THE BABCOCK & WILCOX COMPANY
POWER GENERATION GROUP

To
J. H. Taylor, Manager, Licensing

From
D. H. Roy, Manager, Plant Design (2315)

535 663.5

Cust.

File No.
or Ref.

Subj.
NRC Research Review Group Meeting

Date
January 20, 1978

This letter to cover one customer and one subject only.

A research review group has been established by the NRC to implement the requirements of an amendment to the Energy Reorganization Act of 1974 which directs the Commission to:

> "... develop a long-term plan for projects for the development of new or improved systems for nuclear power plants."

This amendment resulted from criticism raised in the Ford Foundation-sponsored report, "Nuclear Power Issues and Choices", that the current safety research program was deficient in research leading to new and improved safety components and systems. The review group is headed by Saul Levine, Director of Nuclear Regulatory Research, and is comprised of the members shown in Attachment 1. Members of industry, including utilities, various national laboratories, EPRI, consulting firms, intervenor organizations, other NRC and DOE organizations, etc., have been asked to serve as consultants to the review group.

The first meeting of the research review group was held on January 10, 1978, with Saul Levine presiding. Attendees are shown in Attachment 2. Saul Levine opened the meeting with an explanation of the purpose of the review group and a brief description of what he hoped to accomplish at this first meeting. The first report to Congress is due to be submitted on April 1, 1978, with subsequent reports to be filed annually thereafter in February. The purpose of the review group is to prepare the plan called for by the Congressional amendment to the Energy Reorganization Act of 1974 and to report progress against the plan in subsequent annual reports. Saul stated that at the first meeting he hoped to generate a list of projects for consideration for inclusion in the report by way of informal dialogue among the review group members and its consultants. He stated it was not the intention of the Nuclear Regulatory Research office to perform detailed design of systems which might improve reactor safety, but to perform confirmatory research in advance of design submittals and to perform research which could lead to generation of conceptual designs for improved safety systems.

GPU

CONFIDENTIAL

Deft. Exh. For ID 457
Plf. Exh. in Ev
Charles Shapiro CSR 2/3/82
Doyle Reporting Inc.

If necessary, the Nuclear Regulatory Research office would submit concepts for improved safety systems to DOE with the request that detailed designs be developed by that agency and be returned to the NRC for further review and research. Obviously, this expansion of the charter of the NRC research organization could contribute to even greater instability in the regulatory arena and decrease even further the incremental power generation cost benefit between nuclear and other competing power generation systems. The NRC has never really viewed themselves as simply an agency which promulgates criteria for the design of safe systems and then reviews the design of systems submitted to it against these criteria; this amendment seems to me to formalize the wider view that the NRC would like to take with respect to its regulatory responsibilities.

As would be expected, the need for improved ECCS systems was discussed by several NRC personnel and by Dr. Spencer Bush acting as a PNL consultant. Jim Zane of EG&G spoke out strongly for the installation of check valves in the cold legs. Improved containment systems, such as vented systems, were mentioned. Identification of innovative means to make nuclear power plants less susceptible to sabotage and to mitigate damage which may result from an act of sabotage were mentioned by Dr. Bush. Research into means for understanding systems interactions and for identifying particularly sensitive or vulnerable interfaces was also suggested for inclusion in the report.

There was much discussion, led principally by Steve Hanauer, of work needed to help eliminate operator error prior, during, and after an upset or accident event. Control room design, pattern recognition, alarm display simplification, automation of actions required to mitigate the event, etc., were discussed in the context of a Human Engineering Research Program. Dr. Hanauer stated that the most significant finding of the WASH 1400 afterstudy was that greater attention need be paid to operator error as related to reactor safety.

The principal items I emphasized during the discussion were:

1. Development of criteria and methods for determining just what an "improvement" is and what incremental benefit to reactor safety any given improvement would make. In my opinion, this should be a principal item of regulatory research, since it (a) provides a systematic basis for cost benefit analysis, and (b) is mandatory before a quantification of acceptable risks can be made. Without these two items, the nuclear power industry will continue to be at the mercy of the regulatory agency, wherein almost any means for improving reactor safety can be mandated without the agency being held accountable for its impact.

