

DOCUMENT COVER SHEET

TDC: _____ Permanent File: _____

DOCUMENT NO. UKP-GW-GL-737	REVISION 1	PAGE 1 of 79	ASSIGNED TO W-Popp	OPEN ITEMS (Y/N) N
DOCUMENT STATUS: <input type="checkbox"/> PRE <input type="checkbox"/> CFC <input type="checkbox"/> CAE <input checked="" type="checkbox"/> DES			Westinghouse Acceptance of AP1000 Design Partner Document by: NA (Name and Date)	

ALTERNATE DOCUMENT NUMBER: N/A WORK BREAKDOWN #: GW
 ORIGINATING ORGANIZATION: NPP International Licensing
TITLE: Plant Life Cycle Safety Report

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

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
UKP-GW-GL-737.pdf	PDF	PDF

© 2009 WESTINGHOUSE ELECTRIC COMPANY LLC, ALL RIGHTS RESERVED – WESTINGHOUSE NON-PROPRIETARY CLASS 3
 All Class 3 Documents require the following two approvals in lieu of a Form 36.

LEGAL REVIEW Lisa Campagna	SIGNATURE / DATE (If processing electronic approval select option) Electronically Approved***
PATENT REVIEW Doug Ekeroth	SIGNATURE / DATE Electronically Approved***

© 2009 WESTINGHOUSE ELECTRIC COMPANY LLC, ALL RIGHTS RESERVED – WESTINGHOUSE PROPRIETARY CLASS 2
 This document is the property of and contains Proprietary Information owned by Westinghouse Electric Company LLC and/or its subcontractors and suppliers. It is transmitted to you in confidence and trust, and you agree to treat this document in strict accordance with the terms and conditions of the agreement under which it was provided to you.

© 2009 WESTINGHOUSE ELECTRIC COMPANY LLC, ALL RIGHTS RESERVED and/or STONE & WEBSTER, INC.
WESTINGHOUSE PROPRIETARY CLASS 2 and/or STONE & WEBSTER CONFIDENTIAL AND PROPRIETARY
 This document is the property of and contains Proprietary Information owned by Westinghouse Electric Company LLC and/or is the property of and contains Confidential and Proprietary Information owned by Stone & Webster, Inc. and/or their affiliates, subcontractors and suppliers. It is transmitted to you in confidence and trust, and you agree to treat this document in strict accordance with the terms and conditions of the agreement under which it was provided to you.

Third Party Provided Information
 To be used only for the specific contract under which it was provided. Requirements and responsibilities for this information are specified in APP-GW-GAP-104.

ORIGINATOR(S) WEC 6.1.pdf Dennis Popp	SIGNATURE / DATE (If processing electronic approval select option) Electronically Approved***	
REVIEWER(S) WEC 6.1.pdf Rick Wright	SIGNATURE / DATE Electronically Approved***	
	SIGNATURE / DATE	
	SIGNATURE / DATE	
VERIFIER(S) WEC 6.1.pdf Larry Eisenstatt	SIGNATURE / DATE Electronically Approved***	Verification Method: Independent Review

Plant Applicability: All AP1000 plants except:
 Only the following plants: UKP

APPLICABILITY REVIEWER** WEC 6.1.pdf J. A. Speer	SIGNATURE / DATE Electronically Approved***
RESPONSIBLE MANAGER* WEC 6.1.pdf Paul Russ	SIGNATURE / DATE Electronically Approved***

* Approval of the responsible manager signifies that the document and all required reviews are complete, the appropriate proprietary class has been assigned, electronic file has been provided to the EDMS, and the document is released for use.

*** *Electronically approved records are authenticated in the electronic document management system. When a document is approved, this footnote is replaced by a footnote with a date stamp.*

Plant Life Cycle Safety Report

UKP-GW-GL-737, Revision 1

Westinghouse Electric Company LLC
P.O. Box 355
Pittsburgh, PA 15230

Copyright © 2010
Westinghouse Electric Company LLC
All Rights Reserved

REVISION HISTORY

Revision	Description of Change
Previously UKP-GW-GL-700, Revision 2	Separate Document: UKP-GW-GL-737, Revision 0 Addition of construction nuclear safety Editorial changes
1	Reworked to incorporate ND/EA comments. New Sections added are the Safety and Quality Philosophy for the Project; Concept of Knowledge Transfer; Documentation. Additional information has been added to the Sections on Design, Construction, Commissioning and Operational Phases. The information relating to the Site Safety manual has been re-ordered and where necessary moved to the Section on Operational Phase. Editorial Changes

TABLE OF CONTENTS

Section	Title	Page
REVISION HISTORY		ii
LIST OF TABLES.....		vii
LIST OF FIGURES		vii
PART 1 GENERAL ISSUES.....		1
1.0 SCOPE OF REPORT		1
2.0 WESTINGHOUSE COMMITMENT		5
3.0 SAFETY AND QUALITY PHILOSOPHY FOR PROJECT		6
4.0 CONCEPT OF KNOWLEDGE TRANSFER		10
4.1 Design Authority		14
5.0 DOCUMENTATION		16
PART 2 PROJECT PHASES		19
6.0 DESIGN PHASE.....		19
7.0 CONSTRUCTION PHASE.....		23
7.1 Advanced Construction Techniques		23
7.2 Modular Construction.....		24
7.3 AP1000 Site Layout.....		24
7.4 Construction Schedules and Arrangements		25
7.4.1 Verification Testing.....		26
8.0 COMMISSIONING PHASE		31
8.1 Commissioning Schedules and Arrangements		31
8.2 AP1000 Test Programme.....		31
8.2.1 Construction and Installation Tests		32
8.2.2 Preoperational Testing.....		33
8.2.3 Startup Test Programme		34

TABLE OF CONTENTS (cont.)

Section	Title	Page
9.0	OPERATIONAL PHASE.....	37
9.1	Safe Operating Envelope and Operating Regime that Maintains Integrity of Envelope	37
9.2	Maintenance and Outage Schedules	38
9.3	Organisational Arrangements for Moving to an Operational Regime.....	40
	9.3.1 Procedures	40
	9.3.2 Training	41
	9.3.3 Emergency Procedures and Services.....	43
	9.3.4 Radiological Protection	43
	9.3.5 Documents and Record Management.....	44
	9.3.6 Nuclear Material Arrangements	46
10.0	DECOMMISSIONING	48
PART 3	HEALTH AND OCCUPATIONAL SAFETY ARRANGEMENTS FOR PROJECT EXECUTION (INSTALLATION/CONSTRUCTION AND COMMISSIONING)	49
11.0	SITE SAFETY MANUAL	49
11.1	Medical Services.....	49
11.2	Construction Fire Prevention Programme	50
11.3	Accident Reporting and Analysis	50
11.4	Fitness for Duty.....	51
11.5	Planning	51
11.6	Recognition and Rewards	52
11.7	Accountability.....	53
11.8	Worker Participation.....	54
11.9	Audits and Assessments	54
11.10	Environment	55
11.11	Project-Specific or Site-specific Issues.....	56
11.12	Other Environment, Health, and Safety Plan Topical Areas	56

TABLE OF CONTENTS (cont.)

Section	Title	Page
PART 4	REFERENCES AND GLOSSARY OF TERMS.....	57
12.0	REFERENCES	57
13.0	GLOSSARY OF TERMS.....	60

TABLE OF CONTENTS (cont.)

Section	Title	Page
Attachments		
1.	Terms of Reference for the AP1000 GDA Submission Steering Committee (AGSSC)	62
2.	Sample Design Review Checklist.....	65

LIST OF TABLES

Table 1-1	Expectations of a Requesting Party Against Contents of LCSR.....	3
Table 7-1	Five Principal Building Structures and Associated Hazards.....	27

LIST OF FIGURES

Figure 1-1	Linkage of Safety Documentation.....	4
Figure 3-1	Key Process Model.....	8
Figure 3-2	Organisational Structure.....	9
Figure 6-1	Design Review Process Flowchart.....	22
Figure 7-1	Key Elements of Environment, Health, and Safety Programme for Construction of AP1000	28
Figure 7-2	Typical Arrangement of Plant Buildings and Associated Key Operations	29
Figure 7-3	Relationship of Construction Test Requirements to Nuclear Safety.....	30
Figure 8-1	Nuclear Installation Testing	36
Figure 9-1	Operational Aids	47

PART 1 GENERAL ISSUES**1.0 SCOPE OF REPORT**

The purpose of the Plant Life Cycle Safety Report (LCSR) is to describe the general arrangements for the overall project including the safety and quality philosophies that Westinghouse expects to be applied and implemented during the project. It is appreciated however, that the delivery of Westinghouse's arrangements post design acceptance and on a Licensed Site will be under and in agreement with the Licensee's arrangements. The document will also concentrate on the high level requirements and arrangements which will be implemented during the various project stages, including the design, construction, commissioning, and operational stages. The document is specific to the nuclear safety aspects of the UK AP1000 GDA project. However where there is an impact on the nuclear safety of the plant from environmental, conventional and chemotoxic safety then these other safety aspects have been mentioned. Security aspects of the UK AP1000 GDA project are not covered in this document.

The structure of Revision 1 of the Plant LCSR has been revised to reflect this change from Revision 0. The information provided in Revision 0 has been reviewed, and where appropriate, expanded or rearranged to align more closely with the various project phases. The report outlines the information required to demonstrate that the construction and installation activities will result in a plant of appropriate quality and that the constructed plant will be capable of being operated within safe limits. The arrangements for moving the safety case to an operating regime are also addressed on conceptual level.

