Docket
50-3

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

OCT 10 1979

GL-79-50

ALL POWER REACTOR LICENSEES

Gentlemen:

This letter is being sent to all licensees authorized to operate a nuclear power reactor and to all applicants with application for a license to operate a power reactor (FSAR docketed).

The NRC recently held regional meetings to discuss the recent impacts on emergency planning and the current regulations, guidance documents and reports concerning emergency planning. At these meetings, the NRR staff explained that the upgraded emergency plans would be required five weeks after the NRR review team site visit. Due to subsequent meetings with many licensees and applicants, the staff has determined that it is necessary to revise the plan preparation and submittal time.

The upgraded emergency plans for all facilities listed number one through number three in enclosure 1 should be submitted, as previously scheduled, five weeks after the NRR review team site visit. The upgraded emergency plans for all facilities listed number four through nine should be submitted by January 1, 1980. This schedule provides for a longer preparation time for the majority of facilities and provides the staff with a more detailed plan to review prior to the site visit.

The upgraded emergency plans should be submitted in accordance with the format of Regulatory Guide 1.101. The upgraded emergency plans will be evaluated against the requirements of Appendix E to 10 CFR Part 50, the regulatory positions set forth in Regulatory Guide 1.101, and the acceptance criteria contained in Emergency Planning Review Guidelines Number One - Revision One dated September 7, 1979 (enclosed).

Enclosed for your information and use is a document on the basis for emergency actions levels that has been provided to the review teams for interim use. Your comments on this document are requested. Comments should be sent to the Secretary of the Commission, U. S. Nuclear Regulatory Commission, Washington, D. C. 20555, Attention: Docketing and Service Branch. All comments received by December 1, 1979 will be considered by the Commission.

The NRR staff is continuing their efforts to develop a model plan and will strive to complete their developmental work at the earliest possible date.

MA

CCP

Each licensee should provide copies of this material to the cognizant State, local entities and also known regional Federal offices involved in emergency preparedness activities. Each licensee will have the responsibility of making arrangements for discussions between the NRC teams and State and local officials during the team site visits.

For further information or comments please contact Mr. Frank G. Pagano on (301) 492-7846.

Sincerely,

Darrell G. Eisenhut, Acting Director
Division of Operating Reactors

Enclosures:
1. Emergency Planning Review Responsibility and Order of Review dated September 7, 1979
2. Emergency Planning Review Guideline Number One - Revision One dated September 7, 1979
3. Basis for Emergency Action Levels for Nuclear Power Facilities dated September 14, 1979

cc w/enclosures:
Service List
Federal Regional Advisory Teams

SEPTEMBER 7, 1979

EMERGENCY PLANNING
REVIEW TEAM RESPONSIBILITY
AND
ORDER OF REVIEW 1/

TEAM 1 JACK ROE	TEAM 2 DEAN KUNIHIRO	TEAM 3 RAY PRIEBE
1. Three Mile Island	1. San Onofre	1. Indian Point 1, 2, 3 3/
2. North Anna 2/	2. Zion	2. Salem 2/
3. St. Lucie	3. Diablo Canyon 2/	3. McGuire 2/
4. Turkey Point	4. Dresden	4. Beaver Valley
5. Rancho Seco	5. Quad Cities	5. Fitzpatrick
6. Ft. St. Vrain	6. Brunswick	6. Nine Mile Point
7. Peach Bottom	7. Robinson	7. Farley
8. Calvert Cliffs	8. Browns Ferry	8. Hatch
9. Surry	9. Oconee	9. Duane Arnold

TEAM 4 TOM MCKENNA	TEAM 5 JIM MARTIN	TEAM 6 BILL AXELSON (R/I
1. Pilgrim	1. D.C. Cook	1. Big Rock Point
2. Trojan	2. Sequoyah 2/	2. LaSalle 2/
3. Zimmer 2/	3. LaCrosse	3. Arkansas
4. Maine Yankee	4. Cooper	4. Palisades
5. Yankee Roe	5. Ginna	5. Crystal River
6. Vermont Yankee	6. Monticello	6. Davis Besse
7. Oyster Creek	7. Prairie Island	7. Kewaunee
8. Millstone	8. Ft. Calhoun	8. Point Beach
9. Connecticut Yankee		

1/ Order listed is order of review based on: (1) Near Term OL's (2) Greatest Population Density, (3) Status of State Emergency Plan Concurrence

2/ Near Term OL

3/ Licensee Plan Only - Review Does Not Include State and Local Plans

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 7 1979

MEMORANDUM FOR: Emergency Planning Staff

FROM: James R. Miller, Acting Assistant Director
for Site and Safeguards

SUBJECT: EMERGENCY PLANNING REVIEW GUIDELINE NUMBER ONE - REVISION ONE - EMERGENCY PLANNING ACCEPTANCE CRITERIA FOR LICENSED NUCLEAR POWER PLANTS

Enclosed is Emergency Planning Review Guideline Number One - Revision One - Emergency Planning Acceptance Criteria for Licensed Nuclear Power Plants. The review guideline supercedes Review Guideline Number One dated August 17, 1979. This review guideline is to be used to review upgraded emergency plans for operating plants and near term OL's. This review guideline has been approved by NRR management.

James R. Miller, Acting Assistant Director
for Site and Safeguards
Division of Operating Reactors

Enclosure:
As stated

Emergency Planning Acceptance Criteria for Licensed Nuclear Power Plants

INTRODUCTION

Licensees will submit updated facility plans either before or after the site visit by the NRR review team, together with the appropriate State and local plans, which will be evaluated collectively against the requirements of Appendix E to 10 CFR Part 50, the positions set forth in Regulatory Guide 1.101, and the acceptance criteria contained herein. The criteria contained herein will be used in conjunction with the aforementioned regulations and guidance to assure that the following emergency planning objectives have been achieved.

(1) Effective coordination of emergency activities among all organizations having a response role.

(2) Early warning and clear instructions to the population-at-risk in the event of a serious radiological emergency.

(3) Continued assessment of actual or potential consequences both onsite and offsite.

(4) Effective implementation of emergency measures in the environs.

(5) Continued maintenance of an adequate state of emergency preparedness.

It should be noted that the planning herein identified for the Emergency Planning Zones (NUREG-0396) need not be fully implemented at this time in order to meet the acceptance criteria. Evaluation of the planning for the plume exposure pathway should be based on what is feasible on the time scale of these reviews with firm commitments to extend such provisions throughout the entire Emergency Planning Zone by January 1, 1981. Also, the Commission has not yet spoken on the "50 mile" aspect of the Emergency Planning Zone associated with the ingestion pathway. Hence, the use of the related acceptance criteria in the evaluation need not be applied to the full extent implied in NUREG-0396. However, the plans must demonstrate that a capability exists to protect the public from exposure via the ingestion pathway.

