AP1000 DOCUMENT COVER SHEET

TDC: _____ Permanent File: _____ APY: _____

RFS#: _____ RFS ITEM #: _____

AP1000 DOCUMENT NO.	REVISION NO.		ASSIGNED TO
APP-GW-GLR-010	0	Page 1 of 20	W-A. Sterdis

ALTERNATE DOCUMENT NUMBER: WORK BREAKDOWN #: GW

ORIGINATING ORGANIZATION: Westinghouse Electric Company

TITLE: **AP1000 Main Control Room Staffing Roles and Responsibilities**

ATTACHMENTS:	DCP #/REV. INCORPORATED IN THIS DOCUMENT REVISION:
CALCULATION/ANALYSIS REFERENCE:	

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
COL010	Microsoft Word	

ORIGINATOR D. L. Harmon	SIGNATURE/DATE	
REVIEWERS	SIGNATURE/DATE	
VERIFIER W. C. Kolb	SIGNATURE/DATE	VERIFICATION METHOD Page by page
AP1000 RESPONSIBLE MANAGER J. W. Winters	SIGNATURE* Electronically approved records are authenticated in the Electronic Document Management System.	APPROVAL DATE 5-April-2006

* Approval of the responsible manager signifies that document is complete, all required reviews are complete, electronic file is attached and document is released for use.

APP-GW-GLR-010
Revision 0

March 2006

AP1000 Standard Combined License Technical Report

AP1000 Main Control Room Staffing Roles and Responsibilities

Revision 0

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Nuclear Power Plants
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AP1000 Standard Combined License Application Technical Report
AP1000 Main Control Room Staffing Roles and Responsibilities

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1.0 PURPOSE

The purpose of this document is to describe the AP1000 staffing assumptions, scope and responsibilities of each main control room position (considering the task analyses and legally mandated staffing requirements) and expected staffing alternatives. Referencing this document will allow a Combined License applicant referencing the AP1000 certified design to satisfy DCD (Reference 1) COL Information Item 18.5-2 and FSER (Reference 2) COL Action Item 18.5.3-1 regarding control room staffing roles and responsibilities.

The information in this document will be used as a basis for a concept of operations defining the intended operational use of each AP1000 human system interface resource. The main control room and human system interface resources are being designed to allow acceptable operation by (a) the minimum staffing complement, (b) an alternative staffing complements, and (c) the maximum control room staff as described in this document.

2.0 GLOSSARY OF TERMS

Main Control Area	The main control area is the area within the Main Control Room (MCR) that contains the reactor console, supervisor console, Wall Panel Information System display units, primary and secondary dedicated safety panels, Diverse Actuation System panel and auxiliary panel.
Reactor Operator	An individual holding an active Reactor Operator's license, who may fulfill a variety of staffing positions requiring such qualification.
Senior Reactor Operator	An individual holding an active Senior Reactor Operator's license, who may fulfill a variety of staffing positions requiring such qualification.

3.0 SCOPE

The scope of this document includes the staffing roles and responsibilities for the main control room and the remote shutdown workstation. The document also addresses staff roles and responsibilities for key operations staff located outside of the above control facilities to allow a complete view of operational roles. The document does not address staffing at support facilities such as the Technical Support Center (TSC) and Emergency Operations Facility (EOF).

This document will not include administrative items such as training, review of procedures, performance management, operations planning and scheduling that are typically performed by other members of an operations department. The document will also not address non-operational routine tasks (e.g., completing time sheets and reading email communications) as these do not comprise roles and responsibilities of the operations staff.

The document addresses operating staff roles and responsibilities for normal operations (i.e., from refueling to full power), abnormal operations, and emergency operations. The document describes operator activities applicable at all times, including normal operations activities such as

tagging, and operations during plant transients including accidents for the following operating staff assumptions:

A) The standard AP1000 main control area operating staff of one Reactor Operator and one Supervisor (Senior Reactor Operator),
B) An alternate staff that includes a Unit Supervisor (Senior Reactor Operator) to supervise plant work activities.
C) A maximum main control room staff.