Additionally, Revision 1 describes the process for how the knowledge within the AP1000 safety case can be most comprehensively transferred to the potential Licensee and outlines Westinghouse expectations for any Operators management system. The linkage of the Plant LCSR to the AP1000 Pre-Construction Safety Report (PCSR) is shown in Figure 1-1.

The Health and Safety Executive (HSE) document New Nuclear Power Stations, Generic Design Acceptance, Guidance to Requesting Parties [Reference 1] provides a summary of what is expected from the requesting parties to demonstrate that any new Nuclear Power Plant is constructed and installed to an appropriate quality and capable of being operated within the safe limits. These expectations have been cross referenced to where the high level information can be found in the LCSR as shown in Table 1-1.

Safety of the AP1000TM¹ design through the life cycle of the plant is the number one priority of Westinghouse Electric Company (Westinghouse). Westinghouse has developed a number of safety programmes to be used in support of the Licensee² throughout the design, construction, and operation of an AP1000 as described in the following paragraphs:

- Design Safety

During the finalization of the design process, Westinghouse implements developed procedures to review all proposed changes in an integrated manner against existing system design, criteria, design bases analyses events, and probabilistic evaluations to ensure that the change does not have an adverse impact on existing plant safety. These procedures and their implementation are the subject of continuous review by both involved utilities and regulatory authorities. To this end there will be an integration of

1. AP1000 is a trademark of Westinghouse Electric Company LLC.

2. This is the company that the HSE licenses under the Nuclear Installations Act 1965.

Westinghouse's design finalization procedures into the Licensee's arrangements for design changes following acceptance of the design by the ND/EA. Details on the established design safety are provided in the "AP1000 Pre-Construction Safety Report" [Reference 8], "UK AP1000 Probabilistic Risk Assessment" [Reference 3], "UK AP1000 Environmental Report" [Reference 4], and all referenced material in these reports.

The arrangements for the design control are provided in Section 6.

- Construction Safety

Although there are no specific laws that govern construction design management in the United States, Westinghouse has always made safety a top priority through all phases of a project as evidenced by its long history and industry ranking as a successful manufacturer and premier supplier of nuclear power plants. Based on Westinghouse review of policies and procedures to determine compliance with "The Construction (Design and Management) [CDM] Regulations" [Reference 5], Westinghouse concludes that it meets the requirements of the UK regulations. However it is recognised that such arrangements will be delivered under and aligned with the arrangements of the Licensee.

The arrangements for construction are outlined further in Section 7.

Westinghouse recognizes that one of the best ways to ensure safety and prevent occupational injuries during the manufacturing, construction, and operation of the AP1000 is to identify and minimise risks during the design process by stipulating safety as a design criteria. To reinforce this, an environmental and safety awareness culture will be established during construction that will involve all personnel, including contractors.

Supporting information on the Health and Occupational Safety arrangements for the project execution is provided in Section 11.

Table 1-1		
EXPECTATIONS OF A REQUESTING PARTY AGAINST CONTENTS OF LCSR		
	Description	LCSR Content
	A demonstration that construction and installation activities will result in a plant of appropriate quality	Section 3
	A demonstration that the constructed plant will be capable of being operated within safe limits.	Section 7
	Arrangements for moving the safety case to an operating regime; that is, the arrangements to ensure that the requirements of, and assumptions in, the safety case will be captured in the following:	
	Technical specifications	Section 9.1
	Maintenance schedule	Section 9.2
	Procedures (normal, emergency, accident management)	Section 9.3
	Training programmes	Section 9.3.1
	Emergency preparedness	Section 9.3.2
	Operating limits	Section 9.1
	Radiation protection arrangements for operators	Section 9.3.4
	Lifetime records	Section 5
	Commissioning requirements and the like	Section 8
	Arrangements for the design and safety case definition and freeze	Section 6
	Arrangements for putting in place a Design Authority	Section 4
	Arrangements that demonstrate that any site-specific changes against the generic design will be managed within an agreed change control process	Section 6

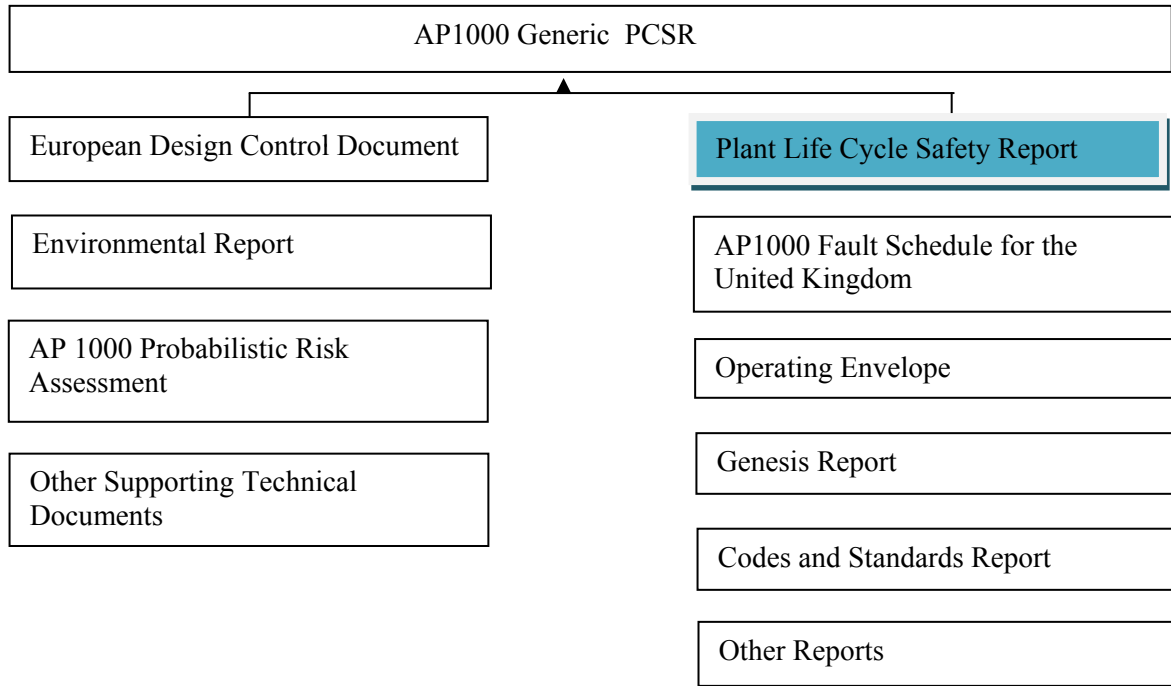


Figure 1-1. Linkage of Safety Documentation

2.0 WESTINGHOUSE COMMITMENT

In support of this policy statement, as given in Reference 9, Westinghouse as the plant designer is committed to:

- Providing safe working conditions to protect the health and safety of our employees and contractors.
- Reducing waste, preventing pollution, conserving resources, and using energy efficiently in our operations.
- Complying with the applicable environment, health, and safety (EHS) legislation and regulations, as well as any other requirements, including fire regulations.
- Continually improving EHS management systems and performance by establishing and maintaining meaningful objectives and targets, taking into consideration significant EHS aspects; technological options; and legal, operational, business, and other requirements.
- Establishing and maintaining procedures to identify the potential for and response to accidents and emergency situations, and to prevent and mitigate the impacts associated with them.
- Training employees to work in a safe and environmentally responsible manner.
- Effectively managing and promptly resolving impacts from historical operations in a manner that minimises risks and liabilities while accommodating current operations.
- Periodically monitoring, auditing, and evaluating EHS performance as it relates to applicable design requirements and established objectives and targets.

Each employee of Westinghouse is responsible for carrying out this Policy and of supporting the associated commitments within the employee's area of responsibility.

Our certifications in ISO 9001:2000 (Lloyd's Register Quality Assurance) and ISO 140001 (Lloyd's Register), specifically at Springfields in the UK, and our human performance initiatives are key indicators that this commitment is an integral part of the way we do business. "Westinghouse Electric Company Quality Management System" (QMS) [Reference 6] is applicable to provision of: project management, design, engineering, manufacturing, procurement, installation, inspection and testing, repair and maintenance, and decommissioning services with respect to nuclear power plants, systems, and components; the nuclear fuel cycle; and radioactive waste disposal facilities, including the design and development of software.

There are several ways that the above commitments are communicated and integrated into our work. Moreover, Westinghouse is a learning organization that drives continuous improvement by transferring best practices and lessons learned. The safety record of results is exemplary. Globally, the Industrial Safety Accident Rate (ISAR) for Westinghouse nuclear businesses for FY07 is 0.55, approximately four times better than the U.S. general industry average of 2.3.

3.0 SAFETY AND QUALITY PHILOSOPHY FOR PROJECT

It is the AP1000 Westinghouse policy to design, produce, market, and distribute our products and services and to conduct our operations in an environmentally sound and socially responsible manner. Westinghouse considers the impact its actions may have on the environment and on the health and safety of our employees, subcontractors, customers, and public.