2. I stated that many of the elements related to determination of sub-cooled blowdown loads and other loads associated with the LOCA are in need of a more realistic research foundation. I stated that this was particularly

CONFIDENTIAL

true of jet plume definition, discharge of fluids at high pressure from large diameter pipes, and structural/fluid interaction. I also mentioned research into means for reducing occupational exposure thru innovative design and maintenance features and research into the development of better incore instrumentation for defining more precisely the nuclear, thermal, and hydraulic state of the core at any given time.

At one point during the discussion, one member of the NRC stated that the review group would be reviewing very carefully and with great interest the safety systems and criteria that are in use or being considered for use in Germany. With flushed face and rapidly accelerating heartbeat, I rose to my feet to caution those who viewed the German situation with great envy to make certain that they fully understood how and why the German approach to reactor safety had developed as it has. I mentioned that population density differences, the different relationship between the licensing review body and government, differences in federal versus state licensing responsibilities, the lack of any suitable alternative to nuclear power, etc., as important considerations in viewing current German safety systems and regulatory practices. Many NRC voices were raised in support of German safety requirements and review procedures, and I continued to iterate my view that the approach here in the U.S. could be and should be conducted in an entirely independent way and that ideas for improving reactor safety arising from whatever source, foreign or domestic, should be reviewed quantitatively and systematically for benefit versus cost impact using the methods and criteria which I believe the regulatory authority is obligated to generate.

One gentleman member of the consulting staff stated that a small, but highly influential element of the anti-nuclear group cannot or will not consider the probabilistic aspects of any given event. He termed this element the catastrophic group in contrast to the actuarial group. It was his opinion that we should spend research dollars to design and implement systems which would satisfy this extremist group of nuclear opponents. With Warren Owen of Duke Power Company, Romano Salvatori of Westinghouse, and Bill Corcoran of Combustion Engineering nodding in agreement, I stated that "if the viability of this industry depends upon the quieting of the catastrophe-minded anti-nuclear group, I believe I can speak for the Babcock & Wilcox Company in voicing the opinion that we would rather abandon the industry than spend one dollar of public money to assuage the extremists."

In summary, there were very few innovative ideas not already contained in ERDA, EPRI, or NRC research programs or contained in the list of ACRS generic concerns or already part of the NUREG 0138 listing brought forward at this first meeting of the review group and its consultants. I stated during the meeting that it seemed to me that there is a conflict of interest in Congress' assigning this task to the NRC. It appears to me that to provide an avenue

CONFIDENTIAL

by which the NRC can force the inclusion of rather well-defined systems or require the use of rather well-specified methods in the design and construction of nuclear power plants and then have the task of reviewing these same systems and methods in an independent way against the safety criteria promulgated by the agency is a conflict of interest. It seems to me also that the U.S. taxpayer, with Congress acting as his agent, could waste a great deal of money on nuclear regulatory research projects with little or no assurance that the improvement in safety is worthwhile. I strongly recommend that we act through the AIF and through the Congressional Committee on Interior and Insular Affairs and through other appropriate Congressional organizations to obtain their support for our position that one of the highest priority research items should be the development of methods, along the lines of WASH 1400, for quantitatively assessing the incremental contribution any system modification or addition makes to reactor safety.

The second meeting of the review group is scheduled for February 10, 1978, at which time the first draft of the report will be available for review.

DHR/ebf

Attachments

cc: (w/att)
J. H. Taylor
G. E. Kulynych
File

(w/o att)
R. M. Ball
C. W. Pryor
C. D. Morgan
J. S. Tulenko
K. E. Suhrke
L. J. Stanek
T. M. Schuler
J. C. Deddens

CONFIDENTIAL

DRAFT

OUTLINE OF REPORT TO U.S. CONGRESS ON

STUDY OF LONG-RANGE PLAN ON IMPROVED SAFETY SYSTEMS

1. INTRODUCTION

Objectives

The FY 1978 Authorization Bill for the U.S. Nuclear Regulatory Commission includes an amendment to the Energy Reorganization Act of 1974 (42 U.S.C. 5875) by adding a new subsection (f) to Section 205:

> "The Commission shall develop a long-term plan for projects for the development of new or improved safety systems for nuclear power plants."

