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NUCLEAR REGULATORY COMMISSION  
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October 30, 1979

(TO ALL OPERATING NUCLEAR POWER PLANTS)

REGULATORY BUREAU FILE COPY

Gentlemen:

SUBJECT: DISCUSSION OF LESSONS LEARNED SHORT TERM REQUIREMENTS

On September 13, 1979, a letter was issued to each power reactor licensee which defined a set of "short term" requirements resulting from the NRC staff investigations of the TMI accident. Since the letter was issued, the staff has attempted to further define these requirements. During the week of September 24, 1979, seminars were held in four regions of the country to encourage industry feedback and dialogue on each short term requirement. As a result of these discussions, four topical meetings were held in Bethesda to discuss certain issues in further detail.

Enclosure 1 provides additional clarification of the NRC staff requirements. It should be noted that the intent of these requirements have not changed throughout this process and are restated in Enclosure 1.

Enclosure 2 is a chart of the NUREG-0578 items and their corresponding implementation schedules. The chart indicates which of the items require prior NRC review and approval and those for which post implementation NRC review is acceptable.

For those items requiring prior NRC approval, your design details should be submitted in a timely manner so that this approval and your implementation of the item can be completed by the required date. For those items which do not require prior NRC approval, you must document your method of implementation by the required completion date. These schedules assume that your methods are in complete agreement with the staff's requirements as previously documented in NUREG-0578, our September 13, 1979 letter, and clarified herein. Where your methods are not in complete agreement with the staff's requirements, a detailed description of your proposed methods along with justification for the differences, is required. Please provide this description and justification as soon as possible but no later than 15 days following receipt of this letter.

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- 2 - October 30, 1979

The schedule for completing each of the short term TMI followup requirements is firm. Some licensees, in responding to our September 13, 1979 letter, have indicated an inability to meet the established implementation schedule. If your response was in this category you are requested to reconsider your implementation schedule with the purpose of improving your implementation dates to meet those required by the staff. Within fifteen days from receipt of this letter, you are requested to submit your revised schedule for implementation. If you are unable to commit to meeting any of the January 1, 1980 requirements, you must provide, for each item, a report on the degree of compliance expected on January 1, 1980, and a detailed justification for the delay.

Sincerely,



Harold R. Denton, Director  
Office of Nuclear Reactor Regulation

Enclosures:

1. Discussion of TMI Lessons Learned  
Short Term Requirements
2. Implementation Schedule

**Enclosure 1**

**DISCUSSION OF  
TMI LESSONS LEARNED  
SHORT TERM REQUIREMENTS**

## TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>
2.1.1	Emergency Power Supply - Pressurizer Heaters..... 1 - Pressurizer Level and Relief Block Valves..... 3	
2.1.2	Performance Testing for BWR and PWR Relief and ..... 5 Safety Valves	
2.1.3.a	Direct Indication of Power-Operated Relief Valve..... 7 Valve and Safety Valve Position for PWRs and BWRs	
2.1.3.b	Instrumentation for Detection of Inadequate Core Cooling - Subcooling Meter,..... 9 - Additional Instrumentation.....13	
2.1.4	Diverse Containment Isolation.....15	
2.1.5.a	Dedicated H <sub>2</sub> Control Penetrations.....16	
2.1.5.c	Capability to Install Hydrogen Recombiner at each.....17 Light Water Nuclear Power Plant	
2.1.6.a	Integrity of Systems Outside Containment Likely.....18 to Contain Radioactive Materials for PWRs and BWRs	
2.1.6.b	Design Review of Plant Shielding and Environmental.....19 Qualification of Equipment for Spaces/Systems Which May Be Used in Post Accident Operations	
2.1.7.a	Auto Initiation of the Auxiliary Feedwater Systems .... 22 (AFSW)	
2.1.7.b	Auxiliary Feedwater Flow Indication to Steam..... 24 Generators	
2.1.8.a	Post-Accident Sampling Capability..... 26	
2.1.8.b	Increased Range of Radiation Monitors ..... 31	
<u>Tables</u>		
2.1.8.b.1	Interim Procedures for Quantifying High Level..... 37 Accidental Radioactivity Releases	
2.1.8.b.2	High Range Effluent Monitor..... 38	
2.1.8.b.3	High Range Containment Radiation Monitor..... 39	

TABLE OF CONTENTS  
(continued)

<u>Section</u>	<u>Title</u>	<u>Page</u>
2.1.8.c	Improved In-Plant Iodine Instrumentation Under..... Accident Conditions	40
2.1.9	Transient and Accident Analysis.....	42
	Containment Pressure Indication (ACRS).....	43
	Containment Water Level Indication (ACRS).....	44
	Containment Hydrogen Indication (ACRS).....	45
	Reactor Coolant System Venting (NRR).....	46
2.2.1.a	Shift Supervisor Responsibilities.....	51
2.2.1.b	Shift Technical Advisor.....	53
2.2.1.c	Shift and Relief Turnover Procedures.....	56
2.2.2.a	Control Room Access.....	57
2.2.2.b	Onsite Technical Support Center.....	58
2.2.2.c	Onsite Operational Support Center.....	64
	<u>Enclosure 2</u>	
	Implementation Schedule.....	65
	Analyses and Training Schedule .....	70

## EMERGENCY POWER SUPPLY (2.1.1)

### Pressurizer Heaters

#### POSITION

Consistent with satisfying the requirements of General Design Criteria 10, 14, 15, 17 and 20 of Appendix A to 10 CFR Part 50 for the event of loss of offsite power, the following positions shall be implemented:

#### Pressurizer Heater Power Supply

1. The pressurizer heater power supply design shall provide the capability to supply, from either the offsite power source or the emergency power source (when offsite power is not available), a predetermined number of pressurizer heaters and associated controls necessary to establish and maintain natural circulation at hot standby conditions. The required heaters and their controls shall be connected to the emergency buses in a manner that will provide redundant power supply capability.
2. Procedures and training shall be established to make the operator aware of when and how the required pressurizer heaters shall be connected to the emergency buses. If required, the procedures shall identify under what conditions selected emergency loads can be shed from the emergency power source to provide sufficient capacity for the connection of the pressurizer heaters.
3. The time required to accomplish the connection of the preselected pressurizer heater to the emergency buses shall be consistent with the timely initiation and maintenance of natural circulation conditions.
4. Pressurizer heater motive and control power interfaces with the emergency buses shall be accomplished through devices that have been qualified in accordance with safety-grade requirements.

#### CLARIFICATION

1. In order not to compromise independence between the sources of emergency power and still provide redundant capability to provide emergency power to the pressurizer heaters, each redundant heater or group of heaters should have access to only one Class 1E division power supply.

2. The number of heaters required to have access to each emergency power source is that number required to maintain natural circulation in the hot standby condition.
3. The power sources need not necessarily have the capacity to provide power to the heaters concurrent with the loads required for LOCA.
4. Any change-over of the heaters from normal offsite power to emergency onsite power is to be accomplished manually in the control room.
5. In establishing procedures to manually reload the pressurizer heaters onto the emergency power sources, careful consideration must be given to:
  - a. Which ESF loads may be appropriately shed for a given situation.
  - b. Reset of the Safety Injection Actuation Signal to permit the operation of the heaters.
  - c. Instrumentation and criteria for operator use to prevent overloading a diesel generator.
6. The Class IE interfaces for main power and control power are to be protected by safety-grade circuit breakers. (See also Reg. Guide 1.75)
7. Being non-Class IE loads, the pressurizer heaters must be automatically shed from the emergency power sources upon the occurrence of a safety injection actuation signal. (See item 5.b. above)

## Emergency Power Supply (2.1.1)

### Pressurizer Level and Relief Block Valves

#### POSITION

Consistent with satisfying the requirements of General Design Criteria 10, 14, 15, 17 and 20 of Appendix A to 10 CFR Part 50 for the event of loss of offsite power, the following positions shall be implemented:

#### Power Supply for Pressurizer Relief and Block Valves and Pressurizer Level Indicators

1. Motive and control components of the power-operated relief valves (PORVs) shall be capable of being supplied from either the offsite power source or the emergency power source when the offsite power is not available.
2. Motive and control components associated with the PORV block valves shall be capable of being supplied from either the offsite power source or the emergency power source when the offsite power is not available.
3. Motive and control power connections to the emergency buses for the PORVs and their associated block valves shall be through devices that have been qualified in accordance with safety-grade requirements.
4. The pressurizer level indication instrument channels shall be powered from the vital instrument buses. The buses shall have the capability of being supplied from either the offsite power source or the emergency power source when offsite power is not available.

#### CLARIFICATION

1. While the prevalent consideration from TMI Lessons Learned is being able to close the PORV/block valves, the design should retain, to the extent practical, the capability to open these valves.
2. The motive and control power for the block valve should be supplied from an emergency power bus different from that which supplies the PORV.
3. Any changover of the PORV and block valve motive and control power from the normal offsite power to the emergency onsite power is to be accomplished manually in the control room.

4. For those designs where instrument air is needed for operation, the electrical power supply requirement should be capable of being manually connected to the emergency power sources.

## PERFORMANCE TESTING FOR BWR AND PWR RELIEF AND SAFETY VALVES (2.1.2)

### POSITION

Pressurized Water Reactor and Boiling Water Reactor licensees and applicants shall conduct testing to qualify the reactor coolant system relief and safety valves under expected operating conditions for design basis transients and accidents.