The manner in which the Westinghouse policy is implemented through the design, procurement, construction, and commissioning phases of the AP1000 is outlined in Chapter 17 of the “UK AP1000, European Design Control Document”(DCD) [Reference 2]. The design of the AP1000 has been based on using the design of the AP600 to the largest possible extent and the QMS used for the AP600 has been maintained as the Quality Plan for the AP1000 programme. As mentioned in the “UK AP1000 European Design Control Document” (DCD) [Reference 2] a project-specific quality plan was produced for the AP600 to supplement the QMS. Similarly, a Project Quality Plan for the UK GDA process has been issued, and this is provided in Reference 7. This document defines the Quality Assurance (QA) objectives for the conduct of activities to be performed by Westinghouse relating specifically to the GDA process for the AP1000 and the supporting licensing activities in the UK. The Project Quality Plan is one part of the fully comprehensive quality management system that Westinghouse has in place. Any work carried out by Westinghouse on the AP1000 project will be in accordance with the Westinghouse QMS [Reference 6].

As mentioned in Section 2, the QMS [Reference 6] is applicable to all aspects of the AP1000 project. In deriving the QMS, consideration has been given to external legislation and regulatory requirements and will be reviewed periodically to maintain currency. In this context, consideration has been given to the key aspects of the following:

- “Safety Manual” in respect of BS OHSAS 18001
- “Quality Manual” in respect of ISO 9001.
- “Environmental Manual” in respect of ISO 14001
- “Radioactive Substances Act 1993 Authorisation”
- “The Pollution, Prevention and Control (England and Wales) Regulations 2000”
- “The Control of Major Accident Hazards [COMAH] Regulations 1999” [Reference 31]

An outlined process model shown in Figure 3-1 identifies the key processes and their interrelationships between the external customers and regulatory requirements. This can be developed further during the AP1000 project.

The “Project Quality Plan for the UK Generic Design Assessment” [Reference 7] defines the Westinghouse Nuclear Power Plants (NPP) organisational structure, together with the responsibilities. Essentially, the UK Licensing Organisation are assigned to represent NPP for the day-to-day interaction with the Regulators’ Joint Project Office and WEC for the AP1000 GDA. The organisational structure is given in Figure 3-2.

The responsibilities of the UK Programme Manager and the UK Licensing Manager are to:

- Develop and maintain the AP1000 documentation to support the GDA process
- Establish and maintain NPP procedures specific to the GDA process

- Function as the primary communications interface with the JPO on all matters relating to the GDA for AP1000
- Interface with the NPP Engineering Organisation to obtain detailed technical and engineering information specific to the GDA process for the AP1000

Westinghouse will implement its Safety Management System:

- Up to the end of Phase 2 of the GDA process,
- During subsequent plant construction and
- During the commissioning phase prior to product acceptance handover to the operating organisation's Licensee.

The safety case is currently owned by WEC, the requesting party for Phase 1 of the GDA process. A key issue is that once the Design Acceptance Confirmation is received, the operating organisations that become Licensees will own the safety case and will be responsible for any changes and future reviews of that design, albeit with input from WEC where deemed appropriate by both parties. The Design Reliability Assurance Programme (D-RAP) is discussed in more detail in Chapter 6 of the European DCD [Reference 2]. This programme is implemented to provide confidence that reliability is maintained during design and plant operations.

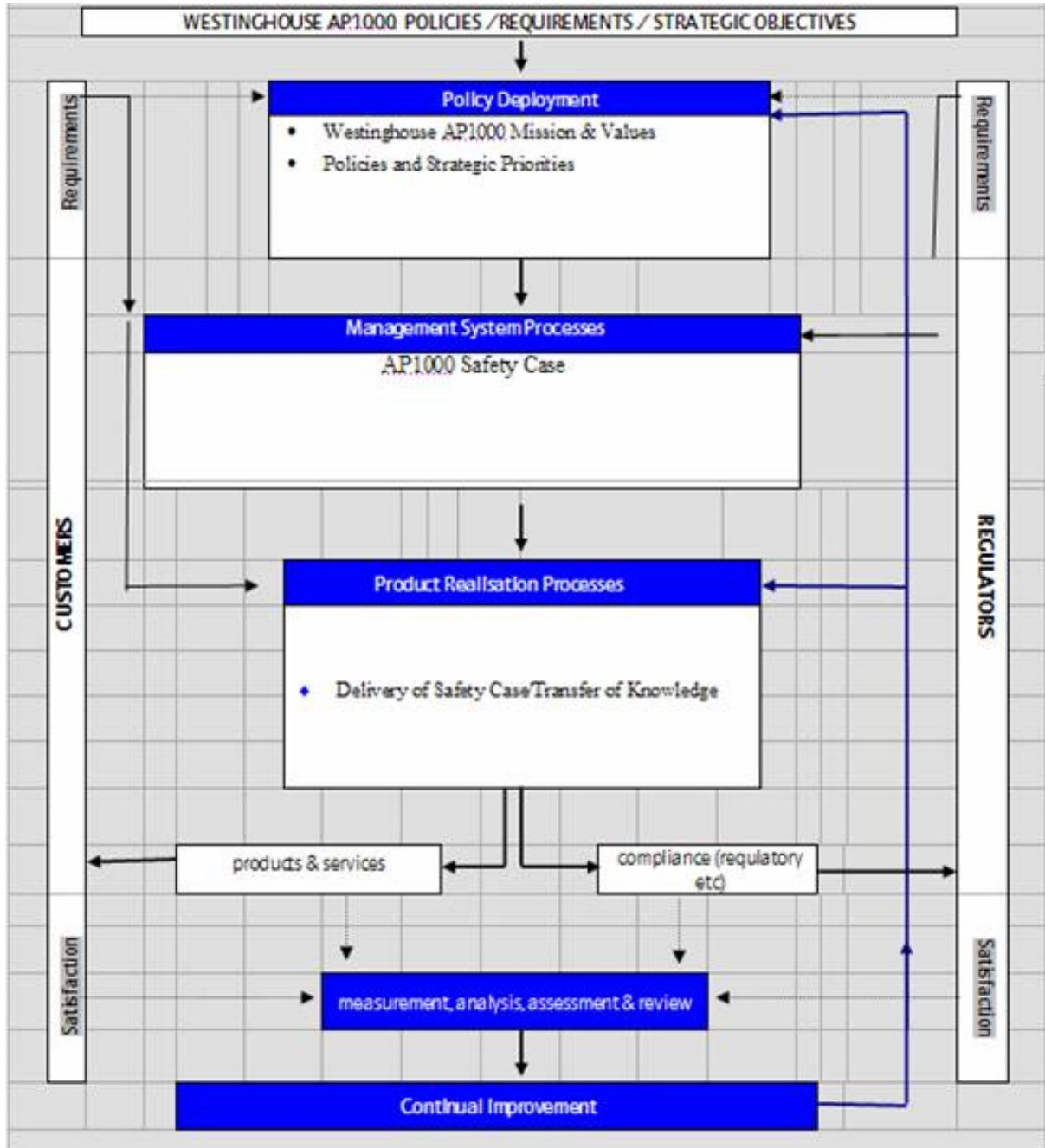
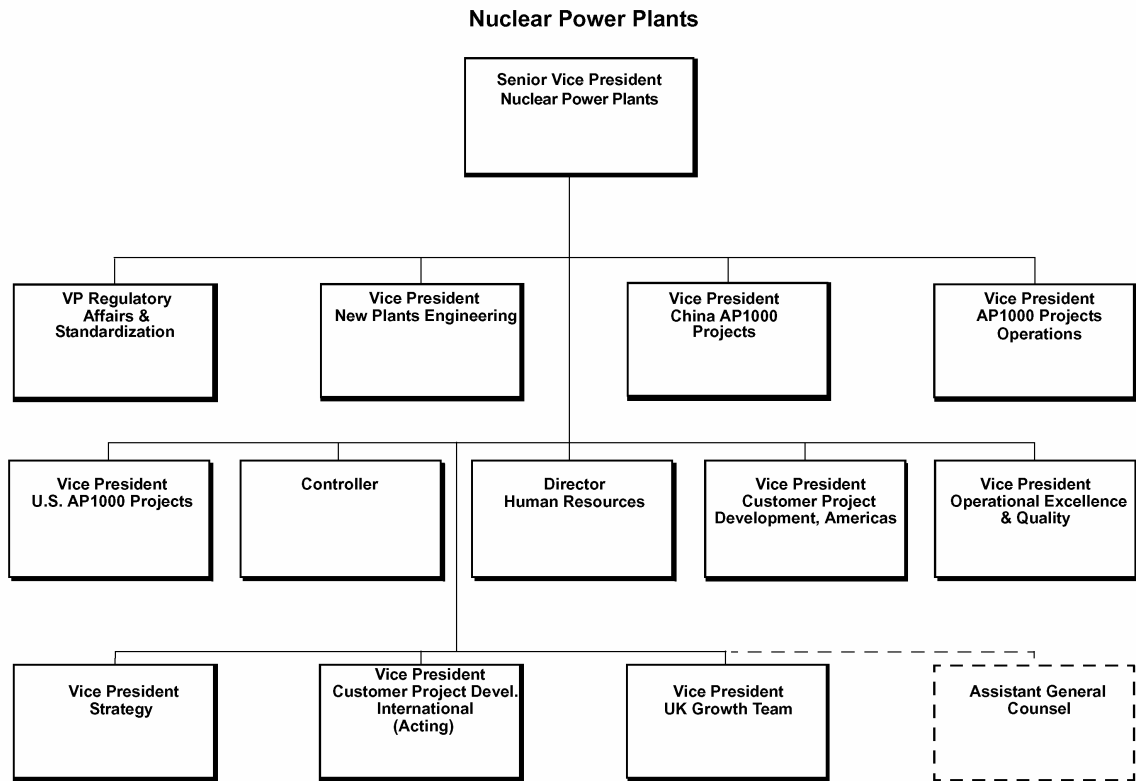