The alternate staffing assumptions are provided to address feedback from expected owner/operators of AP1000 units. The maximum control room staff provides an upper bound for the number of people to be accommodated in the main control room during significant emergency events. The maximum control room staff is consistent with the design of the passive main control room emergency habitability system (VES).

4.0 STAFFING ASSUMPTIONS AND RESPONSIBILITIES

4.1 General Staffing Assumptions

A licensed Reactor Operator (RO) is present at the controls of the AP1000 plant at all times, in conformance with Regulatory Guide 1.114 (Reference 3) and 10 CFR 50.54(k) (Reference 4).

A licensed Senior Reactor Operator (SRO) is present in the AP1000 Main Control Room (MCR) during modes other than refueling and cold shutdown in accordance with 10 CFR 50.54(m) (Reference 4).

A Shift Technical Advisor is available in the plant in accordance with NUREG-0737, Supplement 1 (Reference 5) criteria.

4.2 MCR Minimum Staffing

Basis: EPRI ALWR URD (Reference 6) Chapter 10 Section 4.2 and AP1000 OCS System Specification Document Section 4.2 (Reference 7).

4.2.1 Staffing Assumption (See Figure 1 for typical reporting structure)

Main Control Area (MCA)

One MCA RO (licensed Reactor Operator)
One MCA Supervisor (licensed Senior Reactor Operator (SRO))

Elsewhere in the MCR

One additional licensed Reactor Operator

Elsewhere in the Plant (but available to the MCR when necessary)

One Operations Shift Manager* (licensed SRO)
One Shift Clerk
One Shift Technical Advisor**
Two Equipment Operators (non-licensed)

* Same as "Shift Supervisor" identified in Reference 7 Section 4.2
** May be fulfilled by shift personnel, other than those in this list, who are assigned to other functions.

4.2.2 Staff Duties and Responsibilities

Main Control Area RO

The Main Control Area (MCA) RO has the following operations duties and responsibilities:

All Operations:

(1) Operates equipment controlled from the MCA including: (a) manipulating actual controls (b) monitoring equipment and system parameters, (c) documenting evolutions and significant events, (d) performing operator actions required by Alarm Response Procedures (ARPs); (e) prioritizing alarms and interpreting alarm significance, (f) diagnosing and recognizing trends.

(2) Maintains cognizance of short-term information such as standing orders or night orders.

(3) Conducts and verifies component lineups.

(4) Uses valid and redundant/supporting plant indications when deciding to act on observations.

(5) Takes reasonable actions to preserve the integrity of plant components.

(6) Takes reasonable actions to protect the health and safety of plant personnel and others working on and around the plant process equipment.

Normal operations:

(1) Performs operator actions required by system specific or normal (general) operating procedures.

(2) Initiates power reductions if required to prevent reactor trip or equipment damage.

(3) Maintains plant conditions within limitations of plant license and identifies less than one hour Technical Specification action statements when they occur.

(4) Initiates holds during plant evolutions to ensure that the evolution does not threaten plant stability, damage equipment, threaten personnel safety or violate plant Technical Specifications or operating procedures.

(5) Notifies grid control (load dispatcher) of conditions that could significantly affect station load.

(6) Coordinates conduct of surveillance tests

(7) Takes control room log readings and reviews and approves logs that are generated automatically.

(8) Provides current plant and system status for shift turnover briefing.

(9) Performs operator MCR actions supporting fuel handling including responding to alarms, communicating with the fuel storage facility, operating systems supporting refueling operations, and stopping fuel movement if conditions warrant.

(10) Understands and maintains system and equipment status required by Technical Specifications for reduced inventory and mid-loop operations during an outage.

(11) Directly supervises hot license class candidates taking the controls or non-licensed operators operating control room equipment.

(12) Interfaces with I&C maintenance personnel that are conducting periodic tests of I&C hardware or software and monitors control room responses to test activities.

Plant Transients and Emergencies:

(1) Executes EOP or AOP steps and initiates or performs required operator actions.

(2) Takes reasonable actions using non-safety plant systems to mitigate or terminate plant transients without challenging the safety systems.

