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US Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: **Submittal of ABWR Licensing Topical Report (LTR) NEDO-33297 "Advanced Boiling Water Reactor (ABWR) Procedures Development Plan"**

Reference: 1) Letter MFN 017-97, J. Quirk to NRC, *ABWR Design Control Document, Revision 4*, dated March 28, 1997, Docket No. 52-001

2) Letter MFN 07-525, T. O'Neil to NRC, Submittal of Topical Licensing Report NEDE-33299P *"Advanced Boiling Water Reactor with Alternate RCIC Turbine-Pump Design,"* December 20, 2006

The subject Licensing Topical Report (LTR) is submitted for NRC review and approval for a change to the current ABWR certified design (reference 1), US NRC Docket No. 52-001. The regulatory basis for this submittal is discussed below.

This is the second of a number of ABWR-related LTRs GE plans to submit and which have been discussed in ABWR Design Centered Working Group (DCWG) meetings with the NRC. The first submittal was reference 2. In support of the DCWG plans, GE requests a generic review and approval of the subject LTR in advance of any future combined operating license applications (COLA) submittals. Note that the proposed change is the result of design detailing performed for ABWRs in the US and in Asia and provides for the generic resolution of a COLA license information item, thereby contributing to standardization.

The enclosed LTR provides a response to a COLA license information item in Tier 2 section 13.5.3 instructing applicants to generate a plant operations procedures

D050

development plan. General Electric believes that all applicants would benefit from following the development plan provided in the enclosure and that the NRC can and should provide a generic review of the plan in advance of any COLA submittal referencing the USABWR DCD. The technical content of the LTR would be appended to the DCD in Tier 2 as Appendix 13A to chapter 13. Specific text changes to the DCD are provided.

Currently, 10 CFR Part 52 does not permit generic changes in certified designs, except for limited purposes that are not applicable in this case. However, as identified in SECY-06-220, the NRC is planning to revise 10 CFR 52.63 to allow for certain types of changes to a design certification. Therefore, GE is providing an appendix in this letter to address the anticipated and preferred regulatory path of DCD amendment, so that the NRC technical review can proceed in parallel while the regulatory environment matures. GE is willing to work with the NRC staff in finalizing the applicable regulatory path as that becomes clearer. The appendix demonstrates that the proposed change is acceptable as a generic change to the design control document (DCD) under the proposed revision to 10 CFR 52.63 in SECY-06-220.

Should the proposed amendment process above not come into being prior to the STP COLA submittal, then the enclosed LTR should be considered as a generic submittal that, if approved, future applicants may reference to address COLA license information item 13.5.3.

The enclosure contains no information that GE considers proprietary although full copyright protection applies.

If you have any questions about the information provided here, please contact Steve Stark, project manager - ABWR licensing, at 408-925-1822, or contact me directly.

Sincerely,

T. J. O'Neil

Timothy O'Neil
Manager, ABWR Projects

Enclosure: NEDO-33297, *Advanced Boiling Water Reactor (ABWR) Procedures Development Plan*, January 2007 – Non-Proprietary

cc:

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Appendix to MFN 07-035

Justification for Changes to the Generic DCD

10 CFR 52.63(a)(1)(vi) (as proposed in SECY-06-220) allows for a change to a generic DCD if the change "Contributes to increased standardization of the certification information." As discussed below, the proposed changes to the generic DCD satisfy this criterion.

The proposed changes involving the operating procedures development program are intended to be generic and applicable to all COL applicants that reference the ABWR design certification. In particular, the proposed changes are the result of first-of-a-kind engineering efforts and design detailing efforts at GE and provide for the resolution of a COL License Information Item. As discussed in this Licensing Topical Report, the proposed changes comply with NRC regulations and guidance as well as industry codes and standards referenced in section 13.5.5 of the DCD. The use of the proposed development plan will encourage the standardization of certification information amongst applicants by providing for a uniform resolution of a COL License Information item. At least one prospective COL applicant (i.e., the COL applicant for South Texas Project Units 3 and 4) intends to use the development plan. Furthermore, it may be expected that other COL applicants will also desire to use the proposed plan in development of their operating procedures.

Given the generic nature of this proposed change, the prospective standardization represented by the change, and the fact that at least one COL applicant intends to follow the described development plan, it would contribute to increased standardization if the NRC were to make a generic change to the DCD to incorporate this proposed change. Therefore, the proposed change satisfies the criteria in 10 CFR 62.63(a)(1)(vi).

GE Energy
Nuclear

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January 2007

Revision 0

LICENSING TOPICAL REPORT

Advanced Boiling Water Reactor (ABWR) Procedures Development Plan

GE Energy
Nuclear

NEDO-33297
Class I
eDRF 0000-0061-9949
January 2007

Revision 0

LICENSING TOPICAL REPORT

Advanced Boiling Water Reactor (ABWR) Procedures Development Plan

IMPORTANT NOTICE

This document NEDO-33297, Revision B, contains no proprietary information.