ACCEPTANCE CRITERIA

I. To assure effective coordination of emergency activities among all organizations having a response role

A. Licensee plans will:

1. Provide for an emergency coordinator at all times, including an individual onsite at the time of an accident, having the authority and responsibility to initiate any emergency actions within the provisions of the emergency plan, including the exchange of information with authorities responsible for coordinating offsite emergency measures.
2. Provide for the augmentation of the minimum onsite emergency organization within 60 minutes for all classes of emergencies above the "alert" level.
3. Identify and define by means of a block diagram the interfaces between and among the onsite functional areas of emergency activity, licensee headquarters support, local services support, and State and local government response organizations. The

above shall include the onsite technical support center and the operational support center as discussed in NUREG-0578.

4. Describe the location and role of the onsite technical support center. See item 3 of Section 3.3.3.b of Appendix A to NUREG-0578 (e.g., communications with NRC and the offsite emergency operations center).

5. Describe the location and role of the onsite operational support center. See item 3 of Section 2.2.2.c of Appendix A to NUREG-0578.

6. Provide for the dispatch of a representative to the principal emergency operations center established by the offsite agencies (not required if licensee's offsite emergency operation center is at the same location as that described in item I.B.4).

B. State/local plans will:

1. Identify authorities responsible for coordinating offsite emergency activities for the Emergency Planning Zones discussed in NUREG-0396.

2. Designate the authority and specific responsibility for each coordinating authority.

3. Describe the concept of operations from the perspective of each official having a coordinating role, including the operational interrelationships of all Federal, State, and local organizations providing emergency support services.

4. Identify the predetermined location of the Emergency Operations Center to be used for the coordination of all offsite emergency support activities.

5. Describe the communication plan for emergencies, including titles and alternates for both ends of the communication links and the primary and backup means of communication. Where consistent with the agency function, these plans will include:

   a. Provision for prompt and assured activation of the State/local emergency response network.

   b. Provision for administrative control methods for assuring effective coordination and control of Federal, State, and local emergency support activities.

   c. Provision for communications with continguous State/local governments within the Emergency Planning Zones.

   d. Provision for communications with Federal emergency response organizations.

   e. Provision for communications with the nuclear facility, State and/or local emergency operations centers, and field assessment teams.

II. To assure early warning and clear instructions to the population-at-risk in the event of a serious radiological emergency

A. Licensee plans will:

1. Provide an emergency classification scheme as set forth in Regulatory Guide 1.101.

2. Establish specific criteria, including Emergency Action Levels (EAL) as appropriate, for declaring each class of emergency.
   a. EALs for declaring a "site emergency" will include instrument readings and system status indications corresponding to an airborne fission product inventory within containment which, if released, could result in offsite doses equivalent to the lower limit of the EPA Protective Action Guides (PAG) for exposure to airborne radioactive materials.
   b. EALs for declaring a "general emergency" will include instrument readings and system status indications corresponding to an airborne fission product inventory within containment which, if released, could result in offsite doses equivalent to the upper limit of the EPA Protective Action Guides (PAG) for exposure to airborne radioactive materials.
3. Provide a clear and explicit methodology for relating EALs to PAGs.
4. Identify the onsite capability and resources to properly assess and categorize accidents including:
   a. Instrumentation for detection of inadequate core cooling. See item 3 of Section 2.1.3.b of Appendix A to NUREG-0578.
   b. Radiation monitors. See item 3 of Section 2.1.8.b of Appendix A to NUREG-0578.
5. Provide for recommending protective actions to the appropriate State and local authorities, based on projected dose to the population-at-risk, in accordance with the recommendation set forth in Table 5.1 of the Manual of Protective Action Guides

and Protective Actions for Nuclear Incidents, EPA-520/1-75-001. Upon declaration of a "general emergency", immediate notification shall be made directly to the offsite authorities responsible for implementing protective measures within the Emergency Planning Zone as discussed in NUREG-0396.

6. Describe the onsite communications capability for assuring contact with the offsite authorities responsible for implementing protective measures including a primary and backup means of communications.
7. Provide for periodic dissemination of educational information to the public within the plum exposure Emergency Planning Zone regarding the potential warning methodology in the event of a serious accident.

B. State/local plans will:

1. Identify authorities having a response role within the Emergency Planning Zone as discussed in NUREG-0396.
2. Designate the authority and specific responsibility for each of the responding authorities.
3. Provide for 24 hours/day manning of communication link by authorities responsible for implementing offsite protective measures.
4. Provide an emergency classification scheme that is consistent with that established by the licensee.
5. Describe the resources that will be used if necessary to provide early warning and clear instructions to the populace within the

Emergency Planning Zone associated with the plume exposure pathway (NUREG-0396) within 15 minutes following notification from the facility operator (e.g., tone alert systems, sirens and radio/TV).

6. Provide for posting information regarding the potential warning methodology and expected response in areas visited by transients within the Emergency Planning Zone (e.g., recreational areas).

7. Identify prewritten emergency messages for response organizations and the public consistent with the classification scheme.

8. Provisions for testing the overall communications link to assure that the criteria specified in item 5 above is met on a continuing basis.

III. To assure continued assessment of actual or potential consequences both onsite and offsite

A. Licensee plans will:

1. Identify the onstie capability and resources to provide valid and continuing assessment throughout the course of an accident including:

    a. Post-accident sampling capability. See item 3 of Section 2.1.8.a of Appendix A to NUREG-0578.

    b. In-plant iodine instrumentation. See item 3 of Section 2.1.8.c of Appendix A to NUREG-0578.

    c. Plots showing the containment radiation monitor reading vs. time following an accident for incidents involving

100% release of coolant activity, 100% release of gap activity, 1% release of fuel inventory, and 10% release of fuel inventory.

2. Identify the capability and resources for field monitoring in the environs of the plant including the additional dosimetry specified in the revised technical position issued by the NRC Radiological Assessment Branch for the Environmental radiological monitoring program.

B. State/local plans will:

1. Identify the agencies having a radiological assessment role within the Emergency Planning Zones as discussed in NUREG-0396, including the lead agency for data coordination.
2. Designate the specific responsibilities for each agency having an assigned assessment role.
3. Describe the arrangements established with the Department of Energy Regional Coordinating Office for radiological assistance under the RAP and IRAP programs.
4. Designate a centralized coordination center for the receipt and analysis of all field monitoring data.
5. Describe the methods and equipment to be employed in determining the magnitude and locations of any radiological hazards following liquid or gaseous radioactivity releases.

IV. To assure effective implementation of emergency measures in the environs

A. Licensee plans will:

1. Provide written agreements with each Federal, State, and local agency and other support organizations having an emergency response role within the Emergency Planning Zones as discussed in NUREG-0396. The agreements will identify the emergency measures to be provided and the mutually acceptable criteria for their implementation.

B. State/local plans will:

1. Designate protective action guides and/or other criteria to be used for implementing specific protective actions in accordnace with the recommendations of EPA regarding exposure to a radioactive gaseous plume (EPA-520/1-75-001) and with those of HEW/FDA regarding radioactive contamination of human food and animal feeds as published in the Federal Register of December 15, 1978 (43 FR 58790).

2. Designate the informational needs (e.g., dose rates, projected dose levels, contamination levels, ariborne or waterborne activity levels) for implementing the protective actions identified in item 1 above.