Figure 3-1. Key Process Model



A7e.fm(030309):1

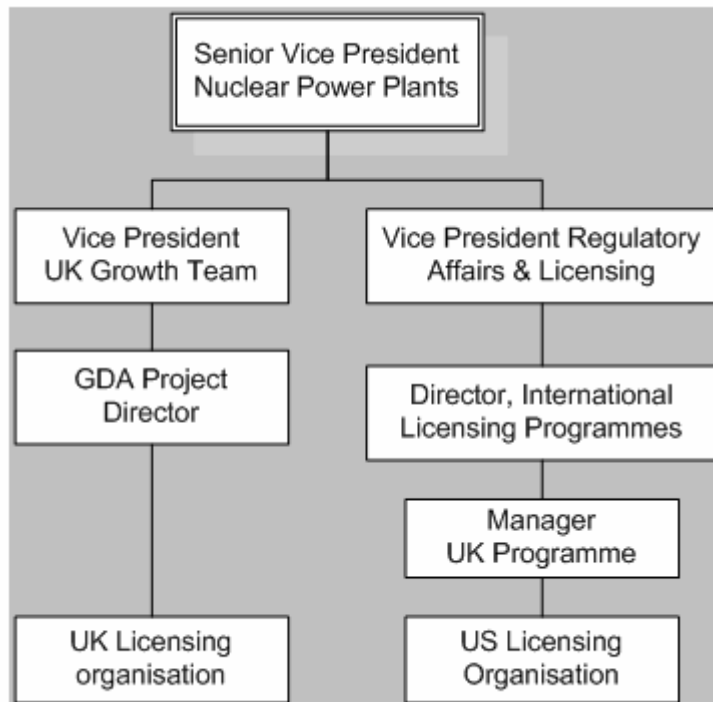


Figure 3-2. Organisational Structure

4.0 CONCEPT OF KNOWLEDGE TRANSFER

The Westinghouse Environmental, Health and Safety Manual [Reference 9] follows the guidance given in “Successful Health and Safety Management” [Reference 12] and outlines the key principles of a good management system as follows:

- Statement of vision and principles
- Definition of the organisation to implement the EH&S Management System, giving key responsibilities
- Means of planning and implementing the EH&S Management System
- Monitoring the resultant performance through audit
- Reviewing the system based on lessons learned and new requirements

These policies, objectives, plans and requirements are implemented through leadership and communications control and supervision, training, procedures and instructions, detailed project plans, measures of performance, and the monitoring and review of the above.

As part of an effective QMS, senior managers will be actively involved in promoting an appropriate safety culture and behavioural skills. Thus, they will be expected to carry out behavioural safety observations, participate in employee briefs, and participate in safety workshops and event investigations. Such systems are discussed further in Section 11.

To aid this knowledge transfer a key point will be clear interface arrangements between Westinghouse and the Licensee. The above principles will be applied to the transfer of knowledge to the potential Licensees including the understanding of the following:

- Design
- Procedures to be used during the procurement and construction phases
- Procedures for normal operation, emergency and accident management
- Procedures required during the installation and commissioning phases
- Safe operating envelope and the operating regime to maintain the integrity of that envelope
- Technical specifications
- Operating Instructions including Commissioning Schedules
- Maintenance schedule
- Training requirements
- Emergency preparedness
- Radiological protection arrangements for the operators

- Safety case documentation – To this end, the potential Licensees have been and will continue to be included in the procedure for the identification of required safety case documentation, preparation of the scope of any identified documents, and the review of the documents. This procedure is given in Reference 10.
- Review of safety documentation – During the GDA process, if there is the requirement to update safety case documentation, that can impact the Utilities PCSR then the potential Licensees will be part of that review process. In moving to an operational regime, the safety case will be owned by the Licensee and an operational safety case will be required. WEC will offer support to the Licensees if required so to do. The safety documentation is discussed in Section 5.

A key aspect of the handover is how the transfer of the knowledge will occur. The aim of the process is to ensure that the potential Licensees meet the requirements of an Intelligent Customer as defined in Reference 11 as follows:

The capability of the organisation to have a clear understanding and knowledge of the product or service being supplied.

To aid the transfer of knowledge from WEC to potential operating organisations (who will be the Licensees), the AP1000 GDA Submission Steering Committee (AGSSC) has been established and one of the potential Operating Organisations chairs the group. The Terms of Reference of this group are given in Attachment 2. The Terms of Reference (ToR) are reviewed on a regular basis to ensure they remain valid. The membership of the AGSSC comprises potential Licensees, Westinghouse licensing personnel and, when appropriate, associated contractors.

The guidance on the requirements for an Intelligent Customer is provided in Reference 11. The aim of the knowledge transfer process is to ensure that the potential Licensee has the capability to secure and maintain the safety of the facility and that, where necessary, the Licensee has the wherewithal to perform as an Intelligent Customer when using contractors to assist in matters relating to the safety case. While it is appreciated that potential Licensees are required to demonstrate their arrangements for compliance to the requirements of the Site Licence, sufficient information should be available to enable those organisations to enact their arrangements. Indeed, potential Licensees will have to demonstrate the following to the regulatory authorities:

- An adequate Safety Management System
- Suitable arrangements in place to be a Licensee
- Suitable resources to discharge the obligations associated with operating a nuclear site.

Thus, Westinghouse will expect to be integrated into these systems and Westinghouse's arrangements, which will meet the Licensees requirements, will be aligned with those of the Licensee. This will aid knowledge transfer during the licensing process and later into the various project phases. The first and foremost important principle to be adhered to in any interaction of the Westinghouse and Licensees management arrangements is that the Licensee is demonstrably responsible for the safety and environmental protection on site. Within the Licensee's control, effective organisation, adequate leadership and personnel competence arrangements should be in place. The Licensee's management arrangements should also clearly demonstrate that responsibility for safety and the environment in all respects is driven from the top of the organisation downwards.

On a contractual basis, Westinghouse will support the Licensee to ensure that knowledge of aspects of the design which affect each of these topics is transmitted in an effective and appropriate way and assurance is visible that this has been achieved. Thus any contract between Westinghouse and a prospective Licensee is expected to define the tasks and the interrelation between the organisations. The management arrangements and the related communication processes between the Licensee and Westinghouse have to be agreed within this framework.

Essentially the Licensee not only has to have suitable arrangements in place, they also have to demonstrate compliance to those arrangements; demonstrate that they adequately control and supervise all activities where safety may be affected, including being capable of exerting proper controls of the activities of contractors and, when appropriate, they have sufficient knowledge to demonstrate they can act as Intelligent Customers.

Whilst it is expected that the Licensees will demonstrate compliance to all of the 36 Licence Conditions there are certain Licence conditions which require arrangements to be made. These are:

- Marking of the site Boundary
- Restrictions on Nuclear Matter on Site
- Documents, Records, authorities and Certificates
- Incidents on Site
- Training
- Emergency Arrangements
- Duly Authorised Persons and other Suitably Qualified and Experienced Persons
- Safety Documentation
- Periodic Review
- Quality assurance
- Radiological Protection
- Construction and Installation of New Plant
- Modification to Design of Plant under Construction
- Commissioning
- Modification or Experiment on Existing Plant
- Operating Instructions
- Examination, Inspection, Maintenance and Testing
- Accumulation of Radioactive Waste

- Decommissioning
- Control of Organisational Change.

Key areas where it will be ensured sufficient information has been made available, transferred, and understanding tested is in the appointment of Duly Authorised Persons (DAPS) and Suitably Qualified and Experienced Persons (SQEPs). These appointments made by the Licensee are required specifically by the Licence Conditions relating to commissioning, control, and supervision of all operations affecting safety, including examination, inspection, maintenance and testing of safety equipment. Indeed as part of the Licensee's overall knowledge management, it is expected that the Licensee will develop training material and in-house assessment capability, as well as developing knowledge on an individual basis. These aspects are discussed in the appropriate Sections of the LCSR. The above requirements will be addressed by the Licensee through its Safety Management Prospectus, which is a fundamental element of the licensing requirements. The expectations of the purpose and content of the Licensees Safety Management Prospectus is given in Reference 42

As previously mentioned, the AGSSC is established during Phase 1 of the GDA process. Part of the knowledge-sharing process has been to establish a system (currently an eroom) which is accessible to the members of the AGSSC. The minutes of meetings, document schedule, suite of safety documentation presented to the Joint Projects Office, technical queries or regulatory observations raised by the Nuclear Directorate/Environment Agency (ND/EA) along with their associated responses, and correspondence to and from the ND/EA with Westinghouse are contained in the eroom. One aspect of the ToR of the AGSSC is that the AGSSC representatives will have sufficient expertise to advise Westinghouse about the safety of the AP1000 design and its safety documentation. Thus, the knowledge transfer process has commenced and will continue throughout the Licensing Phase of the UK AP1000 project and through the construction, commissioning, and operational phases of the project. This is discussed further in Section 9.

