Draft

Report of Completion

of

Generic Activity A-34:

"Instruments for Monitoring Radiation and Process Variables During Accidents"

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Environmental Analysis
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1.0 INTRODUCTION

In December, 1975 the Staff issued for comment Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident." After reviewing the comments received the staff issued Revision 1 to this Regulatory Guide in August 1977. (A copy of Regulatory Guide 1.97, Revision 1 is provided in Appendix A).

The objective of Regulatory Guide 1.97 is to insure that during and following an accident, appropriate parameters and system functions are monitored in order that plant personnel will have sufficient information to take appropriate actions to restrict the courses and consequences of an accident. At the start of an accident, the operator cannot always determine what accident has occurred and therefore cannot always determine the appropriate response. For this reason, the reactor trip and certain safety actions (e.g. emergency core cooling actuation) are designed to be performed automatically during the initial stages of an accident. However, instrumentation is also necessary to provide information about plant parameters and system functioning that alerts the operator to conditions beyond those expected so that appropriate operator actions may be taken. The operator must have sufficient information available to: (1) determine the course of an accident; (2) make intelligent decisions about taking manual action; and (3) assist in determining what actions, if any, are needed to execute

the plant emergency plan. It should be noted that it is not the intent of Regulatory Guide 1.97 that operators be encouraged to circumvent automatic features prematurely, but rather that they be adequately informed in order that they can take necessary planned and unplanned actions.

In August 1977, the staff issued Task Action Plan A-34, "Instruments for Monitoring Radiation and Process Variables During an Accident" (a copy of the most recent revision of the Task Action Plan is contained in Appendix B). The purpose of the Task Action Plan is to develop guidance for applicants, licensees and staff reviewers concerning implementation of Revision 3 of Regulatory Guide 1.97.

In the course of implementing the initial phase of the Task Action Plan, it became obvious that Regulatory Guide 1.97 included a few provisions which industry claimed to be impractical at the present time, and other provisions for which more definitive guidance was needed to define acceptable means of compliance. The primary issues in controversy are Positions C.1 and C.3 of the Regulatory Guide.

Position C.1 is intended to insure that the station design includes sufficient instrumentation to meet the objectives described in Position C.1 for each of the Design Basis Accidents normally analyzed by an applicant in Chapter 15 of a Safety Analysis Report.

Position C.3 describes specific instrumentation to be used if accident conditions degrade beyond those assumed in the FSAR. Various industry representatives expressed concern about the ranges of the instruments described in Position C.3 and the implication of monitoring for Class 9

accidents. This Position is not explicitly intended to monitor Class 9 accidents. Position C.3 is intended to provide assurance that even under conditions that degrade far beyond those that are assumed in the accident analyses, the operator will have usable instrumentation that will provide a basis for decision making. The operator must not be placed in a position where all his relevant instrumentation is off-scale. The ranges of the instruments described in Position C.3 are not based directly on accident scenarios but are based on engineering judgments of the admittedly extreme points beyond which the high probability of failure of important fission product barriers (e.g., reactor pressure vessel or containment structure) would make the need for instrumentation a moot point.

The remaining Positions in the Regulatory Guide describe the details of the design and qualification of the accident monitoring instrumentation and therefore do not pose the same type of implementation problems.

2.0 IMPLEMENTATION

During the months since issuance of Regulatory Guide 1.97 and Task Action Plan A-34, the staff and representatives of the nuclear industry have attempted to clarify the intent of the Regulatory Guide. Based on this work the staff has reached the following conclusions concerning implementation of Regulatory Guide 1.97 Revision 1.