(3) Anticipates, as can be reasonably expected, impending reactor trip and manually initiates reactor trip. Initiates reactor trip if indications exceed automatic reactor trip setpoints and a trip has not occurred.

(4) Anticipates, as can be reasonably expected, impending engineered safety feature actuations and manually initiates (with the concurrence of the MCA Supervisor) the engineered safety feature prior to automatic initiation. Initiates engineered safety features if indications exceed automatic actuation setpoints and an actuation has not occurred.

(5) Monitors post accident instrumentation to determine critical safety function status, safety system status and radiological release.

(6) Takes reasonable actions (with the concurrence of the MCA Supervisor) to operate equipment that is not specifically called for by the EOPs for accident mitigation.

Main Control Area Supervisor

The Main Control Area (MCA) Supervisor has the following operations duties and responsibilities:

All Operations:

(1) Commands and supervises activities in the main control area. Designates specific operational responsibilities to ROs when multiple ROs are conducting operations (see additional MCR RO).

(2) Conducts frequent, periodic direct monitoring of MCR activities and performs job observations.

(3) Remains in the main control area unless another individual with a valid SRO license is designated to assume control room command.

(4) Determines mode of operation

(5) Evaluates plant performance and makes operational judgments based on operating characteristics, reactor behavior and instrument interpretation.

(6) Approves all evolutions or testing affecting core reactivity

(7) Ensures MCR staff maintains cognizance of short-term information such as standing orders or night orders

(8) Obtains and verifies controlled procedure version.

(9) Tracks inoperable alarms

Normal Operations:

(1) Ensures shift operations are conducted in accordance with plant procedures and operating license including tracking limiting conditions for operation.

(2) Approves removal from service of equipment and systems for maintenance, testing or operational activities and return of such equipment to service.

(3) Maintains awareness of all maintenance, testing, troubleshooting or other activities that could affect unit operation and the risk associated with each activity and takes necessary actions to prevent inadvertent actuation signals.

(4) Controls access to the MCR.

(5) Conducts shift turnover briefing between shifts.

(6) Conducts shift briefings prior to the start of each shift.

(7) Supervises implementation of radiological waste management program with respect to shift operations

(8) Ensures operations surveillances are conducted on schedule.

(9) Maintains primary and secondary chemistry control.

(10) During Modes 4, 5, and 6 maintains awareness of (a) defense-in-depth configuration, (b) thermal margin, (c) containment closure/equipment hatch status and ensures that the safe shutdown configuration controls are satisfied.

(11) Prepares scheduled work activities including (a) reviewing work order schedules and their potential impact on operations, (b) implementing and removing tag outs, (c) directly interfacing with work crews.

(12) Initiates maintenance or trouble shooting requests for identified equipment problems.

Plant Transients and Emergencies:

(1) Determines circumstances and cause of a reactor trip or substantial unexplained power excursion and determines if the reactor can be returned to power operation safely. Obtains necessary approvals before return to power.

(2) Performs MCR functions required by Emergency plan, Health Physics Manual and Security Plan.

(3) Selects and prioritizes emergency procedure implementation.

(4) Assesses critical safety function status and priorities with appropriate logic and parameters.

(5) Initiates reports of Reactor Trips and other events reportable to the NRC.

(6) Controls radiation releases and guards against personnel exposure.

Additional MCR RO (non-designated)

No specific responsibilities or duties are assigned to the additional RO in the minimum staffing complement. The additional MCR RO is available to perform designated operator roles and responsibilities at the command of the MCA Supervisor (normally or during transients/emergencies) or at the request of the MCA RO during normal operations.

Typical roles and responsibilities of the additional MCR reactor operator may focus on (1) administrative activities in place of or to supplement the MCA RO or (2) secondary plant / electrical operations in cooperation with the MCA Reactor Operator. (For the purposes of this document, the secondary plant includes the steam and power conversion systems, auxiliary fluid systems, HVAC systems, water and waste treatment systems, and radioactive waste systems).

Unique roles and responsibilities for an operator performing these duties may include:

Administrative: (1) Coordinates conduct of surveillance tests

(2) Takes control room log readings and reviews and approves logs that are generated automatically.