IMPORTANT NOTICE REGARDING CONTENTS OF THIS REPORT

Please read carefully

The information contained in this document is furnished **for the purpose of supporting the Combined License Applications for, and licensing activities related to, the STP Units 3 and 4 ABWR projects**. The only undertakings of General Electric Company with respect to information in this document are contained in the contract between General Electric Company and South Texas Project, and nothing contained in this document shall be construed as changing that contract. The use of this information by anyone for any purpose other than that for which it is intended is not authorized; and with respect to **any unauthorized use**, General Electric Company makes no representation or warranty and assumes no liability as to the completeness, accuracy, or usefulness of the information contained in this document.

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Enclosures

Enclosure 1: Appendix A: ABWR Procedure Development Plan

Enclosure 2: Appendix B: Tier 2 Marked Changes

1.0 Introduction

The purpose of this Licensing Topical Report (LTR) is to obtain US Nuclear Regulatory Commission approval of a generic change in the design certification for the U.S. Advanced Boiling Water Reactor (ABWR) design, in accordance with planned revisions to 10 CFR 52.63. The change involves replacement of certain portions of the present Tier 2 of the ABWR Design Control Document (DCD) revision 4, US NRC Docket #52-001.

As the regulatory processes for generic amendment of approved and certified reactor designs such as the ABWR (10CFR52 Appendix A) are currently in a state of flux, GE understands that a generic change may not be feasible for the NRC to grant until the planned revision to 10 CFR 52.63 becomes effective. If NRC does not make the planned revisions to 10 CFR 52.63, future COLA applicant(s) would then intend to seek site-specific departures from the DCD based on the content of this licensing topical report. NRC review of the technical content of this LTR is requested with the understanding that this LTR and subsequent discussions between GE and NRC staff may form the basis for site-specific departures requested in one or more future Combined Operating License Applications.

2.0 Description of Certification Design

Tier 2 of the ABWR Design Control Document (DCD) Section 13.5 deferred discussion of Plant Operating Procedure development to the COL Applicant. As such, sections 13.5.1 and 13.5.2 were identified as "Out of ABWR Standard Plant scope". Section 13.5.3 established a COL action item to provide a Procedure Development Plan as part of the COL submittal.

3.0 Description of Proposed Change

Enclosure 1 provides a standardized Procedure Development Plan as an appendix to section 13.5. Enclosure 2 identifies changes to the certified design. Section 13.5 will reference Appendix A for the description of licensee requirements for development and implementation requirements for plant procedures.

4.0 Justification for Change

This change provides the information required for closure of COL Action Item 13.5.3. The US ABWR certified design amendment provides increased certification details and promotes effectiveness, transparency and predictability of the procedure development process.

5.0 Conclusion

The proposed amendment enhances the requirements for development and implementation of plant procedures.

All DCD Tier 2 changes have been evaluated under the criteria in Section VIII.B.5 of the ABWR design certification rule and no unreviewed safety question is created by the proposed departure

APPENDIX A

ABWR PROCEDURES DEVELOPMENT PLAN

1.0 Introduction

Historically, procedure development programs were conducted by utilities and have not been part of Human System Interface (HSI) design activities. Procedures were essentially retrofitted to suit the existing interface because they were developed after the plant HSI design.

For new plant designs and advanced reactors, procedures will be developed as the part of the same design process as that for the other components of the HSI to ensure their full integration as part of HSI. The same human factors analyses, such as task analyses, will be used to guide control panel design as well as procedure development. The same human factor principles will be applied to both aspects of the interface to ensure complete integration and consistency. Further, procedures will be evaluated in conjunction with the HSI; that is, procedures are a significant aspect of system verification and validation.

1.1 *Purpose*

The purpose of this plan is to prescribe and guide the conduct of procedure development for the ABWR. This plan addresses the COL License Information items in ABWR Design Control Document Tier 2 section 13.5.3.

1.2 *Scope*

Procedures covered in this plan includes: Administrative Procedures, Maintenance and Other Procedures, Plant Operating Procedures and Emergency Operating Procedures (EOP).

2.0 Reference Documents

2.1 *Supporting Documents*

(1). ABWR Tier 2 Rev. 04, Section 13.5 Plant Procedures

(2). Gilmore, et al, "User-Computer Interface in Process Control: A Human Factors Engineering Handbook", Academic Press, San Diego, CA, 1989

(3). ABWR Tier 2 Rev. 04, Appendix 18A, Emergency Procedure Guidelines

2.2 *Codes and Standards*

(1). ANSI/ANS-3.2-1982, Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants

2.3 *Regulation and Regulatory Requirements*

(1). NUREG-0660, NRC Action Plan Developed as a Result of the TMI-2 Accident, 1980

(2). NUREG-0711, Human Factors Engineering Program Review Model, 1994

(3). NUREG-0737, Clarification of TMI Action Plan Requirements, 1980

(4). NUREG-0737, Supplement No. 1, Clarification of TMI Action Plan Requirements, 1982

(5). NUREG-0800, Standard Review Plan, Rev. 0, 1981 Section 13.5.1, Administrative Procedures

(6). NUREG-0800, Standard Review Plan, Rev. 1, 1985 Section 13.5.2, Operating and Maintenance Procedures

(7). NUREG-0899, Guidelines for the Preparation of Emergency Operating Procedures, 1982

(8). NUREG-1358, Lessons Learned From the Special Inspection Program for Emergency Operating Procedures, 1989

(9). NUREG-1358, Lessons Learned From the Special Inspection Program for Emergency Operating Procedures, Supplement 1, 1992

(10). NUREG/CR-5228, Techniques for Preparing Flowchart Format Emergency Operating Procedures, Volumes 1 and 2, 1989

(11). Regulatory Guide 1.33, Quality Assurance Program Requirements (Operation), Rev. 2, 1978

3.0 Implementation

3.1 *Administrative Procedures*

(1). Administrative procedures are those procedures that (a) provide the administrative controls with respect to performing activities or evolutions, and (b) define and provide controls for operational activities of the plant staff. Examples of procedures that fall in this category are identified in section 4.1.