### CLARIFICATION

1. Expected operating conditions can be determined through the use of analysis of accidents and anticipated operational occurrences referenced in Regulatory Guide 1.70.
2. This testing is intended to demonstrate valve operability under various flow conditions, that is, the ability of the valve to open and shut under the various flow conditions should be demonstrated.
3. Not all valves on all plants are required to be tested. The valve testing may be conducted on a prototypical basis.
4. The effect of piping on valve operability should be included in the test conditions. Not every piping configuration is required to be tested, but the configurations that are tested should produce the appropriate feedback effects as seen by the relief or safety valve.
5. Test data should include data that would permit an evaluation of discharge piping and supports if those components are not tested directly.

6. A description of the test program and the schedule for testing should be submitted by January 1, 1980.
7. Testing shall be complete by July 1, 1981.

DIRECT INDICATION OF POWER-OPERATED RELIEF

VALVE AND SAFETY VALVE POSITION FOR PWRs AND BWRs (2.1.3.a)

POSITION

Reactor System relief and safety valves shall be provided with a positive indication in the control room derived from a reliable valve position detection device or a reliable indication of flow in the discharge pipe.

CLARIFICATION

1. The basic requirement is to provide the operator with unambiguous indication of valve position (open or closed) so that appropriate operator actions can be taken.
2. The valve position should be indicated in the control room. An alarm should be provided in conjunction with this indication.
3. The valve position indication may be safety grade. If the position indication is not safety grade, a reliable single channel direct indication powered from a vital instrument bus may be provided if backup methods of determining valve position are available and are discussed in the emergency procedures as an aid to operator diagnosis and action.
4. The valve position indication should be seismically qualified consistent with the component or system to which it is attached. If the seismic qualification requirements cannot be met feasibly by January 1, 1980, a justification should be provided for less than seismic qualification and a schedule should be submitted for upgrade to the required seismic qualification.

5. The position indication should be qualified for its appropriate environment (any transient or accident which would cause the relief or safety valve to lift). If the environmental qualification program for this position indication will not be completed by January 1, 1980, a proposed schedule for completion of the environmental qualification program should be provided.

## INSTRUMENTATION FOR DETECTION OF INADEQUATE CORE COOLING (2.1.3.b)

### SUBCOOLING METER

#### POSITION

Licensees shall develop procedures to be used by the operator to recognize inadequate core cooling with currently available instrumentation. The licensee shall provide a description of the existing instrumentation for the operators to use to recognize these conditions. A detailed description of the analyses needed to form the basis for operator training and procedure development shall be provided pursuant to another short-term requirement, "Analysis of Off-Normal Conditions, Including Natural Circulation" (see Section 2.1.9 of NUREG-0578)

In addition, each PWR shall install a primary coolant saturation meter to provide on-line indication of coolant saturation condition. Operator instruction as to use of this meter shall include consideration that is not to be used exclusive of other related plant parameters.

#### CLARIFICATION

1. The analysis and procedures addressed in paragraph one above will reviewed and should be submitted to the NRC "Bulletins and Orders Task Force" for review.
2. The purpose of the subcooling meter is to provide a continuous indication of margin to saturated conditions. This is an important diagnostic tool for the reactor operators.
3. Redundant safety grade temperature input from each hot leg (or use of multiple core exit in T/C's) are required.
4. Redundant safety grade system pressure measures should be provided.
5. Continuous display of the primary coolant saturation conditions should be provided.

6. Each PWR should have: (A.) Safety grade calculational devices and display (minimum of two meters) or (B.) a highly reliable single channel environmentally qualified, and testable system plus a backup procedure for use of steam tables. If the plant computer is to be used, its availability must be documented.
7. In the long term, the instrumentation qualifications must be required to be upgraded to meet the requirements of Regulatory Guide 1.97 (Instrumentation for Light Water Cooled Nuclear Plants to Assess Plant Conditions During and Following an Accident) which is under development.
8. In all cases appropriate steps (electrical, isolation, etc.) must be taken to assure that the addition of the subcooling meter does not adversely impact the reactor protection or engineered safety features systems.
9. The attachment provides a definition of information required on the subcooling meter.

INFORMATION REQUIRED ON THE SUBCOOLING METER

Display

Information Displayed (T-Tsat, Tsat, Press, etc.) \_\_\_\_\_

Display Type (Analog, Digital, CRT) \_\_\_\_\_

Continuous or on Demand \_\_\_\_\_

Single or Redundant Display \_\_\_\_\_

Location of Display \_\_\_\_\_

Alarms (include setpoints) \_\_\_\_\_

Overall uncertainty (°F, PSI) \_\_\_\_\_

Range of Display \_\_\_\_\_

Qualifications (seismic, environmental, IEEE323) \_\_\_\_\_

Calculator

Type (process computer, dedicated digital or analog calc.) \_\_\_\_\_

If process computer is used specify availability. (% of time) \_\_\_\_\_

Single or redundant calculators \_\_\_\_\_

Selection Logic (highest T., lowest press) \_\_\_\_\_

Qualifications (seismic, environmental, IEEE323) \_\_\_\_\_

Calculational Technique (Steam Tables, Functional Fit, ranges) \_\_\_\_\_

Input

Temperature (RTD's or T/C's) \_\_\_\_\_

Temperature (number of sensors and locations) \_\_\_\_\_

Range of temperature sensors \_\_\_\_\_

Uncertainty\* of temperature sensors (°F at 1 )

\_\_\_\_\_

Qualifications (seismic, environmental, IEEE323)

\_\_\_\_\_

Pressure (specify instrument used)

\_\_\_\_\_

Pressure (number of sensors and locations)

\_\_\_\_\_

Range of Pressure sensors

\_\_\_\_\_

Uncertainty\* of pressure sensors (PSI at 1 )

\_\_\_\_\_

Qualifications (seismic, environmental, IEEE323)

\_\_\_\_\_

Backup Capability

Availability of Temp & Press

\_\_\_\_\_

Availability of Steam Tables etc.

\_\_\_\_\_

Training of operators

\_\_\_\_\_

Procedures

\_\_\_\_\_

\*Uncertainties must address conditions of forced flow and natural circulation

## INSTRUMENTATION FOR DETECTION OF INADEQUATE CORE COOLING (2.1.3.b)

### ADDITIONAL INSTRUMENTATION

#### POSITION

Licensees shall provide a description of any additional instrumentation or controls (primary or backup) proposed for the plant to supplement those devices cited in the preceding section giving an unambiguous, easy-to-interpret indication of inadequate core cooling. A description of the functional design requirements for the system shall also be included. A description of the procedures to be used with the proposed equipment, the analysis used in developing these procedures, and a schedule for installing the equipment shall be provided.

#### CLARIFICATION

1. Design of new instrumentation should provide an unambiguous indication of inadequate core cooling. This may require new measurements to or a synthesis of existing measurements which meet safety-grade criteria.
2. The evaluation is to include reactor water level indication.
3. A commitment to provide the necessary analysis and to study advantages of various instruments to monitor water level and core cooling is required in the response to the September 13, 1979 letter.
4. The indication of inadequate core cooling must be unambiguous, in that, it should have the following properties:
  - a) it must indicate the existence of inadequate core cooling caused by various phenomena (i.e., high void fraction pumped flow as well as stagnant boil off).
  - b) it must not erroneously indicate inadequate core cooling because of the presence of an unrelated phenomenon.

5. The indication must give advanced warning of the approach of inadequate core cooling.
6. The indication must cover the full range from normal operation to complete core uncovering. For example, if water level is chosen as the unambiguous indication, then the range of the instrument (or instruments) must cover the full range from normal water level to the bottom of the core .

## CONTAINMENT ISOLATION (2.1.4)

### POSITION

1. All containment isolation system designs shall comply with the recommendations of SRP 6.2.4; i.e., that there be diversity in the parameters sensed for the initiation of containment isolation.
2. All plants shall give careful reconsideration to the definition of essential and non-essential systems, shall identify each system determined to be essential, shall identify each system determined to be non-essential, shall describe the basis for selection of each essential system, shall modify their containment isolation designs accordingly, and shall report the results of the re-evaluation to NRC.
3. All non-essential systems shall be automatically isolated by the containment isolation signal.
4. The design of control systems for automatic containment isolation valves shall be such that resetting the isolation signal will not result in the automatic reopening of containment isolation valves. Reopening of containment isolation valves shall require deliberate operator action.

### CLARIFICATION

1. Provide diverse containment isolation signals that satisfy safety-grade requirements.
2. Identify essential and non-essential systems and provide results to NRC.
3. Non-essential systems should be automatically isolated by containment isolation signals.
4. Resetting of containment isolation signals shall not result in the automatic loss of containment isolation

DEDICATED H<sub>2</sub> CONTROL PENETRATIONS (2.1.5.a)

POSITION

Plants using external recombiners or purge systems for post-accident combustible gas control of the containment atmosphere should provide containment isolation systems for external recombiner or purge systems that are dedicated to that service only, that the redundancy and single failure requirements of General Design Criterion 54 and 56 of Appendix A to 10 CFR 50, and that are sized to satisfy the flow requirements of the recombiner or purge system.

CLARIFICATION

1. This requirement is only applicable to those plants whose licensing basis includes requirements for external recombiners or purge systems for post-accident combustible gas control of the containment atmosphere.
2. An acceptable alternative to the dedicated penetration is a combined design that is single-failure proof for containment isolation purposes and single-failure proof for operation of the recombiner or purge system.
3. The dedicated penetration or the combined single-failure proof alternative should be sized such that the flow requirements for the use of the recombiner or purge system are satisfied.
4. Components necessitated by this requirement should be safety grade.
5. A description of required design changes and a schedule for accomplishing these changes should be provided by January 1, 1980. Design changes should be completed by January 1, 1981.