A key element of the knowledge transfer is to train personnel of potential Licensees and ensure any learning gained from the construction and operation of other AP1000 plants worldwide. This is discussed further in Section 11.3.

Overall the arrangements for knowledge transfer will be defined and discussed in detail with the prospective Licensees and the process developed throughout the various project phases leading up to and beyond the start of operation. These will include, but not be limited to:

- Programme and processes (GDA, for construction, for operation)
- Understanding of the safety case
- Technical knowledge of the plant systems, staffing and required competences
- Arrangements for training and competence retention
- Arrangements for experience feedback.

In addition, one key aspect of a good Licensee is the capability of knowledge management and knowledge preservation. In Reference 11, it mentions that the IAEA Knowledge Management Glossary defines knowledge management as follows:

An integrated, systematic approach to identifying, acquiring, transforming, developing, disseminating, using, sharing and preserving knowledge, relevant to achieving specified objectives. Knowledge Management helps an organisation to gain insight and understanding from its own experience. Specific activities in knowledge management help the organisation to better acquire, store and utilise knowledge.

Similarly, knowledge preservation is defined as follows:

A process of maintaining an organisational system of knowledge and capabilities that preserves and stores perceptions, actions and experiences over time and secures the possibility of recall for the future.

To this end, Westinghouse has mature processes for the management and preservation of knowledge relating to design development of the AP1000. The division of document retention will align with the requirements for Design Authority. However the Licensee will define which documents are to be retained to meet its License obligations.

4.1 Design Authority

Reference 13 (INSAG -19) discusses the issue of maintaining integrity of design of a nuclear power plant over its lifetime to achieve a continuous high level of safety. It is recognized that:

- The Westinghouse structure required to support the plant and the staff of the design facility is expected to change during the plants lifetime.
- Failure to ensure that unless full knowledge of the plant design is maintained, and any changes are managed, the risk of a potential incident may be increased over the lifetime of the plant. This may be due to unintentional consequences of implementing changes which affect plant safety.
- Potential Licensees will have to establish a process to maintain design integrity which will be largely dependent upon the contractual arrangements between the Licensee and Westinghouse.

Section 6 discusses the design change control process which has been established by Westinghouse and implemented throughout the development of the AP1000.

During the design, construction, and commissioning phases of the plant, Westinghouse will be the Design Authority. However, at a suitable point, this role will be handed over to the Licensee, and Westinghouse will become the Responsible Designer essentially as described in Reference 13, albeit that Westinghouse will provide support to the Licensee until agreed otherwise. Formal procedures will be established between Westinghouse and the Licensees to define the responsibilities throughout the development of the AP1000 design, procurement, construction, installation, and commissioning phases.

It is appreciated that during the design and construction phases when Westinghouse is the design authority, some elements may be assigned to other responsible designers. However, the responsibility of the overall design integrity will remain with Westinghouse, which has sufficient in-house knowledge to understand the impact of work contracted out. The formal arrangements will be part of the QMS. It is appreciated that the Licensee will also be required to have suitable arrangements to maintain design integrity and once the Site Licence has been granted any changes will be carried out in accordance with the Licensee's arrangements for making modifications, under Licence Condition 20. The future Licensee is likely to be part of

the Pressurised Water Reactors Owners Group, which provides a focus for information, services, and development programmes from which the owners and Licensees of AP1000 plants can benefit.

5.0 DOCUMENTATION

The safety assessment process is described in Section 5 of the PCSR [Reference 8]. The PCSR and the associated documentation as shown in Figure 1-1 are owned by Westinghouse. However, during Phase 2 of the GDA process, the potential Licensee will be required to produce its own safety documentation, using the relevant AP1000 safety case documentation.

The role of the Design Authority has been addressed above in Section 4, and, therefore, the potential Licensee will have, via formal arrangements, access to relevant information on the design. Safety case documentation produced to date has been shown to meet Westinghouse safety criteria and guidance provided in the Safety Assessment Principles [Reference 14]. Westinghouse has demonstrated that the risks have been reduced to as low as reasonably practicable (ALARP), as discussed in Section 8 of the PCSR [Reference 8]. The demonstration of meeting the safety criteria is provided within the various safety case reports submitted to the ND/EA. As mentioned, the safety case documentation will have to be owned by the future Licensees and, thus, meets their own safety criteria. To ensure that there is no conflict, all the Westinghouse safety case documentation, produced for the GDA process, has been and will continue to be provided to the member organisations of the AGSSC for review prior to submission to the ND/EA. Thus, any potential differences in safety criteria should have been resolved.

The safety case is one of the important ways to demonstrate that the safety is being properly managed. It is also considered important that the safety case is suitably maintained and that the principles of configuration management are suitably implemented. For the purposes of the safety case submission for the GDA process there is a design reference point for the AP1000 at the end of Step 3 of the GDA process. It is also considered important that a record of the safety case, including any changes, is maintained throughout the lifetime of the AP1000 project. Further details in respect of records are provided in Section 9.3.5.

The safety case is considered to be an important tool in the management of safety. It is way of:

- Defining the basis on which the plant has been shown to be safe
- Defining a benchmark against which any proposed changes can be reviewed
- Providing a basis for training and awareness of safety to plant personnel
- Demonstrating that the risks are tolerable and ALARP
- Providing the background to operational requirements
- Justifying the safety of the plant until the next stage of the GDA process and throughout the construction, commissioning and operational phases of the plant.

Throughout the various phases of the AP1000 project the safety case will be reviewed and revised and at each stage will consider the relevant safety, engineering and management information. It is appreciated that the regulatory body may specify regulatory ‘hold points’, beyond which the Licensee may not proceed without regulatory agreement or consent. Westinghouse would expect that the safety case at each stage will demonstrate the safety of the phase prior to commencement. The expected principle phases of the AP1000 project and the purpose of the associated safety reports are provided below starting with the Pre Construction Safety Report.

Pre Construction Safety Report. The purpose of this is to;

- Demonstrate the detailed design proposal will meet the safety objectives prior to non-active construction
- Demonstrate the safety of the non-active construction and installation phase
- To specify the generic safety functions and the design requirements for all safety functions and reference where the designs are, or will be substantiated
- To demonstrate that the plant can be built to an appropriate quality and that it can be operated safely and within the safe operating limits.

Site Specific Pre Construction Safety Report. The main purpose of this is similar to the above, but also to address any site specific issues which weren't specifically covered by the above. This is an important document which will be required by the potential Licensee as part of the licensing phase

Pre Commissioning Safety Report. This may be split into two separate phases of inactive and active commissioning. The purpose of the inactive phase is to:

- Demonstrate that the plant as built will meet the safety criteria and standards set in the PCSR and that it can be operated safely.
- To define the extent of the inactive commissioning and that it will demonstrate the proper functioning of safety systems, procedures and equipment, via safety commissioning schedules.
- To justify the safety during commissioning.

The active phase will:

- Demonstrate that the detailed design proposal will meet the safety objectives prior to active commissioning
- Demonstrate the safety of the active commissioning activities
- confirm the success of the inactive commissioning or the acceptability of any shortfalls
- Define the extent of the active commissioning and that it will demonstrate the proper functioning of safety systems, procedures and equipment, via safety commissioning schedules
- Demonstrate that the plant as built and as commissioned will meet the safety criteria and standards in the PCSR and can be operated safely.
- Demonstrate that there are sufficient and suitable safety measures in place.

Pre Operational Safety Report. The main purpose of this is to confirm the success of the active commissioning or the acceptability of any shortfalls.

Plant Operations Safety Report. The main purpose of which is to demonstrate that the plant , as built and commissioned meets the safety criteria and standards set down in the PCSR and that all necessary pre operational actions have been completed, validated and implemented.

As part of the transfer of information from Westinghouse to the Licensees, any assumptions made in the safety case documentation will be highlighted. These aspects will also form part of the training of Licensee personnel.

Arrangements for future safety case production, approval procedure, independent nuclear safety assessment, and periodic review will be part of the Licensee's own arrangements. However, any required assistance from Westinghouse will be via contractual arrangements.

Further details on Documents and Records Management are provided in Section 9.3.5.

PART 2 PROJECT PHASES**6.0 DESIGN PHASE**

The evolution of the design of the AP1000 is described in detail in the “Safe and Simple: The Genesis and Process of the AP1000 Design” [Reference 15] and has been built on the design philosophy which emphasised safety and simplicity, while recognising the benefits of a standard design to be deployed on multiple sites. This approach of using a standard design was welcomed in the U.S., and this principle of using a standard design is now being applied throughout the world in applications to other regulatory authorities. The design has been kept safe, proven and simple, and throughout its evolution, it has adhered to the principles of ALARP. This philosophy has been applied to the development of the AP1000 from the AP600. Reference 15 outlines the process used in the development of the AP600 and AP1000, detailing the discrete design decisions made, and lists all of the changes made after the design was subject to the change control procedure [Reference 16]. During the evolution of the AP1000 from the AP600, several constraints were imposed including:

- Safety first – maintain large margins to safety limits
- Maintain passive nature of safety functions
- Maintain no operator actions for safety functions for 72 hours
- Maintain use of proven components and technology
- Do not change the plant footprint so that the layout and analysis already completed is kept
- Eliminate design impacts unrelated to power
- Minimise design impacts on the European DCD.

The resultant design became at least ALARP as the AP600, and in some areas, more so.