3. Describe the evacuation plan and/or other protective measures for the Emergency Planning Zone associated with the plume exposure pathway (NUREG-0396) including:

a. Maps showing evacuation routes as well as relocation and shelter areas.

b. Population and their distribution around the nuclear facility.

c. Means for notification of all segments of the transient and resident population.

d. Plans for protecting those persons whose mobility may be impaired due to such factors as institutional confinement.

e. Provisions for the use of radioprotective drugs, particularly for emergency workers, including quantities, storage, and means of distribution.

f. Means of effecting relocation.

g. Potential egress routes and their projected traffic capacities under emergency use.

h. Potential impediments to use of egress routes, and potential contingency measures.

4. Describe the protective measures to be used for the Emergency Planning Zone associated with the ingestion pathway (NUREG-0396) including the methods for protecting the public from consumption of contaminated foodstuffs.

5. Provide for maintaining dose records of all potentially exposed emergency workers involved in response activities.

V. To assure continued maintenance of an adequate state of emergency preparedness

A. Licensee plans will:

1. Provide, in addition to the drills and exercises identified in Regulatory Guide 1.101, a joint exercise involving Federal, State, and local response organizations. The scope of such an exercise should test as much of the emergency plans as is reasonably achievable without involving full public participation. Definitive performance criteria will be established for all levels of participation to assure an objective evaluation. This joint test exercise will be scheduled about once every five years.

B. State/local plans will:

1. Provide for emergency drills and exercises to test and evaluate the response role of the agency, including provisions for critique by qualified observers.
2. Provide for participation in the joint Federal, State, local and licensee exercise described in A.1 above.
3. Describe the training program for those individuals having an emergency response assignment.
4. Provide for periodic review and updating of the emergency response plans of the agency.

TITLE: Instrumentation for Detection of Inadequate Core Cooling in PWRs and BWRs (Section 2.1.3.b)

1. INTRODUCTION

General Design Criterion 13, "Instrumentation and Control," of Appendix A to 10 CFR 50, requires instrumentation to monitor variables "... for accident conditions as appropriate to assure adequate safety." In the past, GDC 13 was not interpreted to require instrumentation to directly monitor water level in the reactor vessel or the adequacy of core cooling. The instrumentation available on some operating reactors that could indicate inadequate core cooling includes core exit thermocouples, cold leg and hot leg resistance temperature detectors (RTDs), in-core neutron detectors, ex-core neutron detectors, and reactor coolant pump current. Generally, such systems were included in the reactor design to perform functions other than monitoring of core cooling or indication of vessel water level.

During the TMI-2 accident, a condition of low water level in the reactor vessel and inadequate core cooling existed and was not recognized for a long period of time. This problem was the result of a combination of factors including an insufficient range of existing instrumentation, inadequate emergency procedures, inadequate operator training, unfavorable instrument location (scattered information), and perhaps insufficient instrumentation.

The purpose of this recommendation is to provide the reactor operator with instrumentation, procedures, and training necessary to readily recognize and implement actions to correct or avoid conditions of inadequate core cooling.

2. DISCUSSION

With the hindsight of TMI-2, it appears that the as-designed and field-modified instrumentation at Three Mile Island Unit 2 provided sufficient information to indicate reduced reactor vessel coolant level, core voiding, and deteriorated core thermal conditions.

To preclude the failure to recognize such conditions in the future, it is appropriate to address the problem in two stages. The first is based on the detection of reduced coolant level or the existence of core voiding with the existing plant instrumentation. This would include wide range core exit thermocouples, cold leg and hot leg RTDs, coolant inventory control, in-core and ex-core detectors, vessel level (BWR), reactor coolant pump current, and other indications of coolant conditions, including coolant saturation meters (PWR). The second stage is to study and develop system modifications that would not require major structural changes to the plant and that could be implemented in a relatively rapid manner to provide more direct indication than that available with present instrumentation. These changes include PWR vessel level detectors.

A number of ideas have been discussed for the second stage by the NRC Division of Reactor Safety Research, the ACRS, and the reactor vendors. Some of the possibilities include pressure differential cells, conductivity probes, heated thermocouples, ultrasonic sounding, as well as gamma and neutron void detectors. However, we conclude that detailed engineering evaluation is required before design requirements for a direct level measurement system can be specified.

3. POSITION

1. 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 this appendix).

   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.

2. 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.

TITLE: Improved Post-Accident Sampling Capability (Section 2.1.8.a)

1. INTRODUCTION

Prompt sampling and analysis of reactor coolant and of containment atmosphere can provide information important to the efforts to assess and control the course of an accident. Chemical and radiological analysis of reactor coolant liquid and gas samples can provide substantial information regarding core damage and coolant characteristics. Analysis of containment atmosphere (air) samples can determine if there is any prospect of a hydrogen reaction in containment, as well as provide core damage information.

No definitive regulatory requirements exist for obtaining and analyzing reactor coolant samples following an accident. Standard Review Plan Section 9.3, "Process Sampling System," and Section 11.5, "Process and Effluent Radiological Monitoring and Sampling Systems," require that reactor coolant sampling provisions exist; however, no mention of accident conditions is made and, historically, this requirement has been understood to apply only to normal conditions. Standard Review Plan Section 12.5, "Health Physics Program," specifies radiological analysis requirements for liquid and gas samples under "routine" conditions, which does not include major accidents.

Standard Review Plan Section 6.2.5, "Combustible Gas Control in Containment," requires the capability to monitor containment air hydrogen levels under accident conditions. It does not, however, specifically require the capability to obtain and analyze a sample of containment air. Regulatory Guide 1.97, "Instrumentation to Follow the Course of An Accident," addresses on-line instrumentation and does not directly address the acquisition and analysis of liquid or gas samples.

2. DISCUSSION

Timely information from reactor coolant and containment air samples can be important to reactor operators for their assessment of system conditions and can influence subsequent actions to maintain the facility in a safe condition. Following an accident, significant amounts of fission products may be present in the reactor coolant and containment air, creating abnormally high radiation levels throughout the facility. These high radiation levels may delay the obtaining of information from samples because people taking and analyzing the samples would be exposed to high levels of radiation. In addition, the abnormally high background radiation, high sample radiation, and high levels of airborne contamination may render in-plant radiological spectrum analysis equipment inoperable during and after an accident.

At TMI-2, all of the above problems were encountered. The licensee was not prepared to obtain and analyze in a timely manner the reactor coolant and containment air samples under accident conditions. The acquisition of reactor coolant and containment air samples was delayed for several days while personnel radiation protection precautions were taken. Once the samples were obtained, there were significant delays in the radiological spectrum analysis of the samples. The TMI spectrum analysis equipment was inoperable because of high background radiation; consequently, the samples had to be packaged and flown to a Department of Energy (DOE) laboratory for radiological analysis.