(2). Regulatory Guide (RG) 1.33, Rev. 2, will be used as a guide for the preparation of plant administrative policies and procedures. The requirements of New Plant FSAR 17.2 will be met for those systems and components listed in section 4.1 to which 10 CFR 50 Appendix B requirements apply.

(3). Administrative procedures are normally developed consistent with governing corporate guidelines and based on the experiences of other operating sites. For multi-unit sites

with existing operating units, the Administrative Procedures in use at those sites will be used to ensure consistent site operation. A review will be performed to ensure that the existing administrative procedures are consistent with the New Plant FSAR. Should any changes be necessary to those procedures as a result of ABWR unique features, the procedures will be updated using the existing procedure change process.

(4). At those sites for which existing units or corporate guidelines are not available, procedures will be prepared following the guidelines listed above and will be issued six months prior to the commencement of the Preoperational Test Program.

(5). The responsibility for preparing, maintaining and approving plant procedures will be assigned by a site-specific administrative procedure. Procedures will be assigned to a specific site organization and manager based on content, intended user, and importance to plant operation. Safety-related procedures will be reviewed by the Plant Operations Review Committee (PORC) and approved by the Plant Manager.

3.2 *Maintenance and Other Procedures*

(1). Procedures under this category address specific site-wide programs as they relate to maintenance and general operations. Procedures in this category are normally developed consistent with governing corporate guidelines and based on the experiences of other operating sites.

(2). A list of typical procedures included in the scope of the Maintenance and Other Operating Procedures is provided in Section 4.2 and 4.3. It is not necessary for all the procedures to contain titles exactly as listed, but all systems, evolutions, and events listed that are applicable to the ABWR certified design will be covered.

(3). For those multi-unit sites that have existing operating units, the existing procedures in use at those sites will be used to ensure consistent site operation. A review will be performed to ensure that the existing administrative procedures are consistent with the New Plant FSAR. Should any changes be necessary to those procedures as a result of ABWR unique features, the procedures will be updated using the existing procedure change process.

(4). At those sites for which existing units or corporate guidelines are not available, procedures will be prepared following the guidelines listed above and be issued six months prior to the commencement of the Preoperational Test Program.

3.3 *Plant Operating Procedures*

(1). Plant operating procedures include the following sub-classifications:

- Integrated Operating Procedures (IOP)
- System Operating Procedures (SOP)

- Abnormal Operating Procedures (AOP)
- Alarm (Annunciator) Response Procedures (ARP)
- Surveillance Test Procedures (STP)

(2). Plant operating procedures will be developed based on inputs and requirements identified in plant design documents (System Design Descriptions), Human Factors Engineering (HFE) Task Analysis, HFE Functional Requirement Analysis and Functional Allocation, Probability Risk Assessment, as well as existing operating ABWR plant experience.

(3). A procedure writer's guide will be developed and implemented that defines the process for developing IOP, SOP, AOP, ARP, and STP. For multi-unit sites with existing operating units, the Writers Guide in use for the operating units will be used to ensure consistent site operation. The guide will contain sufficiently objective criteria so that procedures developed are complete, accurate, consistent in organization, style, and content, easy to understand. It will provide instructions for procedure content and format, including the writing of action steps and the specification of acceptable acronym lists and acceptable terms to be used.

(4). The content of the IOPs, SOPs, and STPs will incorporate the following elements as applicable.

- Title
- Discussion
- References
- Prerequisites
- Precautions (including warnings, cautions, and notes)
- Limitations and actions
- Required operator actions
- Acceptance criteria (Surveillance Test Procedures only)
- References
- Attachments

(5). The format for the Abnormal Operating Procedures (AOPs) and procedures for other significant events will include the following, as appropriate:

- Symptoms

- Automatic actions
- Immediate operator actions
- Subsequent operator actions

(6). The format for the Alarm (Annunciator) Response Procedures will include the following, as appropriate:

- Alarm message description
- Automatic actions
- Operator actions
- Probable causes

(7). The scope encompassed by the procedure development plan includes those Plant Operating Procedures addressed in Section 4.3 through 4.8. These procedures direct operator actions during normal, abnormal, and emergency operations, periods when plant systems and equipment are undergoing test, maintenance, and inspection.

(8). The methods and criteria for the development, verification, and validation will be in accordance with TMI Items I.C.1, and I.C.9. The verification and validation process is described in the Human Factors Engineering Program Plan.

(9). Implementation, maintenance and revision of procedures will be in accordance with the established site administrative procedures.