CAPABILITY TO INSTALL HYDROGEN RECOMBINER  
AT EACH LIGHT WATER NUCLEAR POWER PLANT (2.1.5.c)

POSITION

The procedures and bases upon which the recombiners would be used on all plants should be the subject of a review by the licensees in considering shielding requirements and personnel exposure limitations as demonstrated to be necessary in the case of TMI-2.

CLARIFICATION

1. This requirement applies only to those plants that included Hydrogen Recombiners as a design basis for licensing.
2. The shielding and associated personnel exposure limitations associated with recombiner use should be evaluated as part of licensee response to requirement 2.1.6.B, "Design review for Plant Shielding."
3. Each licensee should review and upgrade, as necessary, those criteria and procedures dealing with recombiner use. Action taken on this requirement should be submitted by January 1, 1980.

INTEGRITY OF SYSTEMS OUTSIDE CONTAINMENT LIKELY  
TO CONTAIN RADIOACTIVE MATERIALS FOR PWRs AND BWRs (2.1.6.a)

POSITION

Applicants and licensees shall immediately implement a program to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident to as-low-as-practical levels. This program shall include the following:

1. Immediate Leak Reduction
  - a. Implement all practical leak reduction measures for all systems that could carry radioactive fluid outside of containment.
  - b. Measure actual leakage rates with system in operation and report them to the NRC.

2. Continuing Leak Reduction

Establish and implement a program of preventive maintenance to reduce leakage to as-low-as-practical levels. This program shall include periodic integrated leak tests at intervals not to exceed each refueling cycle.

CLARIFICATION

Licensees shall, by January 1, 1980, provide a summary description of their program to reduce leakage from systems outside containment that would or could contain highly radioactive fluids during a serious transient or accident. Examples of such systems are given on page A-26 of NUREG-0578. Other examples include the Reactor Core Isolation Cooling and Reactor Water Cleanup (Letdown function) Systems for BWRs. Include a list of systems which are excluded from this program. Testing of gaseous systems should include helium leak detection or equivalent testing methods. Consider in your program to reduce leakage potential release paths due to design and operator deficiencies as discussed in our letter to you regarding North Anna and Related Incidents dated October 17, 1979.

DESIGN REVIEW OF PLANT SHIELDING AND ENVIRONMENTAL  
QUALIFICATION OF EQUIPMENT FOR SPACES/SYSEMS WHICH  
MAY BE USED IN POST ACCIDENT OPERATIONS (2.1.6.b)

POSITION

With the assumption of a post-accident release of radioactivity equivalent to that described in Regulatory Guides 1.3 and 1.4 (i.e., the equivalent of 50% of the core radioiodine, 100% of the core noble gas inventory, and 1% of the core solids, are contained in the primary coolant), each licensee shall perform a radiation and shielding design review of the spaces around systems that may, as a result of an accident, contain highly radioactive materials. The design review should identify the location of vital areas and equipment, such as the control room, radwaste control stations, emergency power supplies, motor control centers, and instrument areas, in which personnel occupancy may be unduly limited or safety equipment may be unduly degraded by the radiation fields during post-accident operations of these systems.

Each licensee shall provide for adequate access to vital areas and protection of safety equipment by design changes, increased permanent or temporary shielding, or post-accident procedural controls. The design review shall determine which types of corrective actions are needed for vital areas throughout the facility.

CLARIFICATION

Any area which will or may require occupancy to permit an operator to aid in the mitigation of or recovery from an accident is designated as a vital area. In order to assure that personnel can perform necessary post-accident operations in the vital areas, we are providing the following guidance to be used by licensees to evaluate the adequacy of radiation protection to the operators:

1. Source Term

The minimum radioactive source term should be equivalent to the source terms recommended, in Regulatory Guides 1.3, 1.4, 1.7 and Standard Review Plant 15.6.5. with appropriate decay times based on plant design.

- a. **Liquid Containing Systems:** 100% of the core equilibrium noble gas inventory, 50% of the core equilibrium halogen inventory and 1% of all others are assumed to be mixed in the reactor coolant and liquids injected by HPCI and LPCI.
  
- b. **Gas Containing Systems:** 100% of the core equilibrium noble gas inventory and 25% of the core equilibrium halogen activity are assumed to be mixed in the containment atmosphere. For gas containing lines connected to the primary system (e.g., BWR steam lines) the concentration of radioactivity shall be determined assuming the activity is contained in the gas space in the primary coolant system.

2. Dose Rate Criteria

The dose rate for personnel in a vital area should be such that the guidelines of GDC 19 should not be exceeded during the course of the accident. GDC 19 limits the dose to an operator to 5 Rem whole body or its equivalent to any part of the body. When determining the dose to an operator, care must be taken to determine the necessary occupancy time in a specific area. For example, areas requiring continuous occupancy will require much lower dose rates than areas where minimal occupancy is required. Therefore, allowable dose rates will be based upon expected occupancy, as well as the radioactive source terms and shielding. However, in order to provide a general design objective, we are providing the following dose rate criteria

with alternatives to be documented on a case-by-case basis.

The recommended dose rates are average rates in the area. Local hot spots may exceed the dose rate guidelines provided occupancy is not required at the location of the hot spot. These doses are design objectives and are not to be used to limit access in the event of an accident.

- a. Areas Requiring Continuous Occupancy:  $\leq 15\text{mr/hr}$ . These areas will require full time occupancy during the course of the accident. The Control Room and onsite technical support center are areas where continuous occupancy will be required. The dose rate for these areas is based on the control room occupancy factors contained in SRP 6.4.
- b. Areas Requiring Infrequent Access: GDC 19. These areas may require access on a regular basis, but not continuous occupancy. Shielding should be provided to allow access at a frequency and duration estimated by the licensee. The plant Radiochemical/Chemical Analysis Laboratory, radwaste panel, motor control center, instrumentation locations, and reactor coolant and containment gas sample stations are examples where occupancy may be needed often but not continuously.

AUTO INITIATION OF THE AUXILIARY  
FEEDWATER SYSTEM (AFWS) (2.1.7.a)

POSITION

Consistent with satisfying the requirements of General Design Criterion 20 of Appendix A to 10 CFR Part 50 with respect to the timely initiation of the auxiliary feedwater system, the following requirements shall be implemented in the short term:

1. The design shall provide for the automatic initiation of the auxiliary feedwater system.
2. The automatic initiation signals and circuits shall be designed so that a single failure will not result in the loss of auxiliary feedwater system function.
3. Testability of the initiating signals and circuits shall be a feature of the design.
4. The initiating signals and circuits shall be powered from the emergency buses.
5. Manual capability to initiate the auxiliary feedwater system from the control room shall be retained and shall be implemented so that a single failure in the manual circuits will not result in the loss of system function.
6. The a-c motor-driven pumps and valves in the auxiliary feedwater system shall be included in the automatic actuation (simultaneous and/or sequential) of the loads onto the emergency buses.
7. The automatic initiating signals and circuits shall be designed so that their failure will not result in the loss of manual capability to initiate the AFWS from the control room.

In the long term, the automatic initiation signals and circuits shall be upgraded in accordance with safety-grade requirements.

## CLARIFICATION

### Control Grade (Short-Term)

1. Provide automatic/manual initiation of AFWS.
2. Testability of the initiating signals and circuits is required.
3. Initiating signals and circuits shall be powered from the emergency buses.
4. Necessary pumps and valves shall be included in the automatic sequence of the loads to the emergency buses. Verify that the addition of these loads does not compromise the emergency diesel generating capacity.
5. Failure in the automatic circuits shall not result in the loss of manual capability to initiate the AFWS from the control room.
6. Other Considerations
  - a. For those designs where instrument air is needed for operation, the electric power supply requirement should be capable of being manually connected to emergency power sources.

AUXILIARY FEEDWATER FLOW INDICATION  
TO STEAM GENERATORS (2.1.7.b)

POSITION

Consistent with satisfying the requirements set forth in GDC 13 to provide the capability in the control room to ascertain the actual performance of the AFWS when it is called to perform its intended function, the following requirements shall be implemented:

1. Safety-grade indication of auxiliary feedwater flow to each steam generator shall be provided in the control room.
2. The auxiliary feedwater flow instrument channels shall be powered from the emergency buses consistent with satisfying the emergency power diversity requirements of the auxiliary feedwater system set forth in Auxiliary Systems Branch Technical Position 10-1 of the Standard Review Plan, Section 10.4.9.

CLARIFICATION

A. Control Grade (Short-Term)

1. Auxiliary feedwater flow indication to each steam generator shall satisfy the single failure criterion.
2. Testability of the auxiliary feedwater flow indication channels shall be a feature of the design.
3. Auxiliary feedwater flow instrument channels shall be powered from the vital instrument buses.

B. Safety-Grade (Long-Term)

1. Auxiliary feedwater flow indication to each steam generator shall satisfy safety-grade requirements.

C. Other

1. For the Short-Term the flow indication channels should by themselves satisfy the single failure criterion for each steam generator. As

a fall-back position, one auxiliary feed water flow channel may be backed up by a steam generator level channel.

2. Each auxiliary feed water channel should provide an indication of feed flow with an accuracy on the order of + 10%.

## IMPROVED POST-ACCIDENT SAMPLING CAPABILITY (2.1.8.a)

### POSITION

A design and operational review of the reactor coolant and containment atmosphere sampling systems shall be performed to determine the capability of personnel to promptly obtain (less than 1 hour) a sample under accident conditions without incurring a radiation exposure to any individual in excess of 3 and 18 3/4 Rems to the whole body or extremities, respectively. Accident conditions should assume a Regulatory Guide 1.3 or 1.4 release of fission products. If the review indicates that personnel could not promptly and safely obtain the samples, additional design features or shielding should be provided to meet the criteria.