In summary, the radiation at TMI caused by the accident delayed acquisition of information to confirm that significant core damage had occurred. Prompt acquisition and spectrum analysis of reactor coolant samples within several hours after the initial scram would have indicated that significant core damage had occurred; perhaps with such information, earlier remedial actions could have been taken. Similarly, analysis of an early containment air sample would have indicated the presence of hydrogen, significant core damage, and the possibility of a hydrogen explosion in the containment.

3. 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) quantify 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.

NRR Lessons Learned Task Force
Short-Term Recommendations

TITLE: Increased Range of Radiation Monitors (Section 2.1.8.b)

1. INTRODUCTION

Monitors for radioactive effluents are designed to detect and measure releases associated with normal reactor operations and anticipated operational occurrences. Such monitors are required to operate in radioactivity concentrations approaching the minimum concentrations detectable with "state-of-the-art" sample collection and detection methods. These monitors comply with the criteria of Regulatory Guide 1.21 with respect to releases from normal operations and anticipated operational occurrences.

Radioactive gaseous effluent monitors designed to operate under conditions of normal operation and anticipated operational occurrences do not have sufficient dynamic range to function under release conditions associated with certain types of accidents. General Design Criterion 64 of Appendix A to 10 CFR Part 50 requires that effluent discharge paths be monitored for radioactivity that may be released from postulated accidents. The gaseous effluent monitoring system for TMI was evaluated during the licensing review and was found to be adequate for calculated releases from postulated accidents; however, the TMI experience gives rise to a new interpretation of postulated accidents and their associated releases.

The radiation level inside containment is a parameter closely related to the potential for release of radioactive materials in plant effluents. Regulatory Guide 1.97, "Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant Conditions During and Following an Accident," requires (for plants whose submittals for construction permit applications were docketed after September 30, 1977) the capability for measuring in-containment radiation levels up to 10^8 rad/hr.

2. DISCUSSION

At TMI-2, the noble gas section of the gaseous radioactive effluent monitor serving the plant vent was designed to measure effluent concentrations up to 10^{-2} μCi/cc (Xe-133). During the initial phases of the accident, noble gas radioactive effluent readings were off scale, with estimates of actual release concentrations calculated to be on the order of 10^{-1} μCi/cc to 1 μCi/cc.

Similarly, a section of the TMI plant vent gaseous radioactive effluent monitor designed to detect and measure radioiodine releases, while remaining on scale, gave an erroneous indication of high radioiodine content in releases from the vent during the initial phases of the accident. The indication was caused by concentration of short-lived noble gases in the charcoal cartridge, with the presence of the noble gases being read and erroneously interpreted as radioiodine by the monitor readout system.

A similar condition existed in the section of the plant vent monitor designed to detect and measure the presence of particulate radioactive material in plant gaseous effluents. In this case, the presence of noble gases in the gas stream passing through the monitor's particulate filter was sufficient to cause the particulate section of the monitor to read off scale and erroneously indicate that large quantities of particulates were being released from the plant vent.

The problem is considered to be generic. A recent survey of existing gaseous effluent monitoring capabilities of operating plants shows that less than 20 percent of operating plants have monitors that would have stayed on scale under the conditions of the TMI accident. It can also be shown, however, that the potential releases from postulated accidents may be several orders of magnitude higher than was encountered at TMI. Under such circumstances, none of the effluent monitors now in service at any operating plant would remain on scale.

A gaseous radiological effluent monitor that does not provide on-scale readings under accident conditions provides only lower-bound information on effluent releases to the environment. A requirement for effluent monitors to have an operating range sufficient to permit on-scale readings under accident conditions is needed to provide meaningful release information for off-site emergency actions.

Three components of gaseous effluents are usually monitored. These are (a) noble gases (for gross activity relative to xenon-133 calibration); (b) radio-iodines (usually sampled by collection on charcoal and detected and measured either on the basis of gross gamma activity, which assumes all activity to be iodine-131, or on the basis of a single-channel sodium iodide gamma spectrometer centered on the 0.364 Mev peak of I-131); and (c) particulates (for gross activity collected on a paper or fiber filter relative to a calibration source such as cesium-137).

Under normal operating conditions, a three-component effluent monitoring system is capable of functioning in accordance with design. Readout, under normal operating conditions, provides the plant operator with a reasonably accurate continuous measurement of the actual instantaneous release concentration of noble gases. However, the measurements of radioiodine over a given time period are based on the accumulation of airborne particulates or radioiodine over a given time period in the filter or adsorption media. It is necessary for the plant operator to separately calculate the effluent concentration of interest on the basis of the time rate-of-change of the monitor readout. (Note: Recent improvements involving the use of microprocessors have made it possible to obtain instantaneous effluent concentrations from integrating-type measurement data by continuous calculation of the time rate-of-change using a built-in computing system.)

The NRC staff recently conducted a survey of installed noble gas effluent monitors at 66 of the 69 operating nuclear units. The survey indicates that nine reactors have effluent monitors whose range exceeds 100 Ci/sec. These monitors would probably have stayed on scale during most of the TMI-2 accident. The remaining reactors have monitors that would have been off scale for various segments of the early days of the accident. Thirty-seven of the 66 reactors have monitors with an upper range that is below 10 Ci/sec. Most of the reactors

(59 out of 66) have monitors with an upper range that exceeds that of the TMI-2 station vent monitor, which was off scale at about 0.5 Ci/sec.

Based on data submitted by plant operators, the installed capability exists for monitoring noble gas releases up to a concentration of approximately $1x10^3$ μCi/cc, which is a factor of 10^5 higher than the maximum range of the instrumentation in use of TMI.

The Task Force notes the recent publication of ANSI N320-1978, "Performance Specification for Reactor Emergency Radiological Monitoring Instrumentation," effective December 6, 1978. ANSI N320-1978 recommends an upper detection limit of 10^5 μCi/cc for noble gases released to the environs through plant stacks. The staff considers the upper detection limit of 10^5 μCi/cc for noble gases to be technically achievable.

The staff understands that technological problems exist in monitoring of particulates and radioiodines in potential plant releases. Completely satisfactory equipment apparently is not currently available on the commercial market. As previously discussed, the accident condition results in the presence of comparatively large concentrations of short-lived noble gases, which the detectors of the particulate and iodine monitor components "see" as particulates and radioiodines. The problem is further compounded by the preferential adsorption of noble gases in the charcoal cartridges. Although the noble gases are not retained for any substantial period of time, the net effect of a continuous flow of gases through the charcoal cartridge is a localized concentration of noble gases, which is "seen" by the radioiodine detector as radioiodine. Under normal operating conditions, the radioiodine detector is operated as a single-channel gamma spectrometer, focussing on the 0.364 Mev peak of I-131 and rejecting the normally encountered Xe-133 and Kr-85. Under accident conditions, however, the short-lived noble gases are present, several of which emit gamma photons near the 0.364 Mev gamma of I-131, thus being registered as I-131 on the monitor readout. In addition, accident levels of I-131 concentrated on the charcoal cartridge in close proximity to the detector can accumulate to the extent of saturating the detector.