3.4 *Emergency Operating Procedures*

(1). ABWR will utilize the approved Emergency Procedure Guidelines (EPG) as found in Chapter 18 of the Design Control Documents Tier 2.

(2). An Emergency Operating Procedure (EOP) writer's guide will be developed and implemented. The document will provide guidance for designing flowcharts and provide standardized guidance on generating the Emergency Support Procedures (ESPs) that provide specific implementation guidance. The writer's guide will contain objective criteria that will require that the emergency procedures are consistent in organization, style, content, and usage of terms. Guidance for developing the writers guide will come from NUREG-0899, NUREG-1358 (including Supplement 1) and NUREG/CR-5228.

(3). Lessons learned as discussed in NUREG-1358 (including Supplement 1), will be considered in the development of the EOPs.

(4). EOPs will be in a symptom-based format with clearly specified entry conditions that provide the operator guidance in response to upset plant conditions in which one or more key variables are out of limits, regardless the cause.

(5). Plant Specific Technical Guidelines (PSTGs) will be generated based on analysis of transients and accidents that are specific to a site plant design and operating philosophy. The PSTGs will be derived from the ABWR EPGs.

(6). As part of the emergency procedure development, a document will be generated identifying any significant deviations from the approved EPGs (including identification of additional equipment beyond that identified in the approved guidelines), along with all necessary engineering evaluations or analyses to support the adequacy of each deviation. As part of this evaluation a determination whether these deviations impact the analysis of controls and indications identified in Appendix 18 F or the Design Control Document Tier-2 will be performed.

(7). Site-specific calculations will be performed to support generation of the curves and limits utilized in the EOPs

(8). ESPs will provide detailed instructions that are not found in the regular plant operating procedures (e.g. IOPs, SOPs, AOPs). The ESPs are considered a normal extension of the EOPs and include instructions for defeating automatic actions, overriding interlocks and establishing abnormal system lineups and cross-connections.

(9). EOPs will be available for the purpose of Human Factors Engineering Verification and Validation. The physical means by which operators access and use these procedures will be evaluated during this phase of the ABWR Human Factors Engineering Program. The EOPs will also be completed in time to support the Plant Operations Training Program.

(10). Implementation, maintenance, and revision of procedures will be in accordance with the established site administrative procedures.

3.5 *Additional Requirements*

(1). Procedures will be consistent with the requirements of 10 CFR Part 50 and the TMI requirements described in NUREG-0737 and supplement 1 to NUREG-0737.

(2). Procedures developed will include, as necessary, the elements described in ANSI/ANS-3.2.

(3). The definition of the methods through which specific operators skills and training needs, as may be considered necessary for reliable execution of the procedures, will be identified and documented as part of the Human Factors Engineering Program.

(4). Procedures addressed in Section 4 below will be available for the purpose of Human factors Engineering Verification and Validation. The physical means by which operators access and use procedures, especially during operational events will be

evaluated in accordance with Human Factors Engineering Verification and Validation as described in the ABWR Human Factors Engineering Program Plan. System Operating Procedures will be available to support operation during the Preoperational Test Phase. Operating Procedures will also be completed in time to support the Plant Operations Training Program. Operating procedures required to support fuel load will be completed approximately six months prior to fuel load.

(5). Procedures will incorporate the results of operating experience and feedback of pertinent information into the plant procedures in accordance with the provisions of TMI I.C.5.

(6). Plant procedures will be based on plant specific requirements such as the service water intake structure and the ultimate heat sink.

(7). Electronically displayed procedures will conform to the same format requirements of the hard copy procedures, but may be adjusted to be consistent with Video Display Unit (VDU) screen design.

(8). Control of plant procedure updates will be developed and implemented in accordance with site administrative controls and quality assurance programs.

(9). Plant security procedures will be administered under the plant security program.

4.0 Procedures Included in Scope of Plan

The following is a list of typical procedures that will be included in the scope of the Plant Procedures Development Plan. It is not necessary for all the procedures to contain titles exactly as listed, but all systems, evolutions, and events listed that are applicable to the ABWR nuclear power station will be covered.

4.1 *Administrative Procedures*

Administrative Procedures are those procedures that (1) provide the administrative controls with respect to performing activities or evolutions and (2) define and provide controls for operational activities of the plant staff. These include:

(1). Control (i.e. control of activities or evolutions)

- Procedure review and approval
- Equipment control procedures
- Control of maintenance and modifications
- Fire protection procedures
- Crane operation procedures

- Temporary changes to procedures
- Temporary procedures
- Special orders of a transient or self-canceling character

(2). Specific Procedures (i.e. operational activities for plant staff)

- Standing orders to shift personnel including the authority and responsibility of the shift supervisor, licensed senior reactor operator in the control room, control room operator, and shift technical advisor
- Assignment of shift personnel to duty stations and definition of "surveillance area"
- Shift relief and turnover
- Fitness for duty
- Control room access
- Limitations on work hours
- Feedback of design construction and applicable important industry and operation experience
- Shift Supervisor administrative duties
- Verification of correct performance of operating activities

4.2 *Maintenance and Other Operating Procedures*

Procedures will be provided to guide operation during maintenance and modification procedures that require operator actions to be taken in the main control room or remote shutdown panel including the following:

(1). Exercising of equipment that is normally idle but that must operate when required.