(3) Provides current plant and system status related to designated duties for shift turnover briefing.

(4) Directly supervises hot license class candidates taking the controls or non-licensed operators operating control room equipment in support of the MCA RO.

(5) When not engaged in administrative or operational tasks, performs reviews and updates/improves HSI resources (e.g. displays, procedures, alarms).

Operations: (1) Operates secondary plant / electrical equipment controlled from the MCA including: (a) manipulating actual controls, (b) monitoring equipment and system parameters, (c) documenting evolutions and significant events, (d) performing operator actions required by Alarm Response Procedures (ARPs); (e) prioritizing alarms and interpreting alarm significance, (f) diagnosing and recognizing trends.

(2) Conducts and verifies secondary plant component lineups.

(3) Communicates with RO to maintain cognizance of reactor and primary systems

(4) Performs operator actions required by secondary plant / electrical system specific or normal (general) operating procedures.

(5) Maintains secondary plant / electrical conditions within limitations of plant license and identifies one hour Technical Specification action statements when they occur (note that relatively few secondary plant / electrical-related technical specifications exist for a passive plant design).

(6) Initiates holds during plant evolutions to ensure that the evolution does not threaten plant stability, damage equipment, threaten personnel safety or violate plant Technical Specifications or operating procedures.

(7) Notifies grid control (load dispatcher) of conditions that could significantly affect station load.

(8) Coordinates conduct of secondary plant / electrical surveillance tests

(9) Takes control room secondary plant / electrical log readings and reviews and approves logs that are generated automatically.

(10) Provides current secondary plant / electrical status for shift turnover briefing.

(11) Anticipates, as can be reasonably expected, impending turbine trip and manually initiates turbine trip. Initiates turbine trip if indications exceed automatic turbine trip setpoints and a trip has not occurred.

(12) Takes reasonable actions (with the concurrence of the MCA Supervisor) to operate secondary plant / electrical equipment that is not specifically called for by the EOPs for accident mitigation.

(13) Provides temporary relief for the MCA RO.

Operations Shift Manager (SRO)

The Operations Shift Manager is normally stationed outside the MCR and has the following operations duties and responsibilities:

Normal Operations:

(1) Ensures plant operations are conducted in accordance with Technical Specifications and approved procedures.

(2) Ensures proper conduct of shift turnover and crew briefs.

(3) Coordinates personnel activities outside the MCR including control of access to vital/controlled areas

(4) Maintains cognizance of current and upcoming maintenance activities for proper coordination.

(5) Makes equipment operability determinations.

(6) Determines the rate for required shutdown or cooldown such that the required condition is completed in a controlled manner within specified times.

(7) Reviews operations logs, condition and event reports and other documentation from the MCR and ensures notification to appropriate operations management.

(8) Coordinates refueling operations

(9) Ensures temporary procedure changes are properly administered.

Plant Transients and Emergencies:

(1) (a) declares plant emergencies, (b) ensures mitigating actions are implemented by all plant groups, (c) ensures on-site and off-site notifications are executed and (d) notifies plant management.

(2) Maintains broad perspective of conditions affecting overall plant safety and oversight of MCR operations.

(3) Assesses risk and makes conservative operations decisions.

(4) Coordinates the fire protection program and the fire brigade and directs fire protection procedures

(5) Ensures that required trip investigations are completed.

(6) Controls access to the MCR

Shift Clerk

The shift clerk has the following operations duties and responsibilities:

Normal Operations:

Maintains required MCR access to procedures. Maintains drawings and manuals current by ensuring revisions are incorporated.

Shift Technical Advisor

The shift technical advisor has the following operations duties and responsibilities:

Normal Operations:

Assesses possible significant Reactor Coolant System abnormalities observed during normal operations at the request of the MCA supervisor.

Plant Transients and Emergencies:

(1) Reports to MCA Supervisor in a technical advisory capacity during emergencies, but has no control or command functions.

(2) Independently monitors and validates Critical Safety Function Status Trees and recommends transition to Functional Restoration Procedures.