A design and operational review of the radiological spectrum analysis facilities shall be performed to determine the capability to promptly quantify (less than 2 hours) certain radioisotopes that are indicators of the degree of core damage. Such radionuclides are noble gases (which indicate cladding failure), iodines and cesiums (which indicate high fuel temperatures), and non-volatile isotopes (which indicate fuel melting). The initial reactor coolant spectrum should correspond to a Regulatory Guide 1.3 or 1.4 release. The review should also consider the effects of direct radiation from piping and components in the auxiliary building and possible contamination and direct radiation from airborne effluents. If the review indicates that the analyses required cannot be performed in a prompt manner with existing equipment, then design modifications or equipment procurement shall be undertaken to meet the criteria.

In addition to the radiological analyses, certain chemical analyses are necessary for monitoring reactor conditions. Procedures shall be provided to perform boron and chloride chemical analyses assuming a highly radioactive initial sample (Regulatory Guide 1.3 or 1.4 source term). Both analyses shall be capable of being completed promptly; i.e., the boron sample analysis within an hour and the chloride sample analysis within a shift.

### DISCUSSION

The primary purpose of implementing Improved Post-Accident Sampling Capability is to improve efforts to assess and control the course of an accident by:

1. Providing information related to the extent of core damage that has occurred or may be occurring during an accident;
2. Determining the types and quantities of fission products released to the containment in the liquid and gas phase and which may be released to the environment;

3. Providing information on coolant chemistry (e.g., dissolved gas, boron and pH) and containment hydrogen.

The above information requires a capability to perform the following analyses:

1. Radiological and chemical analyses of pressurized and unpressurized reactor coolant liquid samples;
2. Radiological and hydrogen analyses of containment atmosphere (air) samples.

#### CLARIFICATION

The licensee shall have the capability to promptly obtain (in less than 1 hour) pressurized and unpressurized reactor coolant samples and a containment atmosphere (air) sample.

The licensee shall establish a plan for an onsite radiological and chemical analysis facility with the capability to provide, within 1 hour of obtaining the sample, quantification of the following:

1. certain isotopes that are indicators of the degree of core damage (i.e., noble gases, iodines and cesiums and non-volatile isotopes),
2. hydrogen levels in the containment atmosphere in the range 0 to 10 volume percent,
3. dissolved gases (i.e.,  $H_2$ ,  $O_2$ ) and boron concentration of liquids.

or have in-line monitoring capabilities to perform the above analysis.

Plant procedures for the handling and analysis of samples, minor plant modifications for taking samples and a design review and procedural modifications (if necessary) shall be completed by January 1, 1980. Major plant modifications shall be completed by January 1, 1981.

During the review of the post accident sampling capability consideration should be given to the following items:

1. Provisions shall be made to permit containment atmosphere sampling under both positive and negative containment pressure.
2. The licensee shall consider provisions for purging samples lines, for reducing plateout in sample lines, for minimizing sample loss or distortion, for preventing blockage of sample lines by loose material in the RCS or containment, for appropriate disposal of the samples, and for passive flow restrictions to limit reactor coolant loss or containment air leak from a rupture of the sample line.
3. If changes or modifications to the existing sampling system are required, the seismic design and quality group classification of sampling lines and components shall conform to the classification of the system to which each sampling line is connected. Components and piping downstream of the second isolation valve can be designed to quality Group D and nonseismic Category I requirements.

The licensee's radiological sample analysis capability should include provisions to:

- a. Identify and quantify the isotopes of the nuclide categories discussed above to levels corresponding to the source terms given in Lessons Learned Item 2.1.6.b. Where necessary, ability to dilute samples to provide capability for measurement and reduction of personnel

exposure, should be provided. Sensitivity of onsite analysis capability should be such as to permit measurement of nuclide concentration in the range from approximately 1  $\mu\text{Ci/gm}$  to the upper levels indicated here.

- b. Restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of 2). This can be accomplished through the use of sufficient shielding around samples and outside sources, and by the use of ventilation system design which will control the presence of airborne radioactivity.
- c. Maintain plant procedures which identify the analysis required, measurement techniques and provisions for reducing background levels.

The licensee's chemical analysis capability shall consider the presence of the radiological source term indicated for the radiological analysis.

In performing the review of sampling and analysis capability, consideration shall be given to personnel occupational exposure. Procedural changes and/or plant modifications must assure that it shall be possible to obtain and analyze a sample while incurring a radiation dose to any individual that is as low as reasonably achievable and not in excess of GDC 19. In assuring that these limits are met, the following criteria will be used by the staff.

1. For shielding calculations, source terms shall be as given in Lessons Learned Item 2.1.6.b.

2. Access to the sample station and the radiological and chemical analysis facilities shall be through areas which are accessible in post accident situations and which are provided with sufficient shielding to assure that the radiation dose criteria are met.
3. Operations in the sample station, handling of highly radioactive samples from the sample station to the analysis facilities, and handling while working with the samples in the analysis facilities shall be such that the radiation dose criteria are met. This may involve sufficient shielding of personnel from the samples and/or the dilution of samples for analysis. If the existing facilities do not satisfy these criteria, then additional design features, e.g., additional shielding, remote handling etc. shall be provided. The radioactive sample lines in the sample station, the samples themselves in the analysis facilities, and other radioactive lines of the vicinity of the sampling station and analysis facilities shall be included in the evaluation.
4. High range portable survey instruments and personnel dosimeters should be provided to permit rapid assessment of high exposure rates and accumulated personnel exposure.

The licensee shall demonstrate their capability to obtain and analyze a sample containing the isotopes discussed above according to the criteria given in this section.

## INCREASED RANGE OF RADIATION MONITORS (2.1.8.b)

### POSITION

The requirements associated with this recommendation should be considered as advanced implementation of certain requirements to be included in a revision to Regulatory Guide 1.97, "Instrumentation to Follow the Course of an Accident", which has already been initiated, and in other Regulatory Guides, which will be promulgated in the near-term.

1. Noble gas effluent monitors shall be installed with an extended range designed to function during accident conditions as well as during normal operating conditions; multiple monitors are considered to be necessary to cover the ranges of interest.
  - a. Noble gas effluent monitors with an upper range capacity of  $10^5$   $\mu\text{Ci/cc}$  (Xe-133) are considered to be practical and should be installed in all operating plants.
  - b. Noble gas effluent monitoring shall be provided for the total range of concentration extending from normal condition (ALARA) concentrations to a maximum of  $10^5$   $\mu\text{Ci/cc}$  (Xe-133). Multiple monitors are considered to be necessary to cover the ranges of interest. The range capacity of individual monitors should overlap by a factor of ten.
2. Since iodine gaseous effluent monitors for the accident condition are not considered to be practical at this time, capability for effluent monitoring of radioiodines for the accident condition shall be provided with sampling conducted by adsorption on charcoal or other media, followed by onsite laboratory analysis.
3. In-containment radiation level monitors with a maximum range of  $10^8$  rad/hr shall be installed. A minimum of two such monitors that are physically separated shall be provided. Monitors shall be designed and qualified to function in an accident environment.

### DISCUSSION

The January 1, 1980 requirement, were specifically added by the Commission and were not included in NUREG-0578. The purpose of the interim January 1, 1980 requirement is to assure that licensees have methods of quantifying radioactivity releases should the existing effluent instrumentation go offscale.

### CLARIFICATION

#### 1. Radiological Noble Gas Effluent Monitors

##### A. January 1, 1980 Requirements

Until final implementation in January 1, 1981, all operating reactors must provide, by January 1, 1980, an interim method for

quantifying high level releases which meets the requirements of Table 2.1.8.b.1. This method is to serve only as a provisional fix with the more detailed, exact methods to follow. Methods are to be developed to quantify release rates of up to 10,000 Ci/sec for noble gases from all potential release points, (e.g., auxiliary building, radwaste building, fuel handling building, reactor building, waste gas decay tank releases, main condenser air ejector, BWR main condenser vacuum pump exhaust, PWR steam safety valves and atmosphere steam dump valves and BWR turbine buildings) and any other areas that communicate directly with systems which may contain primary coolant or containment gases, (e.g., letdown and emergency core cooling systems and external recombiners). Measurements/analysis capabilities of the effluents at the final release point (e.g., stack) should be such that measurements of individual sources which contribute to a common release point may not be necessary. For assessing radioiodine and particulate releases, special procedures must be developed for the removal and analysis of the radioiodine/particulate sampling media (i.e., charcoal canister/filter paper). Existing sampling locations are expected to be adequate; however, special procedures for retrieval and analysis of the sampling media under accident conditions (e.g., high air and surface contamination and direct radiation levels) are needed.

It is intended that the monitoring capabilities called for in the interim can be accomplished with existing instrumentation or readily available instrumentation. For noble gases, modifications to existing monitoring systems, such as the use of portable high range survey

instruments, set in shielded collimators so that they "see" small sections of sampling lines is an acceptable method for meeting the intent of this requirement. Conversion of the measured dose rate (mR/hr) into concentration ( $\mu\text{Ci/cc}$ ) can be performed using standard volume source calculations. A method must be developed with sufficient accuracy to quantify the iodine releases in the presence of high background radiation from noble gases collected on charcoal filters. Seismically qualified equipment and equipment meeting IEEE-279 is not required.

The licensee shall provide the following information on his methods to quantify gaseous releases of radioactivity from the plant during an accident.