(2). Removal of reactor head

(3). Plant radiation protection procedures

(4). Emergency preparedness procedures

(5). Instrument calibration and test procedures

(6). Chemical-radiochemical control procedures

(7). Radioactive waste management procedures

(8). Maintenance and modification procedures

(9). Material control procedures

(10). Precautions for performing testing, maintenance and inspections of Main Control Room and Remote Shutdown control panels

(11). Activation and implementation of the facility emergency plan

4.3 *Radiation Control Procedures*

The following procedures will be provided as discussed in Section A 7(d) of ANSI/ANS-3.2

(1). Mechanical vacuum pump operation.

(2). Air ejector operation

(3). Packing steam exhauster operation

(4). Sampling

(5). Air ejection, ventilation, and stack monitor

(6). Area radiation monitoring system operation

(7). Process radiation monitoring system operation

(8). Meteorological monitoring

(9). Discharge of effluents

(10). Dose calculations

Equipment-specific requirements (items 1through 7) will be addressed in the System Operating Procedures and elements that must be incorporated for the entire site (items 8 through 10) will be addressed in Administrative or Maintenance Procedures.

4.4 *Integrated Operating Procedures*

Integrated operating procedures provide instruction for the integrated operation of the plant. As discussed in Section A5 of ANSI/ANS-3.2, typical integrated operating procedures will include evolutions listed below:

(1). Cold Shutdown to Hot Standby

(2). Hot Shutdown to Startup

(3). Recovery from Reactor Trip

(4). Operation at Hot Standby

(5). Turbine Startup and Synchronization of Generator

(6). Changing Load and Load Following

(7). Power Operation and Process Monitoring

(8). Power Operation with Less than Full Reactor Coolant Flow

(9). Plant Shutdown to Hot Standby

(10). Hot Standby to Cold Shutdown

(11). Preparation for Refueling and Refueling Equipment Operation

(12). Refueling and Core Alternations

4.5 *System Operating Procedures*

Instructions for energizing, filling, venting, draining, starting up, shutting down, changing modes of operation, returning to service following testing (if not contained in the applicable testing procedure), and other instructions appropriate for operation of systems will be delineated in System Operating Procedures. As discussed in Section A3 of ANSI/ANS-3.2, typical System Operating Procedures are listed below:

(1). Nuclear Steam Supply System (Vessel and Recirculating System)

(2). Control Rod Drive System

(3). Reactor Water Cleanup System

(4). Standby Liquid Control System

(5). Residual Heat Removal System

(6). High Pressure Core Flooder System

(7). Reactor Core Isolation Cooling

(8). Automatic Depressurization System

(9). Reactor Building Cooling Water System

(10). Containment

- Maintaining Integrity
- Containment Ventilation System

- Inerting and Deinerting

(11). Fuel Pool Cooling and Cleanup System

(12). Main Steam System

(13). Turbine/Generator System

(14). Condensate System

(15). Feedwater System

(16). Makeup Water System

(17). Reactor Building Service Water System

(18). Turbine Building Service Water

(19). Reactor Building HVAC System

(20). Control Building HVAC System

(21). Radwaste HVAC System

(22). Standby Gas Treatment System

(23). Instrument Air System

(24). Electrical System

- Offsite: Circuits between offsite transmission network and the onsite Class 1E distribution system
- Onsite: Emergency Power Sources (e.g., Diesel generator, batteries)
  - AC System
  - DC System

(25). Neutron Monitoring System

- Startup Range Neutron Monitoring System
- Power Range Neutron Monitoring System
- Traversing In-core Probe System

(26). Reactor Protection System

(27). Rod Worth Minimizer

4.6 *Alarm (Annunciator) Response Procedures*

Procedures will be prepared for off-normal or alarm conditions that require operator action in the Main Control Room. An individual procedure will be written for each annunciator window containing instructions for each alarm associated with that window which is important to safety or the operation of the power plant. These instructions will normally contain (1) the meaning of the alarm, (2) the source of the signal, (3) the immediate action that is to occur automatically, (4) the immediate operator action, and (5) the long-range actions. If more than one annunciator applies to a given procedure, repetition of the procedure may not be required if the applicable annunciators are listed at the beginning of the procedure.

4.7 *Abnormal Operating Procedures*

As discussed in Section A 10 of ANSI/ANS-3.2, procedures will be provided to guide operation for significant events. Examples of such events are listed below.