(3) Independently assesses plant parameters to ascertain whether core damage has occurred or is imminent.

(4) Independently evaluates effectiveness of AOPs or EOPs to terminate or mitigate events.

(5) Independently performs an evaluation of operability of equipment to comply with Technical Specifications.

(6) Independently performs investigation of causes of abnormal events and classifies emergency conditions.

Equipment Operator (non-licensed)

Two non-licensed equipment operators are normally located outside the MCR and have the following operations duties and responsibilities:

Normal Operations:

(1) Locally monitors plant equipment

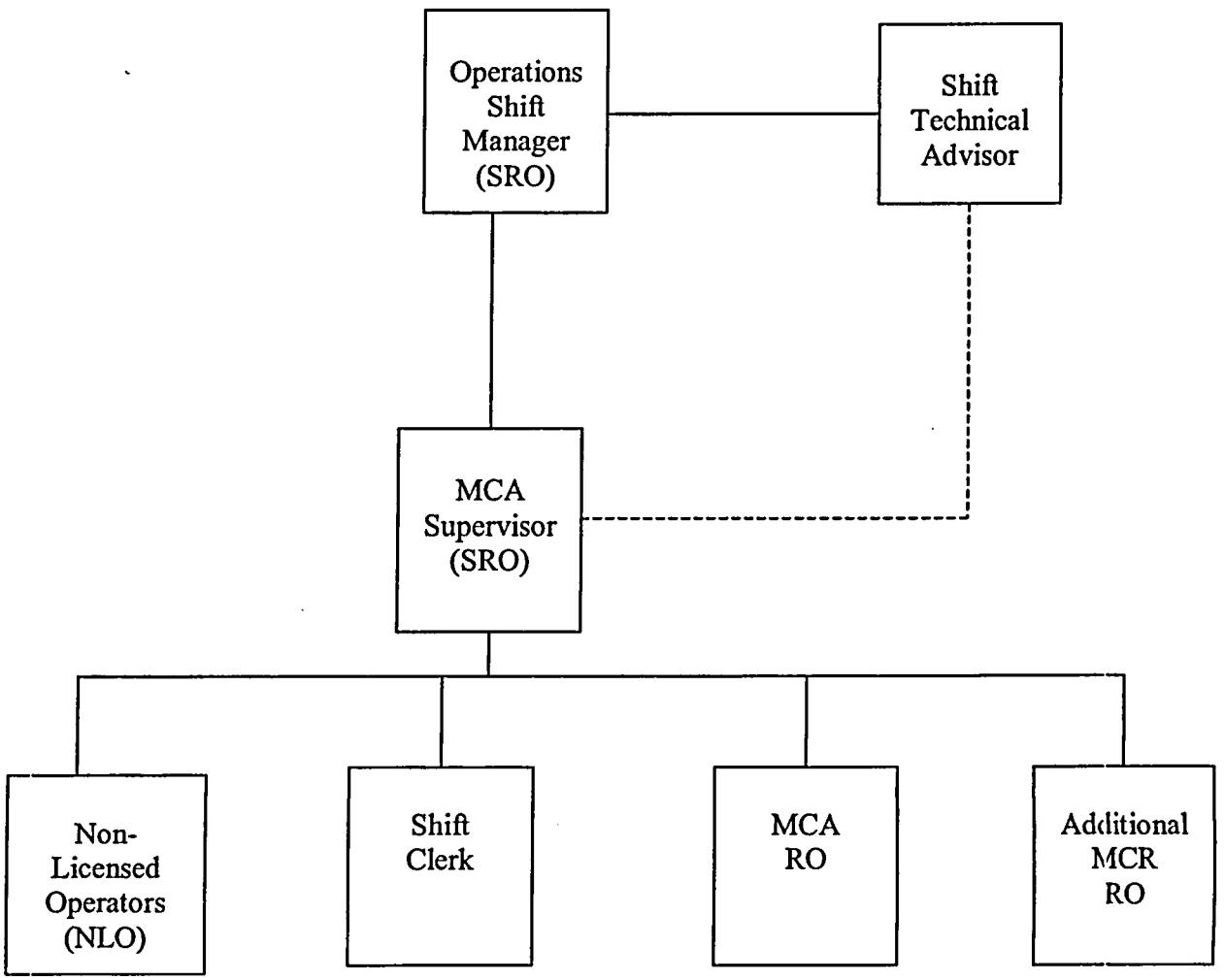
(2) Locally performs unit evolutions and system operations under the direction and command of the MCA Supervisor.