Westinghouse considers safety early in the design phase of equipment and facilities design. The design review is one of the primary tools to capture plant lifetime nuclear and personnel safety considerations. This is the starting point for Westinghouse to build manufacturing, construction, and operating safety into the plant design. This is outlined in the following:

- A flowchart of the design review process is provided in Figure 6-1.
- The Westinghouse Design Procedure is defined in Reference 17.
- A sample of our design review checklist is provided in Attachment 3.
- Safety in fabrication and construction is highlighted in Section 7 of this report and the appropriate Westinghouse Level II quality assurance procedures will be applied.

Design reviews are conducted at appropriate stages of design development to provide an objective overview of design adequacy, safety, performance, and cost. Design reviews are performed when:

- A design is inadequate and its failure could result in significant risk to public safety, environment, worker health, company financial exposure, or customer satisfaction.
- The design is a significant departure or extrapolation from a past proven design or analytical methodology.
- The physical configuration is similar to proven designs, but there are potentially significant changes in application or acceptance criteria.
- The design involves significant changes to power plant operations, processes, or systems.
- A customer or regulatory body stipulates a requirement. (For any changes that may have an impact on safety, independent reviews will be performed by individuals or multidisciplinary review teams.)
- A new design concept not currently employed on this project.

Sufficient time must be provided in the design plan to ensure that adequate reviews are performed, and action items are resolved satisfactorily before the design or design change is released.

Design reviews address the following as applicable:

- Correct selection of design input
- Correct incorporation of design inputs into the design
- Specification of design input and verification requirements for interfacing organizations
- Adequate identification, description, and reasonableness of assumptions
- Appropriateness of design methods
- Reasonableness of design output compared to design input
- Adequacy of critical fits and clearances and, when applicable, plant construction and equipment installation

The current safety case is made against the design provided in the European DCD [Reference 2] and the documents which comprise the design reference point at the end of Step 3 of the GDA process. Changes made to the design will be subject to the design control process [Reference 16]. Thus, future revisions of the safety case either by Westinghouse or the potential Licensees can incorporate such changes. The Licensee will have to have its own arrangements to demonstrate how that process will take place once they take ownership of the safety case. Specifically following the design acceptance by ND/EA any changes to the design will have to be accepted by the potential Licensee, through their acceptance process, up to the point where a Site License is granted. Any resultant changes will be in accordance with the Licensee's arrangements for LC 20.

Changes that are introduced to the design by Westinghouse during the construction or commissioning phases will be subject to the Westinghouse design control procedure [Reference 16], and this information will be provided to the Licensee, who can then ensure that its arrangements are followed. However the Licensee is expected to have an acceptance procedure before any changes that could affect safety or the environment are put into effect. The relationship between Westinghouse and the Licensee will require Westinghouse to provide any information and support to the Licensee to enable him to make informed decisions and to be able to present the case for change knowledgeably to the regulators. In this case clear and effective lines of communication are to be defined.

The Licensee will take full responsibility for ensuring that Westinghouse is fully informed as to all the aspects of safety or environmental significance of any work that Westinghouse may be requested to carry out in this context, and this is expected to be fully incorporated into the Licensee's Management arrangements.

Following the granting of a Site Licence the Licensee will have the option to assess the impact of any changes to be carried out by contractual arrangements with WEC, another third party or by the Licensee's own in-house design and safety team as discussed under the role of the Design Authority in Section 4. If it is out-sourced, the Licensee will demonstrate that it has suitable Intelligent Customer capability to:

- Generate the detailed specification,
- Assess the potential impact on the safety case,
- Define where suitable expertise may lie, that is, who is SQEP to contract the work performed,
- Ensure that the appropriate methodology has been applied to any changes to the safety case,
- Have the knowledge to review the response,
- Lead the presentation of the safety case arguments to the regulator, and
- Implement the change, safely looking at any hazards which may arise from the incorrect installation of that change.

Westinghouse will assist the Licensee in attaining such knowledge, and developing suitable capability is addressed in Sections 4.0 and 9.3.

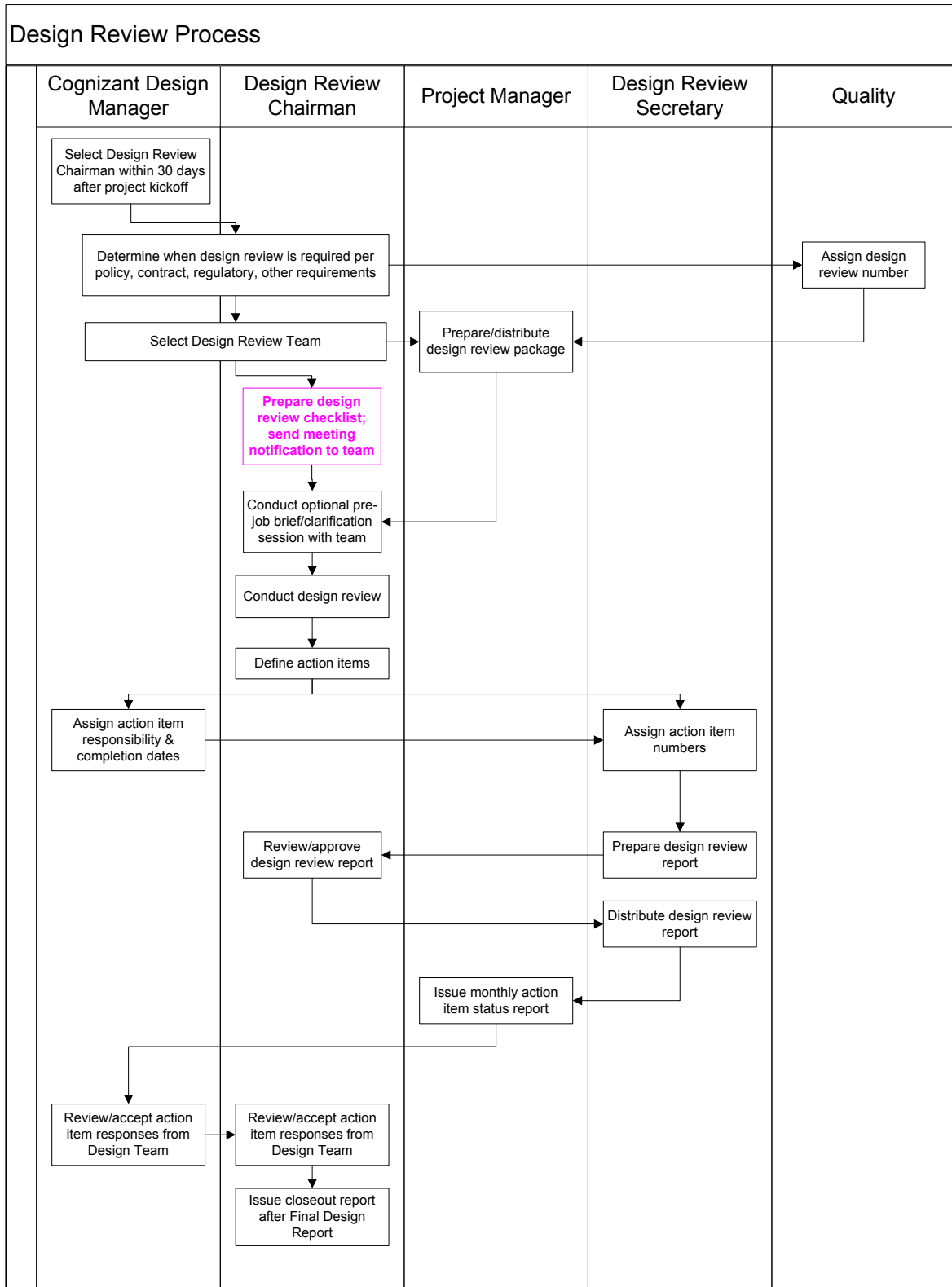


Figure 6-1. Design Review Process Flowchart

7.0 CONSTRUCTION PHASE

During the construction phase responsibility for safety and the environment will rest with the Licensee. Their arrangements will ensure that they are fully compliant to the Construction (Design and Management) Regulations (Reference 5). In this respect the Licensee will determine the extent of work responsibility that they wish to impart to Westinghouse and other contractors. As a minimum, the Licensee will ensure that both Westinghouse's and the Licensee's management arrangements permit access to the relevant Westinghouse knowledge and support necessary to ensure safety and environmental protection on site during construction and subsequent commissioning and operation of the plant. Throughout the construction phase Westinghouse will work closely with the Licensee to provide all the necessary technical information to enable the development of the safety case documentation. Westinghouse's construction arrangements will align with and be delivered under the Licensee's arrangements. These will also need to be confirmed as acceptable by the Licensee that they meet the expectations of the UK Regulators. These aspects are developed in more detail below.