It has been suggested that other adsorbents may be found that would preferentially concentrate the radioiodines, but not the noble gases. If this is found to be practicable, this could somewhat alleviate the radioiodine monitoring dilemma; however, the short-lived noble gases would still be present in the airstream passing through the monitor and the monitor would still give false data. At this time, there are no demonstrated techniques and no currently available equipment that will provide for the desired monitoring of radioiodines or particulates in plant gaseous effluents under accident conditions.

The Task Force concludes that sampling of plant gaseous effluents, with laboratory analysis of samples subsequent to release, is the only valid technique for monitoring accidental releases of radioiodines and particulates. In the absence of valid on-line monitoring capability for accident-level releases of radioiodines and particulates, we strongly urge that research be undertaken promptly to develop such capability.

The Task Force is working with other members of the NRC staff to urge that the NRC promptly adopt ANSI N320-1978 in its entirety, including those provisions dealing with radiation measurements in containment and other plant buildings, airborne radioactivity measurements within the plant, and airborne radioactivity measurements and radiation measurements in the environment. Implementation of the standard should take place as soon as practical for those criteria consistent with available equipment. It is further urged that research programs be established for development of instrumentation and equipment to meet the criteria that cannot be met by currently available equipment. The mechanisms suggested for implementation include adoption by reference of certain criteria in a revision to Regulatory Guide 1.97 and preparation of one or more additional Regulatory Guides to implement the remaining criteria.

At TMI-2, the radiation monitor in containment had a range capacity of 10^6 rad/hr, which was adequate to meet the conditions of the accident. In reviewing the monitoring capabilities of other plants, however, it is found that there are few operating plants with instrumentation capable of measuring levels in excess of 10 rad/hr. During the initial post-accident period at TMI, questions arose as to the validity of the instrument readout and to the operational characteristics of the instrument under the accident environment. The Task Force considers that the in-containment high-level monitoring instrumentation at TMI-2 was adequate to measure the existing radiation levels; however, it also considers that such instrumentation should consist of at least two channels, each separated physically from the other, and that the instrumentation system should be qualified to the design criteria for safety-grade instrumentation. Furthermore, the in-containment radiation monitor should be capable of measuring radiation up to 10^8 rad/hr, as currently required in Regulatory Guide 1.97. The Task Force also recommends that the instrumentation described above be required for all operating plants and for all plants now under construction.

3. 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 μCi/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 a minimum of 10^{-7} μCi/cc (Xe-133) to a maximum of 10^5 μCi/cc (Xe-133). Multiple monitors are considered to be necessary to cover the ranges of interest. The range capacity of individual monitors shall 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.

TITLE: Improved In-Plant Iodine Instrumentation (Section 2.1.8.c)

1. INTRODUCTION

10 CFR Part 20 provides criteria for control of exposures of individuals to radiation in restricted areas, including airborne iodine. Since iodine concentrates in the thyroid gland, airborne concentrations must be known in order to evaluate the potential dose to the thyroid. If the airborne iodine concentration is overestimated, plant personnel may be required to perform operations functions while using respiratory equipment, which sharply limits communication capability and may diminish personnel performance during an accident. The purpose of this recommendation is to improve the accuracy of measurement of airborne iodine concentrations within nuclear power plants.

2. DISCUSSION

The concentration of iodine in atmospheric air is determined by measuring the activity of iodine adsorbed in a carbon filter through which air has been pumped. The charcoal filter is removed from the air pump and allowed to ventilate to permit the noble gases to diffuse to the atmosphere. The filter is then counted for radioactivity content and the remaining activity is ascribed to iodine. This procedure is conservative; however, it is possible for sufficient noble gas to be adsorbed in the charcoal so that the resulting iodine determination may be unduly conservative (high). This was the case at Three Mile Island. Because the iodine concentration was greatly overestimated, plant personnel performed their operations functions using respiratory equipment when such use was not necessary. Actual iodine concentrations apparently were below levels requiring such protective actions. One acceptable method to eliminate this problem is to measure the iodine by gamma energy spectrum analysis. Equipment for such measurements is commercially available.

3. POSITION

Each licensee shall provide equipment and associated training and procedures for accurately determining the airborne iodine concentration throughout the plant under accident conditions.

Review of the TMI-2 accident also shows a lack of reliable technical data, information, and records on which to base accident recovery decisions. Knowledgeable nuclear engineers were unable to understand the details of plant conditions or plant design so as to better advise the operators of appropriate actions for accident recovery.

On many occasions subsequent to the March 28 accident, as-built drawings reflecting the actual configuration of critical portions of the plant were either not available or contained erroneous information. This situation contributed to delays in accident recovery.

Over the long term, it will probably be useful to provide plant status monitoring and recording equipment in the onsite technical support center. The Task Force recommends that requirements in this regard be developed in conjunction with requirements concerning the kind and form of information to be transmitted to the NRC.

3. 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.

A complete set of as-built drawings and other records, as described in ANSI N45.2.9-1974, shall be properly stored and filed at the site and accessible to the technical support center under emergency conditions. These documents shall include, but not be limited to, general arrangement drawings, P&IDs, piping system isometrics, electrical schematics, and photographs of components installed without layout specifications (e.g., field-run piping and instrument tubing).

TITLE: Onsite Technical Support Center (Section 2.2.2.b)

1. INTRODUCTION

Each applicant for a construction permit is required by 10 CFR 50.34(a) to include in its PSAR a discussion of preliminary plans for coping with emergencies. Each applicant for an operating license is required by paragraph 50.34(b) to include plans for coping with emergencies in its FSAR. Appendix E to 10 CFR Part 50 establishes minimum requirements for emergency plans. Regulatory Guide 1.101 provides more complete guidance to be used in developing the emergency plans required in FSARs for nuclear power plants. These plans are described in the PSAR and are submitted as a part of the FSAR. They do not consistently cover the role of technical and management personnel during an emergency. Similarly, there are no detailed regulatory requirements concerning the need for technical information on plant status and operation outside of the control room during off-normal events. The capability to transmit and record vital plant data in real-time is also not a current requirement, nor is it required that as-built plant drawings and updated records be available to support emergency activities.

The purpose of this recommendation is to establish a center outside of the control room that acts in support of the command and control function and to improve plant status and diagnostic information at this location for use by technical and management personnel in support of reactor command and control functions.

2. DISCUSSION

The recommendations given above for the role of the shift supervisor, the addition of a shift technical advisor, and the limitation of control room access are to be complemented by this recommendation to require the establishment of an onsite technical support center. The activities of plant engineering and management personnel are an important part of the overall station response to an accident and must be properly defined and logistically supported. These people provide the in-depth technical support of control room activities and typically are responsible for the implementation of emergency procedures.

During the first 2 days following the accident at TMI-2, it was difficult for senior government officials to establish contact with senior plant management. It is anticipated that the onsite technical support center will serve as the focal point for such communication in the future.

There is also an indication from the events at TMI-2 that implementation of emergency plans by personnel in the control room acted to congest and confuse the reactor operations control activities. The technical support center would provide a place, in close communication with the control room so as to have sufficient knowledge of current and projected plant status, for more orderly implementation of emergency procedures.