(3) Takes responsibility for cleanliness of plant equipment.

(4) Communicates any abnormal conditions or operability concerns to supervision.

Figure 1

Typical Organization for AP1000 Minimum Staffing



4.3 MCR Alternate Staffing with Unit Supervisor

Basis: Operational feedback obtained during review of existing plant's staff structure and review feedback.

An alternate staffing arrangement is provided that identifies distinct roles and responsibilities for a Unit Supervisor (SRO) who is normally located outside the MCR.

For this staffing arrangement the roles and responsibilities of the MCA Supervisor are adjusted and roles of the Unit Supervisor are added. Roles and responsibilities for the MCA RO, Operations Shift Manager, Shift Clerk, Shift Technical Advisor and Non-Licensed Operators remain unchanged from the minimum staffing assumption.

Staffing Assumption

Main Control Area

One licensed Reactor Operator at the controls
One Licensed Senior Reactor Operator (Supervisor)

Elsewhere in the MCR

One additional licensed Reactor Operator

Elsewhere in the Plant (but available to the MCR when necessary)

One Operations Shift Manager* (licensed SRO)
One Unit Supervisor (licensed SRO)
One Shift Clerk
One Shift Technical Advisor**
Two Equipment Operators (non-licensed)

* Same as "Shift Supervisor" identified in Reference 7 Section 4.2
** May be fulfilled by shift personnel, other than those in this list, who are assigned to other functions.

Main Control Area Supervisor

The Main Control Area Supervisor has the same duties and responsibilities as for the minimum staffing assumption except that the following two normal operations duties are transferred to the Unit Supervisor:

> (10) During Modes 4, 5, and 6 maintains awareness of (a) defense-in-depth configuration, (b) thermal margin, (c) containment closure/equipment hatch status.

(11) Prepares scheduled work activities including (a) reviewing work order schedules and their potential impact on operations, (b) implementing and removing tag outs, (c) directly interfacing with work crews.

Unit Supervisor

The Unit Supervisor (sometimes referred to as the Work Control Supervisor) is normally stationed outside the MCR and has the following operations duties and responsibilities:

Normal Operations:

(1) Responsible for preparing scheduled work activities including (a) review of work order schedules and potential impact on operations, (b) implementation and removal of tag outs, (c) direct interface with work crews.

(2) Communicates through the MCA Supervisor to request work activities performed by the MCA RO.

(3) Informs the MCA Supervisor of information from work activities involving Technical Specification Compliance or equipment operability determinations.

(4) During Modes 4, 5, and 6 maintain awareness of (a) defense-in-depth configuration, (b) thermal margin and (c) containment closure/equipment hatch status.

Plant Transients and Emergencies:

(1) Coordinates plant actions under direction from the Operations Shift Manager.

(2) Supports the MCA operations staff in the MCR on an as-needed basis.

4.4 MCR Maximum Staffing

Basis: EPRI ALWR URD (Reference 6) Chapter 10 Section 4.2 and AP1000 OCS System Specification Document (Reference 7) Section 4.2

Staffing Assumption

Main Control Area

One MCA RO (licensed RO normally in the MCA)
One MCA Supervisor (licensed SRO normally in the MCA)
One Additional Reactor Operator (normally non-designated elsewhere in the MCR)
Second additional Reactor Operator (normally elsewhere in the plant)
One Unit Supervisor (SRO)

Elsewhere in the MCR

One Operations Shift Manager*
One Shift Technical Advisor**
One Shift Clerk
One communicator (for communications external to MCR)
One NRC Observer
One Plant Management Observer

* Same as "Shift Supervisor" identified in Reference 7 Section 4.2
** May be fulfilled by shift personnel, other than those in this list, who are assigned to other functions.