1. The large amount of experience accumulated to date permits identification of those parameters that should be monitored to satisfy Position C.1. The list of parameters is provided as Appendix C. The staff will require that these parameters be monitored on all plants for which a construction permit application was docketed after September 30, 1977 (as per section D of Regulatory Guide 1.97 Revision 1). The accident monitoring instrumentation of plants for which a construction permit application was docketed prior to September 30, 1977 has been reviewed as part of the licensing process. Although the parameters monitored at specific plants may be different than those specified in Appendix C, the staff still believes that with the addition of the instruments described in Position C.3, existing accident monitoring equipment is acceptable. Therefore, the staff has concluded that the resources that would be required to backfit the instruments required to monitor the parameters listed in Appendix C would not be justified based on the benefits derived from having a standard set of accident monitoring instruments on all plants.

2. The staff concludes that technology currently exists to permit implementation of the instrumentation described in Positions C.3.a through C.3.c. Prior to issuance of Regulatory Guide 1.97 Revision 1 the staff did not require that accident monitoring instrumentation be provided with ranges extending beyond the conditions expected to result from Design Basis Accidents. For the reasons discussed in Section 1.0, the staff now believes that such instrumentation should be required on all plants. Therefore, the staff requires that the instrumentation described in Position C.3.a through C.3.c be implemented for reactor plant license applications and all plants licensed for construction or operation.

3. With respect to Position C.3.d, the staff is not certain that existing release rate monitoring technology is sufficient to permit adequate monitoring of the ranges of radioactivity release rates that might be encountered if, as assumed in Position C.3, conditions degrade beyond those expected to result from the Design Basis Accidents. Therefore, the staff will delay requiring implementation of Position C.3.d until studies of the capabilities of existing release rate monitoring technology can be undertaken.

4. It has been pointed out that it may not be feasible to qualify instrumentation to extreme conditions consistent with the instrument ranges described in Position C.3, particularly radiation levels inside containment of up to 10^8 rads/hour (Position C.3.b). The staff agrees that qualification of instrumentation located inside containment to such levels may not currently by possible.

However, the staff believes that all of the instrumentation described in Position C.3 can either be shielded or located outside the containment, where a less hostile environment would exist, and appropriately calibrated.

5. Position C.6 states that accident monitoring instrumentation should be designed so that a single failure does not prevent the operator from accomplishing the objectives of Position C.1. However, it is the staff's position that redundant instrumentation is not required on each train of a system that has a redundant counterpart.

6. The staff worked closely with several applicants for construction permits and operating licenses, and with the Atomic Industrial Forum Ad Hoc Committee on Post Accident Monitoring Instrumentation. All of the concerns raised by the involved industry representatives have not been resolved to the satisfaction of all parties. However, the staff believes that sufficient guidance has been developed so that Task A-34 can be classified as complete. The staff will continue to work with the industry representatives in an attempt to resolve any minor issues that remain unresolved.

INSTRUMENTATION TO FOLLOW THE COURSE OF AN ACCIDENT

not existing now

Parameter

Containment pressure

Hot leg flow (PWR) } both

Cold leg flow (PWR)

Level in steam generator

Main steamline flow rate ✓ (measure feed to flow)

Pressure of reactor coolant

Pressurizer level (PWR)

Radiation level in condenser air ejector

Steam-generator pressure (PWR)

Temperature of reactor coolant

Position of Valves in Vital Systems

Component cooling water system Flow

Containment cooling fan flow

Containment spray flow

Containment sump and suppression pool level

Control rod position indicators

Emergency cooling water storage tank level

Emergency filter train operation

Emergency ventilation system(s) damper positions

? Injection flow

Power (Neutron flux)

Residual heat removal flow

Parameter

Safety injection flow

Status of power supplies

Ultimate heat sink temperature and level

Area radiation levels in auxiliary buildings

Boron concentration and/or flow (PWR)

Containment temperature

Hydrogen concentration in containment

Radiation level in containment

Radiation level in main steamline (BWR)

Reactor vessel coolant level ✓

Temperature of space in vicinity of vital equipment ✓

Activity levels in surface and ground water

Activity release rate from principle plant vents and discharge points

Wind direction, speed and vertical temperature difference

Environmental Radiation Levels