TITLE: Onsite Operational Support Center (Section 2.2.2.c)

1. INTRODUCTION

Each applicant for a construction permit is required by 10 CFR 50.34(a) to include in its preliminary safety analysis report a discussion of preliminary plans for coping with emergencies. Each applicant for an operating license is required by paragraph 50.34(b) to include plans for coping with emergencies in its final safety analysis report. Appendix E to 10 CFR Part 50 establishes minimum requirements for emergency plans. Regulatory Guide 1.101 provides more complete guidance to be used in developing the emergency plans required in FSARs for nuclear power plants. These plans do not consistently cover the role and logistical support for operations support personnel during an emergency.

The purpose of this recommendation is to establish a primary operational support area, to be designated as the onsite operational support center, for shift personnel to be in direct communication with the control room and other operations managers for assignment to duties in support of emergency operations.

2. DISCUSSION

During the TMI-2 accident, operational support personnel (e.g., auxiliary operators not assigned to control room, health physics personnel, and technicians) reported to the control room. This contributed to the congestion and confusion in the control room. Although these personnel are required for operations outside of the control room and perhaps a few in the control room, there is a need to restrict their access to only those specifically requested by the shift supervisor to be present in the control room. Thus, there is a need to establish an area in which shift personnel report for further instructions from the operations staff.

3. 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.

BASIS FOR EMERGENCY ACTION LEVELS FOR NUCLEAR POWER FACILITIES

This document is provided for interim use during the initial phases of the NRC effort to promptly improve emergency preparedness at operating nuclear power plants. Changes to the document can be expected as experience is gained in its use and public comments are received. Further, the Commission has initiated a rulemaking procedure, now scheduled for completion in January 1980 in the area of Emergency Planning and Preparedness. Additional requirements are to be expected when rulemaking is completed and some modifications to this document may be necessary.

Four classes of Emergency Action Levels are established which replace the classes in Regulatory Guide 1.101, each with associated examples of initiating conditions. The classes are:

Notification of Unusual Event

Alert

Site Emergency

General Emergency

The rationale for the notification and alert classes is to provide early and prompt notification of minor events which could lead to more serious consequences given operator error or equipment failure or which might be indicative of more serious conditions which are not yet fully realized. A gradation is provided to assure fuller response preparations for more serious indicators. The site emergency class reflects conditions where some significant releases are likely or are occurring but where a core melt situation is not indicated based on current information. In this situation full mobilization of emergency personnel in the near site environs is indicated as well as dispatch of monitoring teams and associated communications. The general emergency class involves actual or imminent substantial core degradation or melting with the potential for loss of containment. The immediate action for this class is sheltering (staying inside) rather than evacuation until an assessment can be made that (1) an evacuation is indicated and (2) an evacuation, if indicated, can be completed prior to significant release and transport of radioactive material to the affected areas.

The example initiating conditions listed after the immediate actions for each class are to form the basis for establishment by each licensee of the specific plant instrumentation readings which, if exceeded, will initiate the emergency class.

Some background information on release potential and expected frequencies for the various classes is provided in this material. Note that there is a wide band of uncertainty associated with the frequency estimates. The release potential given reflects the amount that could be released over a long time period or under favorable meteorological conditions without exceeding the exposure criteria of a more severe class. Release of these amounts in a short time period under unfavorable meteorological dispersion conditions might trigger the criteria of a more severe class.

Class	Licensee Actions	State and/or Local Offsite Authority Actions
Notification of unusual event **Class Description** Unusual events are in process or have occurred which indicate a potential degradation of the level of safety of the plant. **Purpose** Purpose of offsite notification is to (1) assure that the first step in any response later found to be necessary has been carried out, (2) provide current information on unusual events, and (3) provide a periodic unscheduled test of the offsite communication link. **Release Potential** No releases of radioactive material requiring offsite response or monitoring are expected unless further degradation of safety systems occurs. **Expected Frequency** Once or twice per year per unit.	1. Promptly inform State and local offsite authorities of nature of unusual condition as soon as discovered 2. Augment on-shift resources 3. Assess and respond 4. Close out with verbal summary to offsite authorities; followed by written summary within 24 hours or 5. Escalate to a more severe class	1. Provide fire or security assistance if requested 2. Standby until verbal closeout or 3. Escalate to a more severe class

EXAMPLE INITIATING CONDITIONS: NOTIFICATION OF UNUSUAL EVENT

1. ECCS initiated
2. Radiological effluent technical specification limits exceeded
3. Fuel damage indication. Examples:
   a. High offgas at BWR air ejector monitor (greater than 500,000 uci/sec; corresponding to 16 isotopes decayed to 30 minutes; <u>or</u> an increase of 100,000 uci/sec within a 30 minute time period)
   b. High coolant activity sample (e.g., exceeding coolant technical specifications for iodine spike)
   c. Failed fuel monitor (PWR) indicates increase greater than 0.1% equivalent fuel failures within 30 minutes.
4. Abnormal coolant temperature and/or pressure or abnormal fuel temperatures
5. Exceeding either primary/secondary leak rate technical specification or primary system leak rate technical specification
6. Failure of a safety or relief valve to close
7. Loss of offsite power or loss of onsite AC power capability
8. Loss of containment integrity requiring shutdown by technical specifications
9. Loss of engineered safety feature or fire protection system function requiring shutdown by technical specifications (e.g., because of malfunction, personnel error or procedural inadequacy)
10. Fire lasting more than 10 minutes
11. Indications or alarms on process or effluent parameters not functional in control room to an extent requiring plant shutdown or other significant loss of assessment or communication capability (e.g., plant computer, all meteorological instrumentation)
12. Security threat or attempted entry or attempted sabotage
13. Natural phenomenon being experienced or projected beyond usual levels
    a. Any earthquake
    b. 50 year flood or low water, tsunami, hurricane surge, seiche
    c. Any tornado near site
    d. Any hurricane

14. Other hazards being experienced or projected

    a. Aircraft crash on-site or unusual aircraft activity over facility

    b. Train derailment on-site

    c. Near or onsite explosion

    d. Near or onsite toxic or flammable gas release

    e. Turbine failure

15. Other plant conditions exist that warrant increased awareness on the part of State and/or local offsite authorities or require plant shutdown under technical specification requirements or involve other than normal controlled shutdown (e.g., cooldown rate exceeding technical specification limits, pipe cracking found during operation)

16. Transportation of contaminated injured individual from site to offsite hospital

17. Rapid depressurization of PWR secondary side.

Class

Alert

Class Description

Events are in process or have occurred which involve an actual or potential substantial degradation of the level of safety of the plant.

Purpose

Purpose of offsite alert is to (1) assure that emergency personnel are readily available to respond if situation becomes more serious or to perform confirmatory radiation monitoring if required, (2) provide offsite authorities current status information, and (3) provide possible unscheduled tests of response center activation.

Release Potential

Limited releases of up to 10 curies of I-131 equivalent or up to 10^4 curies of Xe-133 equivalent.

Expected Frequency

Once in 10 to 100 years per unit.