Staff Duties and Responsibilities

For the maximum staffing assumption the duties and responsibilities of the MCA RO, the additional MCR RO, the MCA Supervisor, the Operations Shift Manager, the Shift Clerk, the Shift Technical Advisor and Non-Licensed Operators remain unchanged from the minimum staffing assumption.

For the maximum staffing assumption, the duties and responsibilities in the MCR of the additional operations personnel in the MCR including the second additional RO, the Unit Supervisor and the communicator will be at the discretion of the MCA Supervisor and Operations Shift Manager. It is not anticipated that there will be any additional roles and responsibilities not already identified in the minimum or alternate staffing assumptions.

The NRC observer and plant management observer do not take active part in operations and will not require HSI devices for their observations of the MCR operations.

4.5 Remote Shutdown Workstation (RSW) Staffing

Staffing Assumption

Remote Shutdown Workstation

One RO (licensed RO)
One Supervisor (licensed SRO)

Staff Duties and Responsibilities

For the RSW staffing assumption the duties and responsibilities of the MCA RO and the MCA Supervisor remain unchanged from the minimum staffing assumption. It is not expected that operators will have to mitigate accidents from the RSW based on US NRC licensing criteria.

5.0 SUMMARY

As a basis for proceeding with the AP1000 MCR design and HSI detailed designs, this document has defined the operational roles and responsibilities for:

A) The minimum AP1000 main control area operating staff of one Reactor Operator and one Supervisor (SRO),
B) An alternate staff that includes a Unit Supervisor (SRO) to supervise plant work activities.
C) A maximum main control room staff.

The document also includes the staffing assumption for the RSW.

6.0 REFERENCES

1. APP-GW-GL-700, Revision 15, AP1000 Design Control Document.

2. NUREG-1793, Final Safety Evaluation Report Related to Certification of the AP1000 Standard Design, September 2004.

3. Regulatory Guide 1.114, Guidance to Operators at the Controls and to Senior Operators in the Control Room of a Nuclear Power Plant.

4. 10 CFR 50.54, Conditions of Licenses, USNRC.

5. NUREG 0737, Supplement 1, Clarifications of TMI Action Plan Requirements, USNRC.

6. EPRI ALWR URD, Vol. III, Passive Plant, Chapter 10 MMIS, Revision 8, 1998.

7. APP-OCS-J7-001, Operations and Controls Centers System Specification Document, Rev. A.

7.0 REGULATORY IMPACT

The FSER discusses the AP1000 task analysis process in Subsection 18.5. Preparation of a report on main control room staffing roles and responsibilities is one of the activities included in the process. The FSER conclusions in 18.5 are not impacted by the completion of this report prior to submittal of a Combined License application.

The changes to the DCD presented in this report do not represent an adverse change to the design function or to how design functions are performed or controlled. The changes to the DCD do not involve revising or replacing a DCD-described evaluation methodology nor involve a test or experiment not described in the DCD. The DCD change does not require a license amendment per the criteria of VIII. B. 5.b. of Appendix D to 10 CFR Part 52.

The DCD change does not affect resolution of a severe accident issue and does not require a license amendment based on the criteria of VIII. B. 5.c of Appendix D to 10 CFR Part 52.

The DCD change does not affect any security assessment performed for AP1000.

8.0 DCD MARK-UP

The following DCD markup identifies how COL application FSARs should be prepared to incorporate the subject change.

Revise the second paragraph of Subsection18.5.4 as follows:

18.5.4 Combined License Information Item

Combined License applicants referencing the AP1000 certified design will address the execution and documentation of the task analysis implementation plan presented in Section 18.5.

Completed. ~~Combined License applicants referencing the AP1000 certified design will document t~~The scope and responsibilities of each main control room position are documented in Reference 14. ~~, considering the assumptions and results of the task analysis.~~

Add Reference 14 to Subsection 18.5.5

18.5.5 References

14. APP-GW-GLR-010, "AP1000 Main Control Room Staffing Roles and Responsibilities," March 2006.