The Conference Report (involving the House Committee on Interior and Insular Affairs and Senate Committee on Environment and Public Works amplifies the meaning of the legislation change by identifying the need for the NRC to take the initiative in the development of improved safety for nuclear power plants and by stating "that the basic purpose of this research is the improvement of reactor safety and not the enhancement of the economic attractiveness of nuclear power versus alternative energy sources." It also calls for an annual report from NRC to the Congress by February 1 of each year, with the first report due on April 12, 1978.

The Conference Report notes that the plan should include a brief description of the projects which are proposed, the need for each project, a timetable for implementation of each project, and the cost of the project. Coordination with other involved agencies such as DOE is encouraged.

In preparing the long-range plan, the Commission is also mindful of the Energy Reorganization Act of 1974, which created NRC, and the background leading to the passage of this act. The Energy Reorganization Act specifically created an Office of Nuclear Regulatory Research to (1) develop recommendations for research deemed necessary for performance by the Commission of its licensing and related regulatory functions and (2) engage in or contract for research which the Commission deems necessary for the performance of its licensing and related regulatory functions.

NRC's research charter as established under the Energy Reorganization Act of 1974 encompasses "confirmatory" safety research as distinct from "developmental" safety research. Confirmatory safety research is taken to mean that research deemed necessary to provide NRC with an objectively verified basis for evaluation of an application made to it for regulatory judgment, or to provide a basis for a regulatory requirement or policy, or to provide NRC with the physical or judgmental capability to regulate the use of nuclear power and materials.

In contrast, developmental safety research is research conducted to evaluate the safety of materials, processes, equipment, etc., that would or might be proposed by an applicant for an NRC license, or a possessor of such a license, in support of an application for a favorable regulatory judgment.

Within these guidelines NRC has the charter to develop general analytical methods to assess the performance capability of systems that are related to the safety of nuclear power plants, recognizing that data obtained to verify these methods could also be used in the design of improved safety systems. Against this background, the new Congressional requirement for the "development of new or improved safety systems" for nuclear power plants could give rise to some difficulty if the NRC were to develop design improvements in sufficient detail so they could be incorporated into plants by designers. Such a course would place the NRC in the difficult position of reviewing and approving as part of its licensing process designs that it had developed. A simple way to solve this problem is for NRC not to create detailed designs, but rather to gather physical data and create analytical models for the analysis needed as part of the approval of improved safety concepts (such as vented containment). Such an approach would enable the NRC to evaluate the safety significance of improvements without performing the detailed designs. Of course, in some areas where it might be especially useful to have detailed design performed, this could be worked out in coordination with DOE.

Reactor Safety

The principal aim in reactor safety is to prevent undue risk to the health and safety of the public from the operation of nuclear power facilities. The basic approach used to ensure the safety of nuclear power plants is to design the plants according to a defense-in-depth philosophy, that is, to build in three levels of nuclear safety: (1) design and fabricate the plant for maximum safety, (2) provide protective systems to monitor and correct off-normal conditions, and (3) install engineered safeguard features to mitigate accident consequences. This philosophy is reflected in the design of three separate barriers to contain radioactive material: (1) fuel cladding, (2) pressure vessel and piping, and (3) reactor containment.

The designs of engineered safeguard features used in the defense-in-depth philosophy are based primarily on the calculated consequences of a series of design basis accidents. In its licensing process, NRC evaluates the safety of nuclear plants against these design basis accidents, including various system transients and component failures. The single failure criterion is also applied to assure adequate reliability is achieved for systems and components important to safety.

