3358 Hampton Road
Raleigh, North Carolina
January 29, 1959

Dr. C. K. Beck
U. S. Atomic Energy Commission
Division of Civilian Application
Washington 25, D. C.
Dear Dr. Beck:

In accordance with your request I have completed a list of recommendations for preparation of the instrumentation portion of hazards reports. I am enclosing a copy for your consideration. I believe that it would be worthwhile to place some stress on a standard format for hazards reports. If this is carried to its logical conclusion, at some time in the future it may be possible to reduce the hazards report to little more than a questionaire.

I hope the long delay in preparing these recommendations has not caused you serious inconvenience. The press of work here has been considerable and I regret to say it has not always been possible to complete tasks with the dispatch one might desire.

I am enclosing the forms 148A covering the time used in preparing this report.

Give my regards to Mary Beth and the children. I hope you are all well.

Yours truly,

Hap

H. A. Lamonds

HAL/db

Enclosures

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DR. BECK:

IN LOOKING OVER YOUR DRAFTS ENTITLED "CONTROL SYSTEMS" AND "CRITERIA FOR CONTROL RODS" A QUESTION OCCURS TO ME. WILL NOT PEOPLE IN INDUSTRY OBJECT TO HAVING THE AEC SPELL OUT SPECIFIC REQUIREMENTS FOR INSTRUMENTATION? IT IS VERY DIFFICULT TO WRITE A SET OF BROAD SPECIFICATIONS SUCH AS THIS WITHOUT UNDULY CRAMPING THE DEVELOPMENT OF NEW IDEAS AND TECHNIQUES IN INSTRUMENTATION. INCIDENTALLY, THERE IS PROBABLY NOT A SINGLE REACTOR IN THE U.S. THAT CONFORMS TO ALL OF THE SPECIFICATIONS SET FORTH IN THESE DRAFTS.

Hap

SUGGESTIONS FOR PREPARATION OF THE INSTRUMENTATION SECTION OF REACTOR HAZARDS REPORTS

The instrumentation system should be described in sufficient detail to allow evaluation by an individual not familiar with the proposed reactor. The description should minimize circuitry details and should be concentrated on the functions and performance of instruments as they relate to the safety of the system. Submission of circuit drawings should be avoided, but it may be necessary to make reference to some components, e.g., relays, magnetic clutches, etc. It is important to give a complete but concise description. It may be necessary to refer to or describe some parts of the instrumentation system in other sections of the hazards report. This should not reduce the thoroughness with which those parts are discussed in this section. The overall performance and safety aspects of all parts of the instrumentation system should be given here. This, of course, includes all auxiliary systems that may affect the behavior of the reactor as well as the nuclear instrumentation.

In the final analysis, the safety of a given installation is more dependent on the adequacy of the instrumentation system than on the nuclear characteristics. For example, it has been shown that a relatively slugish reactor may be easily damaged if not properly instrumented, while many reactors of a much more dangerous type are easily managed by well designed instrumentation systems.

The following material is intended to serve as a guide for preparing the instrumentation portions of hazards reports. In some cases leading questions are presented to indicate the type of information required. It is not intended that the report be confined to only the topics indicated here. All pertinent details should be included. Needless to say, an evaluation cannot be made on the basis of partial information. Failure to present adequate descriptive material can be expected to lead to requests for supplementary reports.

Reactor Instrumentation

A. Prepare block diagrams of nuclear instrumentation including area and site monitors. Show interconnections where they exist.

B. Give a description of the nuclear instrumentation including the range of each instrument and relationship between ranges of various channels.

C. Furnish block diagrams of instrumentation for reactor auxiliary systems including heat transfer equipment. Show interconnections.

D. Give descriptions of the auxiliary instrumentation systems. Describe expected interactions between auxiliary systems and the reactor and show the roles played by the instrumentation systems in these interactions. For example, if multiple heat exchange loops are used, under what conditions may a cold loop be actuated while the reactor is in operation. What means are provided to prevent an excursion due to the introduction of low temperature coolant into the reactor.

E. Give detailed information on the operation of all automatic control systems that might affect the reactor. Discuss consequences of probable failures of instruments or components in these systems.

F. Prepare a chart showing all instrument interlocks. The chart should describe the interlock, show which major instruments are involved, give the purpose of the interlock, and the level or conditions required for actuation.

G. Prepare a chart of alarm and automatic shutdown devices. The chart should give a description of the alarm or the trip, list of major instruments involved, purpose and level or condition required to actuate system. If coincidence trips are used, how are non-safe failures detected?

H. Give response time of each safety system. The rod insertion times should be given along with the overall response times of the safety systems. What method of energy storage is used to ensure insertion of safety rods in an emergency. If shutdown devices other than safety rods are used, discuss their operation.

I. Give maximum reactivity insertion rate and reactivity worth of each control element. Describe rod driving system and means used to insure that the stated rod driving rate is not exceeded. What instruments or controls operate each element? Can more than one element be operated simultaneously? If so, under what conditions? If not, how are they interlocked? What is normal sequence of operation? What provisions if any are made to insure proper operation of controls.

J. Outline start-up, operation and shut-down procedures. What instrument checks are made prior to start-up? Is a source interlock incorporated in the system? Is it mechanically possible to withdraw all control elements either simultaneously or in sequence by one single act on the part of the operator or by a single malfunction? Assume failure of the period safety circuits and that reactivity is added at a maximum rate until a level safety is actuated. How much above the maximum operating level will the power rise? Will damage to the reactor result from such an incident?