The key elements of the Environment, Health, and Safety Programme for construction of the AP1000 are shown schematically in Figure 7-1 and listed below:

- EHS policies, procedures and practices – outlined in Section 3.0
- Project-specific site safety manual – outlined in Section 11.0
- Project Site EHS Manager – who will be appointed
- Safety policy and procedures – as outlined in Section 9.3
- Risk assessments – outlined in Section 11.0
- On-site welfare facilities – discussed in Section 11.0
- Elimination of hazards during the design process – This is a fundamental engineering principle of the SAPs [Reference 14] and has been applied throughout the development of the AP1000, as discussed in Reference 15 and Chapter 6 of the European DCD [Reference 2].
- Safety awareness campaign – outlined in Section 11.0
- General safety training – outlined in Section 9.4
- Required use of PPE – outlined in Sections 9.3.4 and 11.7
- Job assignment specific training – outlined in Section 9.4
- Site inspection and oversight – outlined in Section 11.0
- Investigation of accidents and corrective actions – as outlined in Section 11.3

7.1 Advanced Construction Techniques

The AP1000 was designed to use advanced construction techniques that help improve safety and site activities. Examples of advanced construction methods used include the following:

- Use of shop pipe bending techniques for large pipe to minimise the need for butt welded elbow fittings
- Vertical installation and placement of equipment and large modules with large capacity cranes
- Maximum use of automatic welding
- Pretesting of modules, subsections, and equipment assemblies in factory environments prior to installation in the field
- Composite steel and concrete structures which minimise the need for temporary shoring and use the permanent steel forming
- Flat wall attachment embedments for support of structural beams from concrete walls in lieu of blockouts
- Preassembled reinforcing steel curtains for wall panels, columns, and foundation slabs
- Prime and finish paint structural and support steel prior to erection
- Jump forming or slipforming concrete where practical

7.2 Modular Construction

The AP1000 has been designed to maximise the safety, schedule, and economic benefits that can be obtained through use of modular construction techniques. Consideration is given to whether the module will be fabricated entirely in an offsite shop, fabricated in major elements offsite with final assembly at an onsite shop or laydown area, or fabricated entirely on site in a module assembly area. One objective of the modular construction concept is that the construction work can be performed in clean, well-lit facilities that are not impacted by weather conditions. This reduces the potential for accidents associated with conventional construction. Examples of the benefits that have been developed are as follows:

- The design of modules maximises the use of standardized elements and components to simplify the work. The design considers access space provisions for installation and construction fit-up, and for maintenance, operation, and component removal/replacement.
- For complex modules to be supplied by an offsite fabricator, Westinghouse will involve the fabricator in the design process on an advisory basis. Shipping considerations, fabrication tolerances at the module interfaces, and facility accessibility provisions for operations and maintenance will be included. The module sizes consider shipping limitations for weight and clearance as well as the capacity of heavy lift cranes on site.

Details of the Construction Verification Process are provided in Chapter 21 of Reference 2 and discussed further in Section 7.4.

7.3 AP1000 Site Layout

Chapter 1.2 of the European DCD [Reference 2] provides a description of the plant including the design criteria, operating characteristics and safety considerations.

The AP1000 site layout was designed to achieve the following:

- Adequate access and escape routes are available on site to areas which are normally or temporarily manned to facilitate the safe operation or shutdown of the plant.
- Safe escape routes are provided from all plant areas and buildings.
- The layout philosophy is such that any equipment can be readily and safely operated, inspected, and maintained.
- Provisions are made to allow plant equipment to be removed and replaced if necessary without the need for dismantling major portions of the plant, including demolishing of structural components.
- Sufficient laydown and portable accommodation areas enable construction, outage, and maintenance work to be safely carried out.

The basic design and technical characteristics are provided in Section 2 of the PCSR [Reference 8]. As mentioned in subsection 2.4.3a typical layout for a single unit will comprise five principal building structures. Table 7-1 lists the five facilities and their main associated hazards. The aim of this is to assist the Licensee in providing a list of buildings and their associated hazards.

A typical layout is shown in Figure 7-2.

7.4 Construction Schedules and Arrangements

The construction verification process is provided in Chapters 14 and 21 of the European DCD [Reference 2], and is the means to demonstrate that the reviewed and approved, as designed, AP1000 pressurised water reactor (PWR) will reflect the constructed AP1000 Nuclear Power Plant in the United Kingdom. This process will provide assurance that an application, which receives a Design Acceptance approval in the UK, is manufactured and installed in conformance to the approved design. The basis of the Construction Verification Process is discussed in the European DCD [Reference 2].

An equivalence study has been carried out to ensure that any codes and standards used in the above construction verification programme have been demonstrated to be acceptable for use in the UK. This is provided in “AP1000 Equivalence/Maturity Study of U.S. Codes and Standards” [Reference 18].

Westinghouse will ensure that prior to construction and installation adequate arrangements will be made and implemented these will include:

- Ensuring that procedures will be in place to ensure that, insofar as safety can be affected, the construction and installation of the plant is controlled, supervised and carried out by SQEP personnel in accordance with written procedures.
- The roles and responsibilities relevant to the construction and installation of new plant will be defined.
- The relevant safety-related Construction (Design and Management) Regulations [Reference 5] appointments will be identified and adequate arrangements will be made and implemented.

- Where other contractors are employed on the construction and installation activities the adequate arrangements will be made to cover the work; for example, QA programmes on the interaction between WEC, the contractor and the Licensee.
- Records of the construction, installation and testing undertaken will be retained by WEC and, where appropriate, by the Licensee for retention in accordance with the Licensee arrangements.

Any construction activities undertaken on the Licenced site will be in accordance with the Licensee arrangements. It is appreciated that the Licensee will assess contractor's arrangements, including those of Westinghouse. Where necessary modifications may be made to Westinghouse's arrangements to demonstrate acceptance by the Licensee.

Part of the above process will involve the production of a construction and installation schedule in accordance with the arrangements outlined above.

The overall objective of the test programme provided in Chapter 14 of the European DCD [Reference 2] is to demonstrate that the plant has been constructed as designed; the systems perform consistent with the plant design; and activities culminating in operation at full Licensed power, including initial fuel load, initial criticality, and power ascension, are performed in a controlled and safe manner. Part of this is provided below and in Section 8.

7.4.1 Verification Testing

Plant nuclear safety begins well before the plant is completed for operation. During the design process, systems are designed and optimised to provide the highest degree of nuclear safety. Westinghouse will implement its applicable Level 2 procedures during these phases, a list of which are provided in Reference 7.. Equipment and construction specifications are developed to describe construction details, such as how welding should be properly performed and the necessary inspections and tests to ensure the quality of the welding. Principal design criteria establish the necessary design, fabrication, construction, testing, and performance requirements for structures, systems, and components important to safety; that is, structures, systems, and components that provide assurance that the power plant can be operated without undue risk to the health and safety of the public.

In the U.S., the safety of the nuclear plant is first governed by compliance with regulatory criteria and established industry standards. The design process then proceeds following approved engineering practices and procedures using verified computer codes and test information. From the design activities, items for verification of the design are logged. It is appreciated that in the United Kingdom there is a permissioning regime. To ensure that the design and construction processes are applicable in the United Kingdom, an equivalence study has been carried out to demonstrate that such codes and standards are acceptable. In addition, based on equipment safety classifications, required tests based on accepted code guidelines, such as American Society of Mechanical Engineers (ASME) and Institute of Electrical & Electronics Engineers, Inc. (IEEE), are adopted. The acceptance of the use of the IEEE guidance is currently under discussion with the ND/EA. Finally, during the design process, detailed testing and inspection programmes are developed using test specifications and test procedures.

The relationships of requirements for the verification test programme, which has been derived in the U.S. and will be the basis for the UK nuclear plant construction programme, are provided in Figure 7-3.

Further information on the Construction and Installation testing is provided in Section 8.2.1.

Table 7-1

FIVE PRINCIPAL BUILDING STRUCTURES AND ASSOCIATED HAZARDS

Building Title	Key Operations	Hazards
Nuclear Island	Fuel storage and handling; Steam Generators Reactor coolant pumps Reactor vessel pressuriser	Radiological Chemotoxic Fire Environmental
Turbine Building		Fire
Annex	Health Physics Operations	Fire Radiological
Diesel Generator	Two diesel generators	Fire Environmental Chemotoxic Missile (Conventional safety)
Radwaste	Handling and storage of plant wastes	Radiological Fire Environmental