1. Noble Gas Effluents

a. System/Method description including:

- i) Instrumentation to be used including range or sensitivity, energy dependence, and calibration frequency and technique,
- ii) Monitoring/sampling locations, including methods to assure representative measurements and background radiation correction,
- iii) A description of method to be employed to facilitate access to radiation readings. For January 1, 1980, Control room read-out is preferred; however, if impractical, in-situ readings by an individual with verbal communication with the Control Room is acceptable based on (iv) below.

- iv) Capability to obtain radiation readings at least every 15 minutes during an accident.
- v) Source of power to be used. If normal AC power is used, an alternate back-up power supply should be provided. If DC power is used, the source should be capable of providing continuous readout for 7 consecutive days.

b. Procedures for conducting all aspects of the measurement/analysis including:

- i) Procedures for minimizing occupational exposures
- ii) Calculational methods for converting instrument readings to release rates based on exhaust air flow and taking into consideration radionuclide spectrum distribution as function of time after shutdown.
- iii) Procedures for dissemination of information.
- iv) Procedures for calibration.

B. January 1, 1981 Requirements

By January 1, 1981, the licensee shall provide high range noble gas effluent monitors for each release path. The noble gas effluent monitor should meet the requirements of Table 2.1.8.b.2.

The licensee shall also provide the information given in Sections 1.A.1.a.i, 1.A.1.a.ii, 1.A.1.b.ii, 1.A.1.b.iii, and 1.A.1.b.iv above for the noble gas effluent monitors.

## **2. Radioiodine and Particulate Effluents**

**A. For January 1, 1980 the licensee should provide the following:**

### **1. System/Method description including:**

- a) Instrumentation to be used for analysis of the sampling media with discussion on methods used to correct for potentially interfering background levels of radioactivity.**
- b) Monitoring/sampling location.**
- c) Method to be used for retrieval and handling of sampling media to minimize occupational exposure.**
- d) Method to be used for data analysis of individual radionuclides in the presence of high levels of radioactive noble gases.**
- e) If normal AC power is used for sample collection and analysis equipment, an alternate back-up power supply should be provided. If DC power is used, the source should be capable of providing continuous read-out for 7 consecutive days.**

### **2. Procedures for conducting all aspects of the measurement analysis including:**

- a) Minimizing occupational exposure**
- b) Calculational methods for determining release rates**
- c) Procedures for dissemination of information**
- d) Calibration frequency and technique**

B. For January 1, 1981, the licensee should have the capability to continuously sample and provide onsite analysis of the sampling media. The licensee should also provide the information required in 2.A above.

3. Containment Radiation Monitors

Provide by January 1, 1981, two radiation monitor systems in containment which are documented to meet the requirements of Table 2.1.8.b.2.

It is possible that future regulatory requirements for emergency planning interfaces may necessitate identification of different types of radionuclides in the containment air, e.g., noble gases (indication of core damage) and non-volatiles (indication of core melt). Consequently, consideration should be given to the possible installation or future conversion of these monitors to perform this function.

TABLE 2.1.8.b.1

INTERIM PROCEDURES FOR QUANTIFYING HIGH LEVEL  
ACCIDENTAL RADIOACTIVITY RELEASES

- Licensees are to implement procedures for estimating noble gas and radioiodine release rates if the existing effluent instrumentation goes off scale.
- Examples of major elements of a highly radioactive effluent release special procedures (noble gas).
  - Preselected location to measure radiation from the exhaust air, e.g., exhaust duct or sample line.
  - Provide shielding to minimize background interference.
  - Use of an installed monitor (preferable) or dedicated portable monitor (acceptable) to measure the radiation.
  - Predetermined calculational method to convert the radiation level to radioactive effluent release rate.

TABLE 2.1.8.b.2

HIGH RANGE EFFLUENT MONITOR

- . NOBLE GASES ONLY
- . RANGE: (Overlap with Normal Effluent Instrument Range)
  - UNDILUTED CONTAINMENT EXHAUST 10<sup>+5</sup>  $\mu$ Ci/CC
  - DILUTED (>10: 1) CONTAINMENT EXHAUST 10<sup>+4</sup>  $\mu$ Ci/CC
  - MARK I BWR REACTOR BUILDING EXHAUST 10<sup>+4</sup>  $\mu$ Ci/CC
  - PWR SECONDARY CONTAINMENT EXHAUST 10<sup>+4</sup>  $\mu$ Ci/CC
  - BUILDINGS WITH SYSTEMS CONTAINING PRIMARY COOLANT OR GASES 10<sup>+3</sup>  $\mu$ Ci/CC
  - OTHER BUILDINGS (E.G., RADWASTE) 10<sup>+2</sup>  $\mu$ Ci/CC
- . NOT REDUNDANT - 1 PER NORMAL RELEASE POINT
- . SEISMIC - NO
- . POWER - VITAL INSTRUMENT BUS
- . SPECIFICATIONS - PER R.G. 1.97 AND ANSI N320-1979
- . DISPLAY\*: CONTINUOUS AND RECORDING WITH READOUTS IN THE TECHNICAL SUPPORT CENTER (TSC) AND EMERGENCY OPERATIONS CENTER (EOC)
- . QUALIFICATIONS - NO

\*Although not a present requirement, it is likely that this information may have to be transmitted to the NRC. Consequently, consideration should be given to this possible future requirement when designing the display interfaces.

TABLE 2.1.8.b.3

HIGH RANGE CONTAINMENT RADIATION MONITOR

- . RADIATION: TOTAL RADIATION (ALTERNATE: PHOTON ONLY)
- . RANGE:
  - UP TO  $10^8$  RAD/HR (TOTAL RADIATION)
  - ALTERNATE:  $10^7$  R/HR (PHOTON RADIATION ONLY)
  - SENSITIVE DOWN TO 60 KEV PHOTONS\*
- . REDUNDANT: TWO PHYSICALLY SEPARATED UNITS
- . SEISMIC: PER R. G. 1.97
- . POWER: VITAL INSTRUMENT BUS
- . SPECIFICATIONS: PER R.G. 1.97 REV. 2 AND ANSI N320-1978
- . DISPLAY: CONTINUOUS AND RECORDING
- . CALIBRATION: LABORATORY CALIBRATION ACCEPTABLE

\*Monitors must not provide misleading information to the operators assuming delayed core damage when the 80 KEV photon Xe-133 is the major noble gas present.

IMPROVED IN-PLANT IODINE INSTRUMENTATION UNDER ACCIDENT CONDITIONS (2.1.8.c)

POSITION

Each licensee shall provide equipment and associated training and procedures for accurately determining the airborne iodine concentration in areas within the facility where plant personnel may be present during an accident.

CLARIFICATION

Use of Portable versus Stationary Monitoring Equipment

Effective monitoring of increasing iodine levels in the buildings under accident conditions must include the use of portable instruments for the following reasons:

- a. The physical size of the auxiliary/fuel handling building precludes locating stationary monitoring instrumentation at all areas where airborne iodine concentration data might be required.
- b. Unanticipated isolated "hot spots" may occur in locations where no stationary monitoring instrumentation is located.
- c. Unexpectedly high background radiation levels near stationary monitoring instrumentation after an accident may interfere with filter radiation readings.

- d. The time required to retrieve samples after an accident may result in high personnel exposures if these filters are located in high dose rate areas.

#### Iodine Filters and Measurement Techniques

- A. The following are short-term recommendations and shall be implemented by the licensee by January 1, 1980. The licensee shall have the capability to accurately detect the presence of iodine in the region of interest following an accident. This can be accomplished by using a portable or cart-mounted iodine sampler with attached single channel analyzer (SCA). The SCA window should be calibrated to the 365 keV of  $^{131}\text{I}$ . A representative air sample shall be taken and then counted for  $^{131}\text{I}$  using the SCA. This will give an initial conservative estimate of presence of iodine and can be used to determine if respiratory protection is required. Care must be taken to assure that the counting system is not saturated as a result of too much activity collected on the sampling cartridge.
- B. By January 1, 1981:  
The licensee shall have the capability to remove the sampling cartridge to a low background, low contamination area for further analysis. This area should be ventilated with clean air containing no airborne radionuclides which may contribute to inaccuracies in analyzing the sample. Here, the sample should first be purged of any entrapped noble gases using nitrogen gas or clean air free of noble bases. The licensee shall have the capability to measure accurately the iodine concentrations present on these samples and effluent charcoal samples under accident conditions.

## TRANSIENT AND ACCIDENT ANALYSIS (2.1.9)

### POSITION

See NUREG-0578, page A-44.

### DISCUSSION

The scope of the required transient and accident analysis is discussed in NUREG-0578. The schedule for these analyses is included in NUREG-0578 and is reproduced in the Implementation Schedule attachment to this letter. The Bulletins and Orders Task Force has been implementing these required analyses on that schedule. The analysis of the small break loss of coolant accident has been submitted by each of the owners groups. These analyses are presently under review by the B&O Task Force. The scope and schedule for the analysis of inadequate core cooling have been discussed and agreed upon in meetings between the owners groups and the B&O Task Force, and are documented in the minutes to those meetings.

The analysis of transients and accidents for the purpose of upgrading emergency procedures is due in early 1980 and the detailed scope and schedule of this analysis is the subject of continuing discussions between the owners groups and the B&O Task Force.

## CONTAINMENT PRESSURE INDICATION

### POSITION

A continuous indication of containment pressure should be provided in the control room. Measurement and indication capability shall include three times the design pressure of the containment for concrete, four times the design pressure for steel, and minus five psig for all containments.