(1). Loss of Coolant (inside and outside primary containment, response to large and small breaks, including leak-rate determination)

(2). Loss of Instrument Air

(3). Loss of Electrical Power (or degraded power sources or both)

(4). Loss of Core Coolant Flow

(5). Loss of Condenser Vacuum

(6). Loss of Containment Integrity

(7). Loss of Service Water

(8). Loss of Shutdown Cooling

(9). Loss of Component Cooling System or Cooling to Individual Components

(10). Loss of Feedwater or Feedwater System Failure

(11). Loss of Protective System Channel

(12). Miss-positioned Control Rod or Rods or Rod Drops

(13). Inability to Drive Control Rods

(14). Conditions Requiring Use of Standby Liquid Control System

(15). Fuel Cladding Failure or High Activity in Reactor Coolant or Offgas

(16). Fire in Control Room or Forced Evacuation of control Room

(17). Turbine and Generator Trips

(18). Malfunction of Automatic Reactivity Control System

(19). Malfunction of Pressure Control System

(20). Reactor Trip

(21). Plant fires

(22). Acts of Nature (e.g., Tornado, flood, dam failure, earthquake)

(23). Irradiated Fuel Damage While Refueling

(24). Abnormal Releases of Radioactivity

(25). Intrusion of Demineralizer Resin into Primary System

(26). Hydrogen Explosions

(27). Containment Isolation (including reopening of individual isolation valve following reset of safety injection or containment isolation valves)

(28). Loss of Annunciators

(29). Safe shutdown and cool-down under degraded core conditions (may be included in EOP actions)

(30). Other expected transients that may be applicable

4.8 *Surveillance Test Procedures*

Procedures will be prepared for each surveillance test, inspection, or calibration required by Technical Specifications. As discussed in Section A8 of ANSI/ANS-3.2, examples of topics covered by surveillance test procedures are listed below:

(1). Containment Leak Rate and Penetration Leak Rate Tests

(2). Containment Isolation Tests

(3). Containment Vacuum Breaker Tests

(4). Containment Spray System Tests

(5). Standby Gas Treatment System Tests (including filter tests)

(6). Emergency Service Water System Functional Tests

(7). Main Steam Isolation Valve Tests

(8). Fire Protection System Functional Tests

(9). Containment Monitoring System Tests

(10). Emergency Core Cooling System Tests

(11). Control Rod Operability and Scram Time Tests

(12). Reactor Protection System Tests and Calibrations

(13). Rod Block Tests and Calibrations

(14). Refueling System Circuit Test

(15). Standby Liquid System Tests

(16). Core Thermal Limit Checks and Core Flux Monitor Calibrations

(17). Emergency Power Tests

(18). Reactor Core Isolation Cooling Tests

(19). NSSS Pressurization and Leak Detection

(20). Inspection of Reactor Coolant System Pressure Boundary

(21). Inspection of Pipe Hanger Settings

(22). Control Rod Drive System Functional Tests

(23). Core Physics Surveillance, Including Heat Balance

(24). Leak Detection System Tests

(25). Area, Portable, and Air borne Radiation Monitor Calibrations

(26). Process Radiation Monitor Calibrations

(27). Safety Relief Valve Tests

(28). Turbine Overspeed Trip Tests

(29). Water Storage Tanks Level Instrumentation Calibrations

(30). Reactor Building In-leakage Tests

(31). Nitrogen Inerting System Tests

4.9 *Emergency Operating Procedures*

Procedures that are symptom-oriented will be prepared to provide the operator guidance for maintaining the reactor in a safe condition with any or all of the principal process variables for the reactor or containment initially outside of limits, regardless of cause. Such procedures do not require the operator to diagnose the cause of the upset. A list of events that procedures will be covered are provided below:

(1). Operator precautions

(2). RPV Control

(3). Primary Containment Control

(4). Secondary Containment Control

(5). Radioactivity Release Control

(6). Level Restoration (Alternate Level Control)

(7). Emergency (RPV) Pressurization

(8). Steam Cooling

(9). RPV Flooding

(10). Level/Power Control

(11). (Primary) Containment Flooding

APPENDIX B

Tier 2 Marked Changes

13.5 Plant Procedures

Refer to Appendix A for requirements for development and implementation of procedures.

~~13.5.1 Administrative Procedures~~

~~Out of ABWR Standard Plant scope.~~

~~13.5.2 Operating and Maintenance Procedures~~

~~Out of ABWR Standard Plant scope.~~

~~13.5.3 COL License Information~~

~~13.5.3.1 Plant Operating Procedures Development Plan~~

~~A Plant Operating Procedures Development Plan shall be generated which establishes:~~

- ~~That the scope encompassed by the procedures development process includes those operating procedures defined in Subsection 13.5.3.4, which direct operator actions during normal, abnormal and emergency operations, including consideration of plant operations during periods when plant systems/equipment are undergoing test, maintenance or inspection.~~

- ~~The methods and criteria for the development, verification and validation, implementation, maintenance and revision of procedures. The methods and criteria shall be in accordance with TMI Items I.C.1 and I.C.9.~~

~~13.5.3.2 Emergency Procedures Development~~

~~In addition to the above, for Emergency Procedures development, the plan shall establish:~~

- ~~That a writer's guide shall be developed and implemented which defines the process for developing emergency procedures. The writer's guide shall contain objective criteria which will require that the emergency procedures developed are consistent in organization, style, content and usage of terms.~~

- ~~The form and content of the documentation describing the emergency procedure development activity results which includes, but is not limited to: (1) the objectives of the emergency procedure development process, (2) the methods employed during emergency procedure development, (3) deviations from generic technical guidelines approved by the NRC and (4) discussion of any design change recommendations and/or negative implications that the current design may have on safe operation as a result of emergency procedures development plan implementation.~~

13.5.3.3 Implementation of the Plan

Implementation of the Plant Operating Procedures Development Plan shall establish:

- Procedures which are consistent with the requirements of 10 CFR Part 50 and the TMI requirements described in NUREG-0737 and Supplement 1 to NUREG-0737.