The defense-in-depth concept is embedded in the NRC regulations (see, for example, Appendices A, "General Design Criteria for Nuclear Power Plants" and B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants" of 10 CFR Part 50) and in the guidance provided by NRC to the nuclear industry. Perhaps more than any other factors, the defense-in-depth concept and the conservative approach taken in nuclear power plant designs have been responsible for the good safety record experienced to date.

Approach to Study

In approaching the question of how to improve on existing safety, a logic structure is needed to allow the categorization and evaluation of suggested improvements. The structure indicated below suggests itself in that (1) it is organized to identify areas of risk reduction into which specific suggestions can be placed and (2) it attempts to list all areas in which improvements might reduce risk.

Categorization of Suggested Safety Improvements

A. Reduce likelihood of accidents due to

1. Internal plant failures

a. Reduce likelihood of initiating events

(1) Pipe breaks

(2) Vessel breaks

(3) Transients

b. Reduce likelihood of failures of systems designed to cope with all above.

2. External events

a. Natural (earthquakes, tornadoes, floods)

b. Man-made (aircraft crashes, turbine missiles, explosions)

3. Sabotage

B. Reduce probability of large consequence accidents by reducing the likelihood of or mitigating the effects of release of large amounts of airborne radioactivity.

2. SUMMARY OF CURRENT REACTOR SAFETY RESEARCH

Chapter 2 will be devoted principally to providing summary background information on ongoing reactor safety research. It will cover the principal areas of NRC research in the field of water reactor safety as well as summaries of research being conducted by reactor vendors (PR), DOE and foreign governments. The principal topics to be covered will be:

1. Safety design and protection of the integrity of the reactor pressure vessel and piping,
2. Thermal-hydraulic tests of hypothetical or design-basis accidents and the effectiveness of engineered safeguard features,
3. Fuel-rod behavior in hypothetical accidents and associated failure limits,

4. Computer code development for accurate predictions of the consequences of hypothetical reactor accidents,
5. Operational safety studies of the adequacy of safety designs, standards and criteria used in operating plants, such as fire protection criteria, qualification testing standards and reactor operator actions,
6. Assessments of the potential effects of severe natural phenomena such as earthquakes, floods, tornadoes, and hurricanes on nuclear facilities to aid in determining facility safety design requirements in these areas,
7. Application of risk assessment methodology to obtain an improved understanding of the risks to the public from potential accidents in light water reactors and fuel cycle facilities.

3. SUGGESTIONS ON RESEARCH TO IMPROVE REACTOR SAFETY

Chapter 3 will be devoted to summarizing a series of documents which over the years have recommended various types of research on improvements to reactor safety and will also summarize the suggestions for research on improved safety to be made by members of and consultants to the Research Review Group. The following set of documents, and others as appropriate, will be reviewed to extract and summarize appropriate recommendations:

a. ACRS documents

1. Letters on reactor safety research
2. List of generic items
3. Report to Congress on reactor safety research program

b. ECCS Acceptance Criteria and Hearing Record

c. Report to the American Physical Society by the Study Group on Light-Water Reactor Safety

d. A Review of Light-Water Reactor Safety Studies (LBL-5286)

e. Environmental Quality Laboratory Report (EQL No. 9)

4. ASSESSMENT OF SUGGESTIONS FOR RESEARCH ON IMPROVED SAFETY

Chapter 4 will contain an assessment and priority listing of the suggestions for research on improved safety that are listed in Chapter 3. Various techniques will be used to perform these assessments. Where appropriate, the potential risk reductions relative to risks predicted in WASH 1400 will be used. Of course, care will have to be taken to ensure the applicability of such comparisons and to take into account the uncertainties in WASH 1400 modeling. An example of such comparison would be an analysis of risk reductions potentially achieveable by the use of vented containment. On the other hand, some suggestions such as ones applicable to improved seismic design might be quite difficult to quantify in terms of potential risk reduction. Here, a more judgmental approach will have to be used. Of course,

estimates of changes in plant cost will be made to help provide some sort of value/impact analysis.

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter will summarize the final recommendations of the report on those research projects which should be undertaken.