### CLARIFICATION

1. The containment pressure indication shall meet the design provisions of Regulatory Guide 1.97 including qualification, redundancy, and testability.
2. The containment pressure monitor shall be installed by January 1, 1981.

## CONTAINMENT WATER LEVEL INDICATION

### POSITION

A continuous indication of containment water level shall be provided in the control room for all plants. A narrow range instrument shall be provided for PWRs and cover the range from the bottom to the top of the containment sump. A wide range instrument shall also be provided for PWRs and shall cover the range from the bottom of the containment to the elevation equivalent to a 600,000 gallon capacity. For BWRs, a wide range instrument shall be provided and cover the range from the bottom to 5 feet above the normal water level of the suppression pool.

### CLARIFICATION

1. The narrow range sump level instrument shall monitor the normal containment sump level vice the containment emergency sump level.
2. The wide range containment water level instruments shall meet the requirements of the proposed revision to Regulatory Guide 1.97 (Instrumentation for Light-Water Cooled Nuclear Power Plant to Assess Plant Conditions During and Following a Accident).
3. The narrow range containment water level instruments shall meet the requirements of Regulatory Guide 1.89 (Qualification of Class IE Equipment of Nuclear Power Plants).
4. The equivalent capacity of the wide range PWR level instrument has been changed from 500,000 gallons to 600,000 gallons to ensure consistency with the proposed revision to Regulatory Guide 1.97. It should be noted that this measurement capability is based on recent plant designs. For older plants with smaller water capacities, licensees may propose deviations from this requirement based on the available water supply capability at their plant.
5. The containment water level indication shall be installed by January 1, 1981.

## CONTAINMENT HYDROGEN INDICATION

### POSITION

A continuous indicaton of hydrogen concentration in the containment atmosphere shall be provided in the control room. Measurement capability shall be provided over the range of 0 to 10% hydrogen concentration under both positive and negative ambient pressure.

### CLARIFICATION

1. The containment hydrogen indication shall meet the design provisions of Regulatory Guide 1.97 including qualification, redundancy, and testability.
2. The containment hydrogen indication shall be installed by January 1, 1981.

## REACTOR COOLANT SYSTEM VENTING

### POSITION

Each applicant and licensee shall install reactor coolant system and reactor vessel head high point vents remotely operated from the control room. Since these vents form a part of the reactor coolant pressure boundary, the design of the vents shall conform to the requirements of Appendix A to 10 CFR Part 50 General Design Criteria. In particular, these vents shall be safety grade, and shall satisfy the single failure criterion and the requirements of IEEE-279 in order to ensure a low probability of inadvertent actuation.

Each applicant and licensee shall provide the following information concerning the design and operation of these high point vents:

1. A description of the construction, location, size, and power supply for the vents along with results of analyses of loss-of-coolant accidents initiated by a break in the vent pipe. The results of the analyses should be demonstrated to be acceptable in accordance with the acceptance criteria of 10 CFR 50.46.
2. Analyses demonstrating that the direct venting of noncondensable gases with perhaps high hydrogen concentrations does not result in violation of combustible gas concentration limits in containment as described in 10 CFR Part 50.44, Regulatory Guide 1.7 (Rev. 1), and Standard Review Plan Section 6.2.5.
3. Procedural guidelines for the operators' use of the vents. The information available to the operator for initiating or terminating vent usage shall be discussed.

### CLARIFICATION

#### A. General

1. The two important safety functions enhanced by this venting capability are core cooling and containment integrity. For events within the present design basis for nuclear power plants, the capability to vent non-condensable gases will provide additional assurance of meeting the requirements of 10CFR50.46 (LOCA criteria) and 10CFR50.44 (containment criteria for hydrogen generation). For events beyond the present design basis, this venting capability will substantially increase the plant's ability to deal with large quantities of non-condensable gas without the loss of core cooling or containment integrity.

2. Procedures addressing the use of the RCS vents are required by January 1, 1981. The procedures should define the conditions under which the vents should be used as well as the conditions under which the vents should not be used. The procedures should be based on the following criteria: (1) assurance that the plant can meet the requirements of 10CFR50.46 and 10CFR50.44 for Design Basis Accidents; and (2) a substantial increase in the plants ability to maintain core cooling and containment integrity for events beyond the Design Basis.

B. BWR Design Considerations

1. Since the BWR owners group has suggested that the present BWR designs inherent capability of venting, this question relates to the capability of existing systems. The ability of these systems to vent the RCS of non-condensable gas must be demonstrated. In addition the ability of these systems to meet the same requirements as the PWR vent systems must be documented. Since there are important differences among BWR's, each licensee should address the specific design features of his plant.
2. In addition to reactor coolant system venting, each BWR licensee should address the ability to vent other systems such as the isolation condenser, which may be required to maintain adequate core cooling. If the production of a large amount of non-condensable gas would cause the loss of function of such a system, remote venting of that system is required. The qualifications of such a venting system should be the same as that required for PWR venting systems.

## C. PWR Vent Design Considerations

### 1. The locations for PWR Vents are as follows:

- a. Each PWR licensee should provide the capability to vent the reactor vessel head.
- b. The reactor vessel head vent should be capable of venting non-condensable gas from the reactor vessel hot legs (to the elevation of the top of the outlet nozzle) and cold legs (through head jets and other leakage paths). Additional venting capability is required for those portions of each hot leg which can not be vented through the the reactor vessel head vent. The NRC recognizes that it is impractical to vent each of the many thousands of tubes in a U-tube steam generator. However, we believe that a procedure can be developed which assures that sufficient liquid or steam can enter the U-tube region so that decay heat can be effectively removed from the reactor coolant system. Such a procedure is required by January 1981.
- c. Venting of the pressurizer is required to assure its availability for system pressure and volume control. These are important considerations especially during natural circulation.

2. The size of the reactor coolant vents is not a critical issue. The desired venting capability can be achieved with vents in a fairly large range of sizes. The criteria for sizing a vent can be developed in several ways. One approach, which we consider reasonable, is to specify a volume of non-condensable gas to be vented and a venting time i.e., a vent capable of venting a gas volume of 1/2 the RCS in one hour. Other criteria and engineering approaches should be considered if desired.

3. Where practical the RCS vents should be kept smaller than the size corresponding to the definition of a LOCA (10CFR50 Appendix A).  
This will minimize the challenges to the ECCS since the inadvertent opening of a vent smaller than the LOCA definition would not require ECCS actuation although it may result in leakage beyond Technical Specification Limits. On PWRs the use of new or existing valves which are larger than the LOCA definition will require the addition of a block valve which can be closed remotely to terminate the LOCA resulting from the inadvertent opening of the vent.
4. An indication of valve position should be provided in the control room.
5. Each vent should be remotely operable from the control room.
6. Each vent should be seismically qualified.
7. The requirements for a safety grade system is the same as the safety grade requirement on other Short Term Lessons Learned items, that is, it should have the same qualifications as were accepted for the reactor protection system when the plant was licensed. The exception to this requirement is that we do not require redundant valves at each venting location. Each vent must have its power supplied from an emergency bus. A degree of redundancy should be provided by powering different vents from different emergency buses.
8. For systems where a block valve is required, the block valve should have the same qualifications as the vent.

9. Since the RCS vent system will be part of the reactor coolant systems boundary, efforts should be made to minimize the probability of an inadvertent actuation of the system. Removing power from the vents is one step in the direction. Other steps are also encouraged.
10. Since the generation of large quantities of non-condensable gas could be associated with substantial core damage, venting to atmosphere is unacceptable because of the associated released radioactivity. Venting into containment is the only presently available alternative. Within containment those areas which provide good mixing with containment air are preferred. In addition, areas which provide for maximum cooling of the vented gas are preferred. Therefore the selection of a location for venting should take advantage of existing ventilation and heat removal systems.
11. The inadvertent opening of an RCS vent must be addressed. For vents smaller than the LOCA definition, leakage detection must be sufficient to identify the leakage. For vents larger than the LOCA definition, an analysis is required to demonstrate compliance with 10CFR50.46.

## SHIFT SUPERVISOR RESPONSIBILITIES (2.2.1.a)

### POSITION

1. The highest level of corporate management of each licensee shall issue and periodically reissue a management directive that emphasizes the primary management responsibility of the shift supervisor for safe operation of the plant under all conditions on his shift and that clearly establishes his command duties.
2. Plant procedures shall be reviewed to assure that the duties, responsibilities, and authority of the shift supervisor and control room operators are properly defined to effect the establishment of a definite line of command and clear delineation of the command decision authority of the shift supervisor in the control room relative to other plant management personnel. Particular emphasis shall be placed on the following:
  - a. The responsibility and authority of the shift supervisor shall be to maintain the broadest perspective of operational conditions affecting the safety of the plant as a matter of highest priority at all times when on duty in the control room. The idea shall be reinforced that the shift supervisor should not become totally involved in any single operation in times of emergency when multiple operations are required in the control room.
  - b. The shift supervisor, until properly relieved, shall remain in the control room at all times during accident situations to direct the activities of control room operators. Persons authorized to relieve the shift supervisor shall be specified.
  - c. If the shift supervisor is temporarily absent from the control room during routine operations, a lead control room operator shall be designated to assume the control room command function. These temporary duties, responsibilities, and authority shall be clearly specified.
3. Training programs for shift supervisors shall emphasize and reinforce the responsibility for safe operation and the management function the shift supervisor is to provide for assuring safety.
4. The administrative duties of the shift supervisor shall be reviewed by the senior officer of each utility responsible for plant operations. Administrative functions that detract from or are subordinate to the management responsibility for assuring the safe operation of the plant shall be delegated to other operations personnel not on duty in the control room.

