the processes themselves are further understood. However, if one had to design a core retention system, one which retains the debris inside containment seems preferable as long as containment integrity could be assured with minimum safeguards.

10. The design of nuclear plant systems for operating in a contaminated condition should be based on the intended system use. Proper shielding should be provided for a soundly chosen worst-accident case. If a system is not designed to be an accident mitigating or prevention system and if adequate protection systems are properly designed and installed, there is little reason to overdesign such systems.

11. A well-trained operating staff is the most effective means of accident prevention and mitigation. The improvements in operator training and plant instrumentation implemented after the TMI-2 accident substantially increase the ability of operating staffs to deal with off-normal events. At this point in time the specification of operator actions to mitigate specific degraded core scenarios is almost as premature as the design of additional mitigating equipment.

12. In future plants the inclusion of a self-contained decay heat removal function may be desirable in order to afford the operators more flexibility in mitigating accidents. However, the design philosophy of the present generation of nuclear plants provides more than adequate heat removal capability and no special systems should be required. In addition, the design, operation and control of such a system must be carefully considered to include the effects of spurious actuations, remote control, containment overpressurization, location of the sources of injection water etc...

13. A design criterion for any post-accident processing system must be to limit the release of contamination to the environment to levels which do not endanger the public health and safety. Therefore at a glance, the concept of locating such equipment in a leak-tight structure is attractive. However, using process equipment over extended periods of time would require maintenance and therefore the integrity of the enclosure would have to be compromised. The use of a leak tight structure could restrict access to the point of actually decreasing the overall plant safety condition.

14. Responses to this question may be found in comments made on Questions 2, 6, 7, 8, 9 and 10. One additional comment is in the area of design analysis (conservative vs. best-estimate). Conservative analyses have a valid purpose, which is to provide a bounding calculation with reasonable assurance that reality is considerably less severe. However, such approaches have been overused in the regulation of nuclear power to the point that safety in general has been deleteriously impacted. This is evident in the "mind set" towards large LOCA's evidenced by the TMI accident sequence. The proper analysis method which is based on an established engineering technique is to use best estimate calculations in order to assess the importance of various phenomena and then apply design margins to assure adequacy. This is the proper approach for all accident prevention or mitigation systems including the Engineered Safety Features. No special seismic design considerations should be required for additional mitigation systems beyond those that would be used if a fossil plant was to be constructed at the site in question. There are two reasons for this. The first one is that current engineering designs already afford a large margin for seismic events. The second one is that the simultaneous or quasi simultaneous occurrence of a degraded core condition with a damaging earthquake has an insignificant probability of occurrence.

15. As indicated in the comments given above, probabilistic analysis is a decisional aid which should be utilized in any safety improvement evaluation. The use of such tools however, is predicated upon a consistent and correct methodology and established quantitative safety goal criteria. The need for a new system must be based on degree of improvement afforded by the change versus all the costs incurred in effecting it. In the area of methodology, non-mechanistic assumptions which have been prevalent in early nuclear probabilistic analysis, must be minimized since use of such assumptions degrades the quality and applicability of the results. Only with such an analytical structure can safety design proceed in a logical manner. Indeed analysis of the present reactor system design may show that in some areas the plants have been overdesigned and other areas are receiving less emphasis than is prudent. The former situation is much more likely. (See also response to Question 5).

16. Any cost benefit analysis must involve an accounting of the impact of alternatives. All alternatives including the so called "null alternative" must be evaluated and compared. One may want to choose, under emotional pressure let's say, different acceptance criteria for different technologies. However, if one is to make decisions which are economically defensible and which could be modified, if proven to be inadequate, in an organized way, those criteria must eventually be quantitative and objective. Otherwise no meaningful consensus can be obtained from the members of our society. The recent ACRS efforts (NUREG-0739) represent an intelligent and sensible attempt to deal with the issue of nuclear power risks and safety goals in our modern high-technology society.

17. This question has been addressed in other responses. Among the many areas in need of better definition before definitive criteria can be established are core behavior and fuel melting under conditions of very limited cooling, debris accumulation on the internals, role of the vessel and the internal structures in delaying core meltdown,

melting through the vessel, debris/liner concrete interaction, effectiveness of cooling mechanisms in stopping the melting process, realistic calculations of containment penetration by and diffusion of molten debris, containment behavior during the concrete mat melt-trough process, available times to take or engineer last resort mitigation measures, ioding release values etc... Perhaps several of these concerns could become irrelevant as the state of the art advances. Certainly many of them are irrelevant if the assumed initial condition of the problem is that the core has already melted through the bottom of the reactor vessel.

18. Reactor siting rulemaking should be postponed until the main issues and the likely outcome of the degraded core rulemaking are defined.

In the issue of emergency planning, the recent published rule covers a spectrum of accidents, including Class 9 accidents. Indentification during the rulemaking proceedings of some, as yet unknown, credible mechanism whereby very large amounts of radioactivity could be released to the environment in exceedingly short times, would advise modifying the present rule. The issue, never successfully tackled, of evacuation risks versus nuclear health risks is another instance where a balanced analysis of risks and benefits must be made.

The issue of the proposed siting rulemaking leads to a larger concern involving the proper rulemaking sequence. As stated previously the success of the degraded core rulemaking is directly tied to the establishment of a quantitative safety goal prior to the imposition of rules. In our opinion the proper rulemaking sequence is: the establishment of a safety goal, establishment of design criteria for Engineering Safety Features based on the understanding gained during the degraded core rulemaking followed by the establishment of permanent emergency planning and reactor siting criteria. Conducting the rulemaking process in a different sequence may not only lead to wasted effort but also involve the implimentation of ill-advised solutions.

We believe the proper rulemaking approach is through an adjucatory process which will insure a balanced consideration of all the issues germane to the topic.

In closing, we would like to thank the Commission for allowing us this opportunity to comment on this very imp rtant subject.

QUESTION #17

What aspects of degraded cooling or melted-core accidents are sufficiently unknown or uncertain as to impede design and analysis of mitigating systems, thus requiring additional research or experimentation?

RESPONSE TO QUESTION #17

Combustion Engineering is in general agreement with the response developed by the AIF Committee on Reactor Licensing and Safety.

QUESTION #18

The NRC has under way a separate rulemaking proceeding concerning reactor siting and an emergency planning rule has recently been approved. If you are familiar with these separate activities, how would you modify present and proposed requirements for emergency planning and reactor siting if accidents beyond the present design basis were to be considered in nuclear power plant safety analyses?

RESPONSE TO QUESTION #18

Combustion Engineering is in agreement with the AIF comments on this item as developed by the Committee on Licensing and Safety.