Licensee Actions

1. Promptly inform State and/or local authorities of alert status and reason for alert as soon as discovered
2. Augment resources by activating on-site technical support center, on-site operations center and near-site emergency operations center (EOC)
3. Assess and respond
4. Dispatch on-site monitoring teams and associated communications
5. Provide periodic plant status updates to offsite authorities (at least every 15 minutes)
6. Provide periodic meteorological assessments to offsite authorities and, if any releases are occurring, dose estimates for actual releases
7. Close out by verbal summary to offsite authorities followed by written summary within 8 hours

or

8. Escalate to a more severe class

State and/or Local Offsite Authority Actions

1. Provide fire or security assistance if requested
2. Augment resources by activating near-site EOC and any other primary response centers
3. Alert to standby status key emergency personnel including monitoring teams and associated communications
4. Provide confirmatory offsite radiation monitoring and ingestion pathway dose projections if actual releases substantially exceed technical specification limits
5. Maintain alert status until verbal closeout

or

6. Escalate to a more severe class

EXAMPLE INITIATING CONDITIONS: ALERT

1. Severe loss of fuel cladding

   a. High offgas at BWR air ejector monitor (greater than 5 ci/sec; corresponding to 16 isotopes decayed 30 minutes)

   b. Very high coolant activity sample (e.g., 300 uci/cc equivalent of I-131)

   c. Failed fuel monitor (PWR) indicates increase greater than 1% fuel failures within 30 minutes or 5% total fuel failures.

2. Rapid gross failure of one steam generator tube with loss of offsite power

3. Rapid failure of more than 10 steam generator tubes (e.g., several hundred gpm primary to secondary leak rate)

4. Steam line break with significant (e.g., greater than 10 gpm) primary to secondary leak rate or MSIV malfunction

5. Primary coolant leak rate greater than 50 gpm

6. High radiation levels or high airborne contamination which indicate a severe degradation in the control of radioactive materials (e.g., increase of factor of 1000 in direct radiation readings)

7. Loss of offsite power <u>and</u> loss of all onsite AC power

8. Loss of all onsite DC power

9. Coolant pump seizure leading to fuel failure

10. Loss of functions needed for plant cold shutdown

11. Failure of the reactor protection system to initiate and complete a scram which brings the reactor subcritical

12. Fuel damage accident with release of radioactivity to containment or fuel handling building

13. Fire potentially affecting safety systems

14. All alarms (annunciators) lost

15. Radiological effluents greater than 10 times technical specification instantaneous limits (an instantaneous rate which, if continued over 2 hours, would result in about 1 mr at the site boundary under average meteorological conditions)

16. Ongoing security compromise

17. Severe natural phenomena being experienced or projected

    a. Earthquake greater than OBE levels

    b. Flood, low water, tsunami, hurricane surge, seiche near design levels

    c. Any tornado striking facility

    d. Hurricane winds near design basis level

18. Other hazards being experienced or projected

    a. Aircraft crash on facility

    b. Missile impacts from whatever source on facility

    c. Known explosion damage to facility affecting plant operation

    d. Entry into facility environs of toxic or flammable gases

    e. Turbine failure causing casing penetration

19. Other plant conditions exist that warrant precautionary activation of technical support center and near-site emergency operations center

20. Evacuation of control room anticipated or required with control of shutdown systems established from local stations

Class

Site Emergency

Class Description

Events are in process or have occurred which involve actual or likely major failures of plant functions needed for protection of the public.

Purpose

Purpose of the site emergency warning is to (1) assure that response centers are manned, (2) assure that monitoring teams are dispatched, (3) assure that personnel required for evacuation of near-site areas are at duty stations if situation becomes more serious, (4) provide current information for and consultation with offsite authorities and public, and (5) provide possible unscheduled test of response capabilities in U. S.

Release Potential

Releases of up to 1000 ci of I-131 equivalent or up to 10^6 ci of Xe-133 equivalent.

Expected Frequency

Once in one hundred to once in 5000 years per unit.

Licensee Actions

1. Promptly inform State and/or local offsite authorities of site emergency status and reason for emergency as soon as discovered.
2. Augment resources by activating on-site technical support center, on-site emergency operations center and near-site emergency operations center (EOC)
3. Assess and respond
4. Dispatch on-site and offsite monitoring teams and associated communications
5. Provide a dedicated individual for plant status updates to offsite authorities and periodic press briefings (perhaps joint with offsite authorities)
6. Make senior technical and management staff onsite available for consultation with NRC and State on a periodic basis
7. Provide meteorological and dose estimates to offsite authorities for actual releases via a dedicated individual or automated data transmission
8. Provide release and dose projections based on available plant condition information and foreseeable contingencies
9. Close out or recommend reduction in emergency class by briefing of offsite authorities at EOC and by phone followed by written summary within 8 hours

<u>or</u>

10. Escalate to <u>general emergency</u> class

State and/or Local Offsite Authority Actions

1. Provide any assistance requested
2. Activate immediate public notification of emergency status and provide public periodic updates
3. Augment resources by activating near-site EOC and any other primary response centers
4. Dispatch key emergency personnel including monitoring teams and associated communications
5. Alert to standby status other emergency personnel (e.g., those needed for evacuation) and dispatch personnel to near-site duty stations
6. Provide offsite monitoring results to licensee and others and jointly assess them
7. Continuously assess information from licensee and offsite monitoring with regard to changes to protective actions already initiated for public and mobilizing evacuation resources
8. Recommend placing milk animals within 2 miles on stored feed and assess need to extend distance
9. Provide press briefings, perhaps with licensee
10. Maintain site emergency status until closeout or reduction of emergency class

<u>or</u>

11. Escalate to <u>general emergency</u> class

EXAMPLE INITIATING CONDITIONS: SITE EMERGENCY

1. Known loss of coolant accident greater than makeup pump capacity

2. Degraded core with possible loss of coolable geometry (indicators should include instrumentation to detect inadequate core cooling, coolant activity and/or containment radioactivity levels)

3. Rapid failure of more than 10 steam generator tubes with loss of offsite power

4. BWR steam line break outside containment without isolation

5. PWR steam line break with greater than 50 gpm primary to secondary leakage and indication of fuel damage

6. Loss of offsite power and loss of onsite AC power for more than 15 minutes

7. Loss of all vital onsite DC power for more than 15 minutes

8. Loss of functions needed for plant hot shutdown

9. Major damage to spent fuel in containment or fuel handling building (e.g., large object damages fuel or water loss below fuel level)

10. Fire affecting safety systems

11. All alarms (annunciators) lost for more than 15 minutes and plant is not in cold shutdown or plant transient initiated while all alarms lost

12. a. Effluent monitors detect levels corresponding to greater than 50 mr/hr for 1/2 hour or greater than 500 mr/hr W.B. for two minutes (or five times these levels to the thyroid) at the site boundary for adverse meteorology

    b. These dose rates are projected based on other plant parameters (e.g., radiation level in containment with leak rate appropriate for existing containment pressure) or are measured in the environs

13. Imminent loss of physical control of the plant

14. Severe natural phenomena being experienced or projected with plant not in cold shutdown

    a. Earthquake greater than SSE levels

    b. Flood, low water, tsunami, hurricane surge, seiche greater than design levels or failure of protection of vital equipment at lower levels

    c. Winds in excess of design levels

15. Other hazards being experienced or projected with plant not in cold shutdown

    a. Aircraft crash affecting vital structures by impact or fire

    b. Severe damage to safe shutdown equipment from missiles or explosion

    c. Entry of toxic or flammable gases into vital areas

16. Other plant conditions exist that warrant activation of emergency centers and monitoring teams and a precautionary public notification

17. Evacuation of control room and control of shutdown systems not established from local stations in 15 minutes

Class

General Emergency

Class Description

Events are in process or have occurred which involve actual or imminent substantial core degradation or melting with potential for loss of containment integrity.