### CLARIFICATION

The attachment provides clarification to the above position.

SHIFT SUPERVISOR RESPONSIBILITY (2.2.1.A)

<u>NUREG-0578 POSITION (POSITION NO.)</u>	<u>CLARIFICATION</u>
Highest Level of Corporate Management (1.)	V. P. For Operations
Periodically Reissue (1.)	Annual Reinforcement of Company Policy
Management Direction (1.)	Formal Documentation of Shift Personnel, All Plant Management, Copy to IE Region
Properly Defined (2.0)	Defined in Writing in a Plant Procedure
Until Properly Relieved (2.B)	Formal Transfer of Authority, Valid SRO License, Recorded in Plant Log
Temporarily Absent (2.C)	Any Absence
Control Room Defined (2.C)	Includes Shift Supervisor Office Adjacent to the Control Room
Designated (2.C)	In Administrative Procedures
Clearly Specified	Defined in Administrative Procedures
SRO Training	Specified in ANS 3.1 (Draft) Section 5.2.1.8
Administrative Duties (4.)	Not Affecting Plant Safety
Administrative Duties Reviewed (4.)	On Same Interval as Reinforcement: i.e., Annual by V. P. for Operations.

## SHIFT TECHNICAL ADVISOR (Section 2.2.1.b)

### POSITION

Each licensee shall provide an on-shift technical advisor to the shift supervisor. The shift technical advisor may serve more than one unit at a multi-unit site if qualified to perform the advisor function for the various units.

The Shift Technical Advisor shall have a bachelor's degree or equivalent in a scientific or engineering discipline and have received specific training in the response and analysis of the plant for transients and accidents. The Shift Technical Advisor shall also receive training in plant design and layout, including the capabilities of instrumentation and controls in the control room. The licensee shall assign normal duties to the Shift Technical Advisors that pertain to the engineering aspects of assuring safe operations of the plant, including the review and evaluation of operating experience.

### DISCUSSION

The NRC Lessons Learned Task Force has recommended the use of Shift Technical Advisors (STA) as a method of immediately improving the plant operating staff's capabilities for response to off-normal conditions and for evaluating operating experience.

In defining the characteristics of the STA, we have used the two essential functions to be provided by the STA. These are accident assessment and operating experience assessment.

#### 1. Accident Assessment

The STA serving the accident assessment function must be dedicated to concern for the safety of the plant. The STA's duties will be to diagnose off-normal events and advise the shift supervisor. The duties of the STA should not include the manipulation of controls or supervision of operators. The STA must be available, in the control room, within 10 minutes of being summoned.

The qualifications of the STA should include college level education in engineering and science subjects as well as training in reactor operations both normal and off-normal. Details regarding these qualifications are provided in paragraphs A.1, 2 and 3 of Enclosure 2 to our September 13, 1979 letter. In addition, the STA serving the accident assessment function must be cognizant of the evaluations performed as part of the operating experience assessment function.

## 2. Operating Experience Assessment

The persons serving the operating experience assessment function must be dedicated to concern for the safety of the plant. Their function will be to evaluate plant operations from a safety point of view and should include such assignments as listed on pages A-50 and A-51 of NUREG-0578. Their qualifications are identical to those described previously under accident assessment and collectively this group should provide competence in all technical areas important to safety. It is desirable that this function be performed by onsite personnel.

### CLARIFICATION

1. Due to the similarity in the requirements for dedication to safety, training and onsite location and the desire that the accident assessment function be performed by someone whose normal duties involve review of operating experiences, our preferred position is that the same people perform the accident and operating experience assessment functions. The performance of these two functions may be split if it can be demonstrated the persons assigned the accident assessment role are aware, on a current basis, of the work being done by those reviewing operating experience.
2. To provide assurance that the STA will be dedicated to concern for the safety of the plant, our position has been that STA's must have a clear measure of independence from duties associated with the commercial operation of the plant. This would minimize possible distractions from safety judgements by the demands of commercial operations. We have determined that, while desirable, independence from the operations staff of the plant is not necessary to provide this assurance. It is necessary, however, to clearly emphasize the dedication to safety associated with the STA position both in the STA job description and in the personnel filling this position. It is not acceptable to assign a person, who is normally the immediate supervisor of the shift supervisor to STA duties as defined herein.

3. It is our position that the STA should be available within 10 minutes of being summoned and therefore should be onsite. The onsite STA may be in a duty status for periods of time longer than one shift, and therefore asleep at some times, if the ten minute availability is assured. It is preferable to locate those doing the operating experience assessment onsite. The desired exposure to the operating plant and contact with the STA (if these functions are to be split) may be able to be accomplished by a group, normally stationed offsite, with frequent onsite presence. We do not intend, at this time, to specify or advocate a minimum time onsite.
  
4. The implementation schedule for the STA requirements is to have the STA on duty by January 1, 1980, and to have STAs, who have all completed training requirements, on duty by January 1, 1981. While minimum training requirements have not been specified for January 1, 1980, the STAs on duty by that time should enhance the accident and operating experience assessment function at the plant.

## SHIFT AND RELIEF TURNOVER PROCEDURES (2.2.1.c)

### POSITION

The licensees shall review and revise as necessary the plant procedure for shift and relief turnover to assure the following:

1. A checklist shall be provided for the oncoming and offgoing control room operators and the oncoming shift supervisor to complete and sign. The following items, as a minimum, shall be included in the checklist.
  - a. Assurance that critical plant parameters are within allowable limits (parameters and allowable limits shall be listed on the checklist).
  - b. Assurance of the availability and proper alignment of all systems essential to the prevention and mitigation of operational transients and accidents by a check of the control console.  
  
(what to check and criteria for acceptable status shall be included on the checklist);
  - c. Identification of systems and components that are in a degraded mode of operation permitted by the Technical Specifications. For such systems and components, the length of time in the degraded mode shall be compared with the Technical Specifications action statement (this shall be recorded as a separate entry on the checklist).
2. Checklists or logs shall be provided for completion by the offgoing and ongoing auxiliary operators and technicians. Such checklists or logs shall include any equipment under maintenance or test that by themselves could degrade a system critical to the prevention and mitigation of operational transients and accidents or initiate an operational transient (what to check and criteria for acceptable status shall be included on the checklist); and
3. A system shall be established to evaluate the effectiveness of the shift and relief turnover procedure (for example, periodic independent verification of system alignments).

### CLARIFICATION

No clarification provided.

## CONTROL ROOM ACCESS (2.2.2.a)

### POSITION

The licensee shall make provisions for limiting access to the control room to those individuals responsible for the direct operation of the nuclear power plant (e.g., operations supervisor, shift supervisor, and control room operators), to technical advisors who may be requested or required to support the operation, and to predesignated NRC personnel. Provisions shall include the following:

1. Develop and implement an administrative procedure that establishes the authority and responsibility of the person in charge of the control room to limit access, and
2. Develop and implement procedures that establish a clear line of authority and responsibility in the control room in the event of an emergency. The line of succession for the person in charge of the control room shall be established and limited to persons possessing a current senior reactor operator's license. The plan shall clearly define the lines of communication and authority for plant management personnel not in direct command of operations, including those who report to stations outside of the control room.

### CLARIFICATION

No clarification provided.

## ONSITE TECHNICAL SUPPORT CENTER (TSC) 2.2.2.b

### POSITION

Each operating nuclear power plant shall maintain an onsite technical support center separate from and in close proximity to the control room that has the capability to display and transmit plant status to those individuals who are knowledgeable of and responsible for engineering and management support of reactor operations in the event of an accident. The center shall be habitable to the same degree as the control room for postulated accident conditions. The licensee shall revise his emergency plans as necessary to incorporate the role and location of the technical support center. Records that pertain to the as-built conditions and layout of structures, systems and components shall be readily available to personnel in the TSC.

### CLARIFICATION

1. By January 1, 1980, each licensee should meet items A-G that follow. Each licensee is encouraged to provide additional upgrading of the TSC (items 2-10) as soon as practical, but no later than January 1, 1981.
  - A. Establish a TSC and provide a complete description,
  - B. Provide plans and procedures for engineering/management support and staffing of the TSC,
  - C. Install dedicated communications between the TSC and the control room, near site emergency operations center, and the NRC,
  - D. Provide monitoring (either portable or permanent) for both direct radiation and airborne radioactive contaminants. The monitors should provide warning if the radiation levels in the support center are reaching potentially dangerous levels. The licensee should designate action levels to define when protective measures should be taken (such as using breathing apparatus and potassium iodide tablets, or evacuation to the control room),
  - E. Assimilate or ensure access to Technical Data, including the licensee's best effort to have direct display of plant parameters, necessary for assessment in the TSC,

- F. Develop procedures for performing this accident assessment function from the control room should the TSC become uninhabitable, and
- G. Submit to the NRC a longer range plan for upgrading the TSC to meet all requirements.

## 2. Location

It is recommended that the TSC be located in close proximity to the control room to ease communications and access to technical information during an emergency. The center should be located onsite, i.e., within the plant security boundary. The greater the distance from the CR, the more sophisticated and complete should be the communications and availability of technical information. Consideration should be given to providing key TSC personnel with a means for gaining access to the control room.

## 3. Physical Size & Staffing

The TSC should be large enough to house 25 persons, necessary engineering data and information displays (TV monitors, recorders, etc.). Each licensee should specify staffing levels and disciplines reporting to the TSC for emergencies of varying severity.