- Requirements that the procedures developed shall include, as necessary, the elements described in ANSI 18.7/ANS-3.2 or subsequent NRC-approved version of ANSI/ANS-3.2 elected by the COL applicant.

- That the operator actions identified in the vendors task analysis and PRA efforts in support of the Standardized Design certification, Standardized Plant Design Emergency Procedure Guidelines and consideration of plant-specific equipment selection and site-specific elements such as the service water intake structure and the ultimate heat sink shall be used as a basis for specifying plant operating procedures.

- The definition of the methods through which specific operator skills and training needs, as may be considered necessary for reliable execution of the procedures, will be identified and documented.

- That the procedures specified in a., above, shall be made available for the purposes of the Human Factors V&V Implementation Plan described in Article VII of Table 18E-1.

- Procedures for the incorporation of the results of operating experience and the feedback of pertinent information into plant procedures in accordance with the provisions of TMI I.C..5.

13.5.3.4 Procedures Included In Scope Of Plan

The following procedures shall be included in the scope of the Plant Operating Procedures Development Plan described above:

System Procedures

Procedures as delineated in Section A3 of ANSI/ANS-3.2 shall be prepared, as appropriate, for the following BWR systems:

- Nuclear Boiler

- Control Rod Drive

- Reactor Water Cleanup

- Standby Liquid Control

- Residual Heat Removal

- ☐ High Pressure Core Flooder
- ☐ Reactor Core Isolation Cooling
- ☐ Reactor Building Cooling Water
- ☐ Containment
  - Maintaining Integrity
  - Containment Ventilation
  - Inerting and Deinerting
- ☐ Fuel Pool Cooling & Cleanup
- ☐ Main Steam
- ☐ Turbine/Generator
- ☐ Condensate/Feedwater
- ☐ Makeup Water
- ☐ Reactor Service Water
- ☐ Turbine Service Water
- ☐ Reactor Building HVAC
- ☐ Control Room HVAC
- ☐ Radwaste Building HVAC
- ☐ Standby Gas Treatment
- ☐ Instrument Air
- ☐ Electrical
  - Offsite: Circuits between offsite transmission network and the onsite Class 1E distribution system
  - Onsite: Emergency Power Sources (e.g., Diesel generator, batteries)
    - AC System
    - DC System
- ☐ Neutron Monitoring
  - Source Range

- Intermediate Range
- Power Range
- TIP System

- Reactor Protection
- Rod Worth Minimizer
- Hydrogen Recombiners

Procedures For Off-Normal Or Alarm Conditions.
Prepare all procedures for off-normal or alarm conditions that require operator action in the MCR and RSS. These correspond to the number of alarm annunciators. Each annunciator important to safety should have its own written procedure, which should normally contain (a) the meaning of the annunciator, (b) the source of the signal, (c) the immediate action that is to occur automatically, (d) the immediate operator action and (e) the long-range actions. If more than one annunciator applies to a given procedure, repetition of the procedure may not be required if the applicable annunciators are listed at the beginning of the procedure.

General Plant Operating Procedures.
As discussed in Section A5 of ANSI/ANS-3.2, procedures shall be prepared for the integrated operations of the plant. Typical general plant procedures are listed below:

- Cold Shutdown to Hot Standby
- Hot Standby to Minimum Load (nuclear startup)
- Recovery from Reactor Trip
- Operation at Hot Standby
- Turbine Startup and Synchronization of Generator
- Changing Load and Load Follow (if applicable)
- Power Operation and Process Monitoring
- Power Operation with Less than Full Reactor Coolant Flow
- Plant Shutdown to Hot Standby
- Hot Standby to Cold Shutdown
- Preparation for Refueling and Refueling Equipment Operation
- Refueling and Core Alterations

~~***Procedures for Combating Emergencies and Other Significant Events.***~~
~~As discussed in Section A10 of ANSI/ANS-3.2, procedures shall be provided to guide operations in emergencies and other significant events. Examples of such events are listed below. If symptomatic procedures are used, a single procedure may cover multiple events.~~

- ☐ ~~Loss of Coolant (inside and outside primary containment) (response to large and small breaks, including leak-rate determination),~~
- ☐ ~~Loss of Instrument Air~~
- ☐ ~~Loss of Electrical Power or Degraded Power Sources, or both.~~
- ☐ ~~Loss of Core Coolant Flow~~
- ☐ ~~Loss of Condenser Vacuum~~
- ☐ ~~Loss of Containment Integrity~~
- ☐ ~~Loss of Service Water~~
- ☐ ~~Loss of Shutdown Cooling~~
- ☐ ~~Loss of Component Cooling System and Cooling to Individual Components~~
- ☐ ~~Loss of Feedwater or Feedwater System Failure (including verification of proper operation of the auxiliary feedwater system)~~
- ☐ ~~Loss of Protective System Channel~~
- ☐ ~~Mispositioned Control Rod or Rods (and rod drops)~~
- ☐ ~~Inability to drive control rods~~
- ☐ ~~Conditions Requiring Use of Standby Liquid Control System~~
- ☐ ~~Fuel Cladding Failure or High Activity in Reactor Coolant or Offgas~~
- ☐ ~~Fire in Control Room or Forced Evacuation of Control Room~~
- ☐ ~~Turbine and Generator Trips~~
- ☐ ~~Other Expected Transients That May Be Applicable~~
- ☐ ~~Malfunction of Automatic Reactivity Control System~~
- ☐ ~~Malfunction of Pressure Control System~~
- ☐ ~~Reactor Trip~~