Purpose

Purpose of the general emergency warning is to (1) initiate predetermined protective actions for public, (2) provide continuous assessment of information from licensee and offsite measurements, (3) initiate additional measures as indicated by event releases or potential releases, and (4) provide current information for and consultation with offsite authorities and public.

Release Potential

Releases of more than 1000 ci of I-131 equivalent or more than 10^6 ci of Xe-133 equivalent.

Expected Frequency

Less than once in about 5000 years per unit. Life threatening doses offsite (within 10 miles) once in about 100,000 years per unit.

Licensee Actions

1. Promptly inform State and/or local offsite authorities of general emergency status and reason for emergency as soon as discovered (Parallel notification of State/local)
2. Augment resources by activating on-site technical support center, on-site emergency operations center and near-site emergency operations center (EOC)
3. Assess and respond
4. Dispatch on-site and offsite monitoring teams and associated communications
5. Provide a dedicated individual for plant status updates to offsite authorities and periodic press briefings (perhaps joint with offsite authorities)
6. Make senior technical and management staff onsite available for consultation with NRC and State on a periodic basis.
7. Provide meteorological and dose estimates to offsite authorities for actual releases via a dedicated individual or automated data transmission
8. Provide release and dose projections based on available plant condition information and foreseeable contingencies
9. Close out or recommend reduction of emergency class by briefing of offsite authorities at EOC and by phone followed by written summary within 8 hours

State and/or Local Offsite Authority Actions

1. Provide any assistance requested
2. Activate immediate public notification of emergency status and provide public periodic updates
3. Recommend sheltering for 2 mile radius and 5 miles downwind and assess need to extend distances
4. Augment resources by activating near-site EOC and any other primary response centers
5. Dispatch key emergency personnel including monitoring teams and associated communications
6. Dispatch other emergency personnel to duty stations within 5 mile radius and alert all others to standby status
7. Provide offsite monitoring results to licensee and others and jointly assess these
8. Continuously assess information from licensee and offsite monitoring with regard to changes to protective actions already initiated for public and mobilizing evacuation resources
9. Recommend placing milk animals within 10 miles on stored feed and assess need to extend distance
10. Provide press briefings, perhaps with licensee
11. Consider relocation to alternate EOC if actual dose accumulation in near-site EOC exceeds lower bound of EPA PAGs
12. Maintain general emergency status until closeout or reduction of emergency class

EXAMPLE INITIATING CONDITIONS: GENERAL EMERGENCY

1. a. Effluent monitors detect levels corresponding to 1 rem/hr W.B. or 5 rem/hr thyroid at the site boundary under actual meteorological conditions

   b. These dose rates are projected based on other plant parameters (e.g., radiation levels in containment with leak rate appropriate for existing containment pressure with some confirmation from effluent monitors) or are masured in the environs.

   Note: Consider evacuation only within about 2 miles of the site boundary unless these levels are exceeded by a factor of 10 or projected to continue for 10 hours

2. Loss of 2 of 3 fission product barriers with a potential loss of 3rd barrier, (e.g., loss of core geometry and primary coolant boundary and high potential for loss of containment).

   Note: Consider 2 mile precautionary evacuation. If more than gap activity released, extend this to 5 miles downwind.

3. Loss of physical control of the facility.

   Note: Consider 2 mile precautionary evacuation.

4. Other plant conditions exist, from whatever source, that make release of large amounts of radioactivity in a short time period possible, e.g., any core melt situation. See the specific PWR and BWR sequences.

   Notes: a. For sequences where significant releases are not yet taking place and large amounts of fission products are not yet in the containment atmosphere, consider 2 mile precautionary evacuation. Consider 5 mile downwind evacuation (45° to 90° sector) if large amounts of fission products are in the containment atmosphere. Recommend sheltering in other parts of the plume exposure Emergency Planning Zone under this circumstance.

   b. For sequences where significant releases are not yet taking place and containment failure leading to a direct atmospheric release is likely in the sequence but not imminent and large amounts of fission products in addition to noble gases are in the containment atmosphere, consider precautionary evacuation to 5 miles and 10 mile downwind evacuation (45° to 90° sector).

   c. For sequences where large amounts of fission products other than noble gases are in the containment atmosphere and containment failure is judged imminent, recommend shelter for those areas where evacuation cannot be completed before transport of activity to that location.

d. As release information becomes available adjust these actions in accordance with dose projections, time available to evacuate and estimated evacuation times given current conditions.

EXAMPLE PWR SEQUENCES

1. Small and large LOCA's with failure of ECCS to perform leading to severe core degradation or melt. Ultimate failure of containment likely for melt sequences. (Several hours available for response)

2. Transient initiated by loss of feedwater and condensate systems (principal heat removal system) followed by failure of emergency feedwater system for extended period. Core melting possible in several hours. Ultimate failure of containment likely if core melts.

3. Transient requiring operation of shutdown systems with failure to scram. Core damage for some designs. Additional failure of core cooling and makeup systems would lead to core melt.

4. Failure of offsite and onsite power along with total loss of emergency feedwater makeup capability for several hours. Would lead to eventual core melt and likely failure of containment.

5. Small LOCA and initially successful ECCS. Subsequent failure of containment heat removal systems over several hours could lead to core melt and likely failure of containment.

NOTE: Most likely containment failure mode is meltthrough with release of gases only for dry containment; quicker and larger releases likely for ice condenser containments for melt sequences or for failure of containment isolation system for any PWR.

EXAMPLE BWR SEQUENCES

1. Transient (e.g., loss of offsite power) plus failure of requisite core shut down systems (e.g., scram or standby liquid control system). Could lead to core melt in several hours with containment failure likely. More severe consequences if pump trip does not function.

2. Small or large LOCA's with failure of ECCS to perform leading to core melt degradation or melt. Loss of containment integrity may be imminent.

3. Small or large LOCA occurs and containment performance is unsuccessful affecting longer term success of the ECCS. Could lead to core degradation or melt in several hours without containment boundary.

4. Shutdown occurs but requisite decay heat removal systems (e.g., RHR) or non-safety systems heat removal means are rendered unavailable. Core degradation or melt could occur in about ten hours with subsequent containment failure.

5. Any major internal or external events (e.g., fires, earthquakes, etc.) which could cause massive common damage to plant systems resulting in any of the above.

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