## 4. Activation

The center should be activated in accordance with the "Alert" level as defined in the NRC document "Draft Emergency Action Level Guidelines, NUREG-0610" dated September, 1979, and currently out for public comment. Instrumentation in the TSC should be capable of providing displays of vital plant parameters from the time the accident began ( $t = 0$  defined as either reactor or turbine trip). The Shift Technical Advisor should be consulted on the "Notification of Unusual Event" however, the activation of the TSC is discretionary for that class of event.

5. Instrumentation

The instrumentation to be located in the TSC need not meet safety-grade requirements but should be qualitatively comparable (as regards accuracy and reliability) to that in the control room. The TSC should have the capability to access and display plant parameters independent from actions in the control room. Careful consideration should be given to the design of the interface of the TSC instrumentation to assure that addition of the TSC will not result in any degradation of the control room or other plant functions.

6. Instrumentation Power Supply

The power supply to the TSC instrumentation need not meet safety-grade requirements, but should be reliable and of a quality compatible with the TSC instrumentation requirements. To insure continuity of information at the TSC, the power supply provided should be continuous once the TSC is activated. Consideration should be given to avoid loss of stored data (e.g., plant computer) due to momentary loss of power or switching transients. If the power supply is provided from a plant safety-related power source, careful attention should be give to assure that the capability and reliability of the safety-related power source is not degraded as a result of this modification.

7. Technical Data

Each licensee should establish the technical data requirements for the TSC, keeping in mind the accident assessment function that has been established for those persons reporting to the TSC during an emergency. As a minimum,

data (historical in addition to current status) should be available to permit the assessment of:

**Plant Safety Systems Parameters for:**

- . Reactor Coolant System
- . Secondary System (PWRs)
- . ECCS Systems
- . Feedwater & Makeup Systems
- . Containment

**In-Plant Radiological Parameters for:**

- . Reactor Coolant System
- . Containment
- . Effluent Treatment
- . Release Paths

**Offsite Radiological**

- . Meteorology
- . Offsite Radiation Levels

**8. Data Transmission**

In addition to providing a data transmission link between the TSC and the control room, each licensee should review current technology as regards transmission of those parameters identified for TSC display.

Although there is not a requirement at the present time, each licensee should investigate the capability to transmit plant data offsite to the Emergency Operations Center, the NRC, the reactor vendor, etc.

9. Structural Integrity

- A. The TSC need not be designed to seismic Category I requirements.

The center should be well built in accordance with sound engineering practice with due consideration to the effects of natural phenomena that may occur at the site.

- B. Since the center need not be designed to the same stringent requirements as the Control Room, each licensee should prepare a backup plan for responding to an emergency from the control room.

10. Habitability

The licensee should provide protection for the technical support center personnel from radiological hazards including direct radiation and airborne contaminants as per General Design Criterion 19 and SRP 6.4.

- A. Licensee should assure that personnel inside the technical support center (TSC) will not receive doses in excess of those specified in GDC 19 and SRP 6.4 (i.e., 5 Rem whole body and 30 Rem to the thyroid for the duration of the accident). Major sources of radiation should be considered.

- B. Permanent monitoring systems should be provided to continuously indicate radiation dose rates and airborne radioactivity concentrations inside the TSC. The monitoring systems should include local alarms to warn personnel of adverse conditions. Procedures must be provided which will specify appropriate protective actions to be taken in the event that high dose rates or airborne radioactive concentrations exist.

- C. Permanent ventilation systems which include particulate and charcoal filters should be provided. The ventilation systems need not be qualified as ESF systems. The design and testing guidance of Regulatory Guide 1.52 should be followed except that the systems do not have to be redundant, seismic, instrumented in the control room or automatically activated. In addition, the HEPA filters need not be tested as specified in Regulatory Guide 1.52 and the HEPA's do not have to meet the QA requirements of Appendix B to 10 CFR 50. However, spare parts should be readily available and procedures in place for replacing failed components during an accident. The systems should be designed to operate from the emergency power supply.
- D. Dose reduction measures such as breathing apparatus and potassium iodide tablets can not be used as a design basis for the TSC in lieu of ventilation systems with charcoal filters. However, potassium iodide and breathing apparatus should be available.

ONSITE OPERATIONAL SUPPORT CENTER (SECTION 2.2.2.c)

POSITION

An area to be designated as the onsite operational support center shall be established. It shall be separate from the control room and shall be the place to which the operations support personnel will report in an emergency situation. Communications with the control room shall be provided. The emergency plan shall be revised to reflect the existence of the center and to establish the methods and lines of communication and management.

CLARIFICATION

No clarification provided.

IMPLEMENTATION SCHEDULE

SECTION NUMBER	TITLE	IMPLEM. CAT. (1)	PROPOSAL REVIEW	IMPLEMENTATION REVIEW
2.1.1	Emergency Power Supply			
	Pressurizer Heaters	A		X
	Pressurizer Level	A		X
	PORV and Block Valve	A		X
2.1.2	Relief and Safety Valve Test			
	Program and Schedule	A		X
	Complete Test	07/81		X
2.1.3 a	Direct Indication of Valve Position	A		X
2.1.3.b	Instrumentation for Inadequate Core Cooling			
	Procedures	A		X
	Design of New Instrumentation	A		X
	Subcooling Meter	A		X
	Installation of New Instr. (E.G., Level Meter)	B	X	

- 65 -

(1) CATEGORY A: IMPLEMENTATION COMPLETE BY JANUARY 1, 1980,  
 CATEGORY B: IMPLEMENTATION COMPLETE BY JANUARY 1, 1981.

Enclosure 2

IMPLEMENTATION SCHEDULE

SECTION NUMBER	TITLE	IMPLEM. CAT. (1)	PROPOSAL REVIEW	IMPLEMENTATION REVIEW
2.1.4	Containment Isolation	A		X
2.1.5	Dedicated H <sup>2</sup> Control Penetrations			
	Description and Schedule Installation	A B		X X
2.1.5.c	Recombiner Procedures	A		X
2.1.6.a	Systems Integrity for High Radioactivity			
	Leak Reduction Program Preventative Maintenance Program	A A		X X
2.1.6.b	Plant Shielding Review			
	Design Review Plant Modifications	A B		X X

(1) CATEGORY A: IMPLEMENTATION COMPLETE BY JANUARY 1, 1980,  
 CATEGORY B: IMPLEMENTATION COMPLETE BY JANUARY 1, 1981.

IMPLEMENTATION SCHEDULE

SECTION NUMBER	TITLE	IMPLEM. CAT. (1)	PROPOSAL REVIEW	IMPLEMENTATION REVIEW
2.1.7.a	Auto Initiation of AFW			
	Control Grade	A	X	
	Safety Grade	B	X	
2.1.7.b	AFW Flow			
	Control Grade	A		X
	Safety Grade	B		X
2.1.8.a	Post-Accident Sampling			
	Design Review	A		X
	Procedures	A		X
	Description of Plant Modifications	A		X
	Plant Modifications	B		X
2.1.8.b	High Range Radiation Monitors			
	In-Containment	B	X	
	Effluents - Procedures Implement	A B	 X	 X

- 67 -

(1) CATEGORY A: IMPLEMENTATION COMPLETE BY JANUARY 1, 1980.  
 CATEGORY B: IMPLEMENTATION COMPLETE BY JANUARY 1, 1981.

IMPLEMENTATION SCHEDULE

SECTION NUMBER	TITLE	IMPLEM. CAT. (1)	PROPOSAL REVIEW	IMPLEMENTATION REVIEW
2.1.8.c	Improved Iodine Instrumentation	A		X
2.1.9	Transient and Accident Analysis	(2)		X
	Containment Pressure Monitor	B		X
	Containment Water Level Mointor	B		X
	Containment Hydrogen Monitor	B		X
	RCS Venting			
	Design Complete	A		X
	Installation Complete	B	X	
2.2.1.a	Shift Supervisor Responsibilities	A		X

- 89 -

(1) CATEGORY A: IMPLEMENTATION COMPLETE BY JANUARY 1, 1980,  
 CATEGORY B: IMPLEMENTATION COMPLETE BY JANUARY 1, 1981.

(2) SEE NUREG-0578

IMPLEMENTATION SCHEDULE

SECTION NUMBER	TITLE	IMPLEM. CAT. (1)	PROPOSAL REVIEW	IMPLEMENTATION REVIEW
2.1.2.B	Shift Technical Advisor			
	Advisor on Duty	A		X
	Complete Training	B		X
2.2.1.C	Shift Turnover Procedure	A		X
2.2.2.A	Control Room Access	A		X
2.2.2.B	On Site Technical Support Center			
	Establish Center	A		X
	Upgrade to Meet All Requirements	B		X
2.2.2.C	On Site Operational Support Center	A		X

- 69 -

- (1) CATEGORY A: IMPLEMENTATION COMPLETE BY JANUARY 1, 1980.  
CATEGORY B: IMPLEMENTATION COMPLETE BY JANUARY 1, 1981.

## ANALYSIS AND TRAINING SCHEDULE

<u>Task Description</u>	<u>Completion Date</u>
1. Small Break LOCA analysis and preparation of emergency procedure guidelines	July-September 1979*
2. Implementation of small break LOCA emergency procedures and retraining of operators	December 31, 1979
3. Analysis of inadequate core cooling and preparation of emergency procedure guidelines	October 1979
4. Implementation of emergency procedures and retraining related to inadequate core cooling	January 1980
5. Analysis of accidents and transients and preparation of emergency procedure guidelines	Early 1980
6. Implementation of emergency procedures and retraining related to accidents and transients	3 months after guidelines established
7. Analysis of LOFT small break tests	Pretest (Mid-September 1979)

\* Range covers completion dates for the four NSSS vendors