- ☐ Plant Fires

- ☐ Acts of Nature (e.g., tornado, flood, dam failure, earthquake)

- ☐ Irradiated Fuel Damage While Refueling

- ☐ Abnormal Releases of Radioactivity

- ☐ Intrusion of Demineralizer Resin into Primary System

- ☐ Hydrogen Explosions

- ☐ Containment Isolation (including reopening of individual isolation valves following reset of safety injection or containment isolation valves).

- ☐ Achievement and Maintenance of Natural Circulation.

- ☐ Safe Shutdown and Cooldown of the reactor core under a degraded core condition, including sampling of the reactor coolant and containment atmosphere.

- ☐ Loss of Annunciators

- ☐ In addition, procedures shall be prepared for activation and implementation of the facility emergency plan. For example, a procedure should be prepared which describes the emergency action level classification system.

- ☐ In addition, procedures shall be prepared for plant operations during plant systems/equipment and HSI (i.e., MCR and RSS) equipment testing, maintenance or inspection.

Procedures for Maintenance and Modification.
Prepare all maintenance and modification procedures that require operator actions to be taken in the MCR or RSS, including the following:

- ☐ Exercise of equipment that is normally idle but that must operate when required.

- ☐ Removal of Reactor Head.

- ☐ Reactor Coolant System operation with loops partially drained.

Procedures for radiation control.
As discussed in Section A7(d) of ANSI/ANS-3.2, the following procedures shall be prepared:

- ☐ Mechanical Vacuum Pump Operation

- ☐ Air Ejector Operation.

- ~~Packing Steam Exhauster Operation~~
- ~~Sampling~~
- ~~Air Ejection, Ventilation and Stack Monitor.~~
- ~~Area Radiation Monitoring System Operation~~
- ~~Process Radiation Monitoring System Operation~~
- ~~Meteorological Monitoring~~
- ~~Discharge of Effluents~~
- ~~Dose Calculations~~

~~Procedures for Calibration, Inspection and Testing.~~
~~Prepare all calibration, inspection and testing procedures that require operator actions to be taken in the MCR or RSS, including the following:~~

- ~~Containment Isolation Tests~~
- ~~Containment Vacuum Relief Valve Tests~~
- ~~Containment Spray System Tests~~
- ~~Standby Gas Treatment System Tests (including filter tests)~~
- ~~Emergency Service Water System Functional Tests~~
- ~~Main Steam Isolation Valve Tests~~
- ~~Fire Protector System Functional Tests~~
- ~~Nitrogen Inerting System Tests~~
- ~~Emergency Core Cooling System Tests~~
- ~~Control Rod Operability and Scram Time Tests~~
- ~~Reactor Protection System Tests and Calibrations~~
- ~~Rod Block Tests and Calibrations~~
- ~~Liquid Poison System Tests~~
- ~~Minimum Critical Heat Flux Checks and In Core Flux Monitor Calibrations~~
- ~~Emergency Power Tests~~

~~☐ Isolation Condenser or Reactor Core Isolation Cooling (RCIC) Tests~~

~~☐ NSSS Pressurization and Leak Detection~~

~~☐ Control Rod Drive System Functional Tests~~

~~☐ Core Physics Surveillance, Including Heat Balance~~

~~☐ Axial and Radial Flux Pattern Determination~~

~~☐ Safety Valve Tests~~

~~☐ Turbine Overspeed Trip Test~~

~~13.5.4~~ 13.5.1 References

In addition to the sources cited previously, accepted methods and criteria for development of plant procedures are embodied in the following documents.

13.5- 1 Gilmore, et al, "User-Computer Interface in Process Control: A Human Factors Engineering Handbook", Academic Press, San Diego, Ca, 1989

13.5- 2 IEC 964, "Design for Control Rooms of Nuclear Power Plants", Bureau Central de la Commission Electrotechnique Internationale

13.5- 3 MIL-H-46855B, "Human Engineering Requirements for Military Systems, Equipment and Facilities", Dept. of Defense

13.5- 4 MIL-STD-1472D, "Human Engineering Design Criteria for Military Systems, Equipment and Facilities", Dept. of Defense

13.5- 5 NUREG-0899, "Guidelines for the Preparation of Emergency Operating Procedures", USNRC, 1982

13.5- 6 NUREG-1358, "Lessons Learned From the Special Inspection Program for Emergency Operating Procedures", USNRC, 1989

13.5- 7 NUREG-1358, Supplement 1, "Lessons Learned From the Special Inspection Program for Emergency Operating Procedures", USNRC, 1992

13.5- 8 NUREG/CR-5228, "Techniques for Preparing Flowchart Format Emergency Operating Procedures" (Vols. 1 & 2), USNRC, 1989