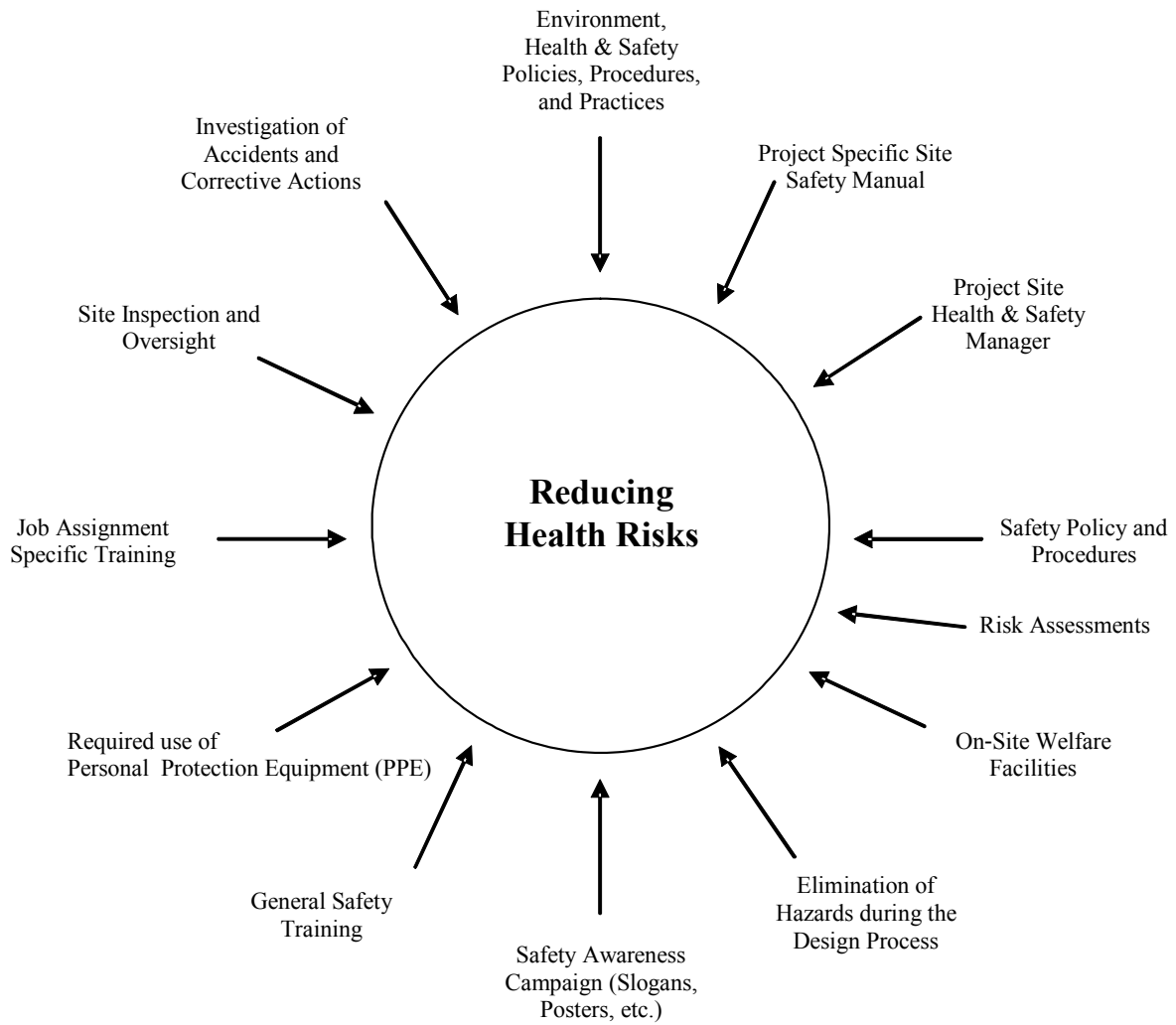


Figure 7-1. Key Elements of Environment, Health, and Safety Programme for Construction of AP1000

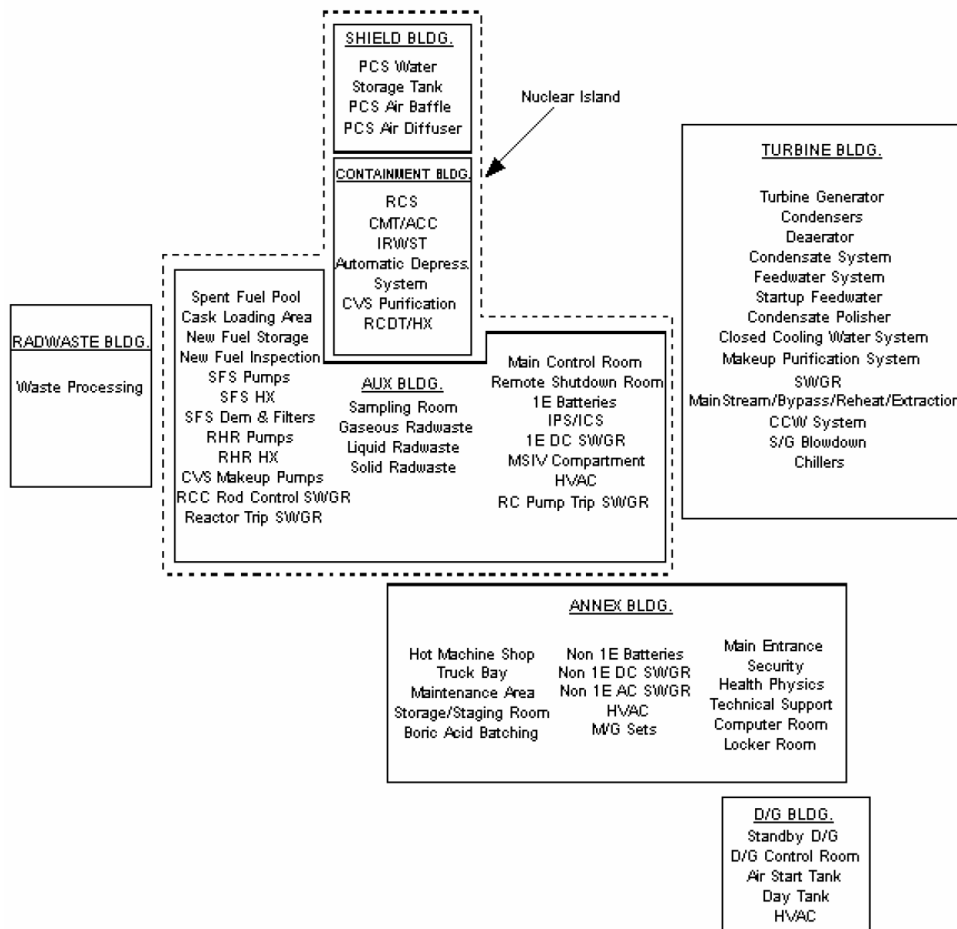


Figure 7-2. Typical Arrangement of Plant Buildings and Associated Key Operations

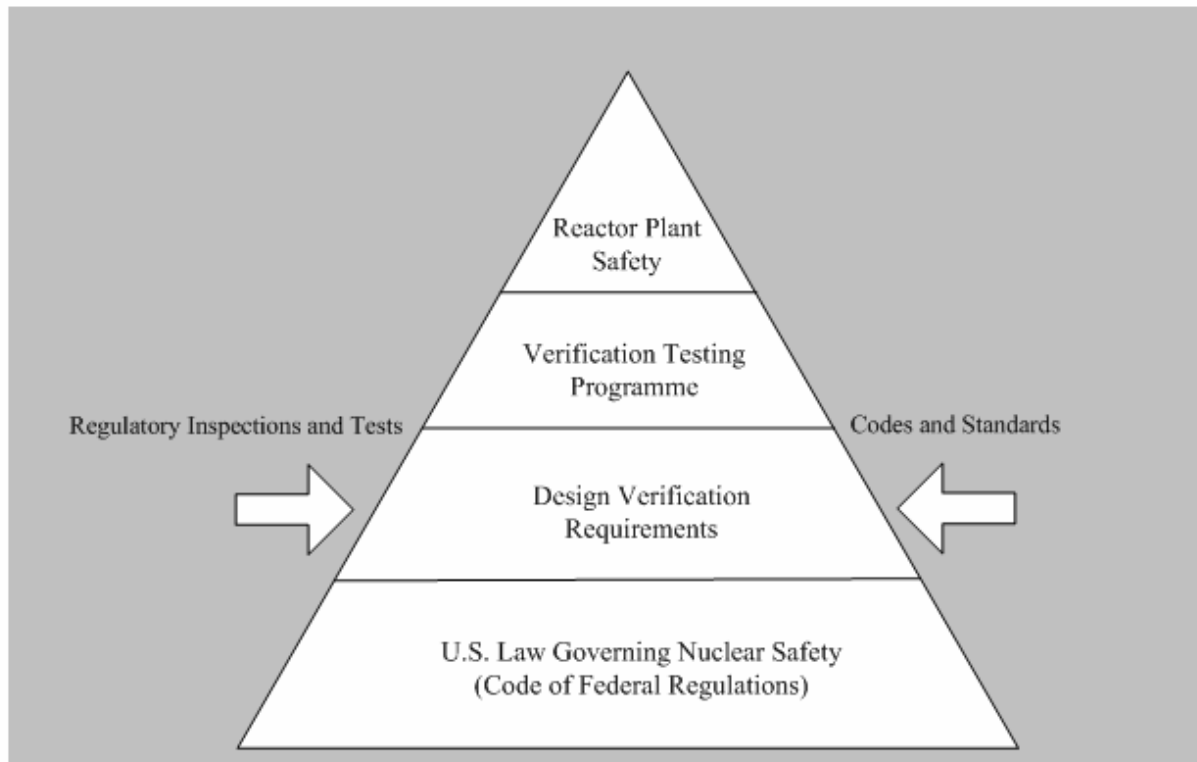


Figure 7-3. Relationship of Construction Test Requirements to Nuclear Safety

8.0 COMMISSIONING PHASE

As for the construction and installation phase, during commissioning the safety of the plant and the environment will rest with the Licensee. Section 10 of the PCSR [Reference 8] discusses how the AP1000 will be commissioned to meet the design intent and comply with the safety case. The commissioning tests will endeavour to identify any errors that may have occurred during the design, manufacture, construction, and installation phases.

8.1 Commissioning Schedules and Arrangements

As for construction and installation, Westinghouse will ensure that prior to commissioning, adequate arrangements are made, implemented and aligned with the Licensee arrangements. The Westinghouse's arrangements need to be confirmed as acceptable by the Licensee and that they meet the expectations of the UK Regulators. These will include:

- Ensuring that procedures will be in place to ensure that, insofar as safety can be affected, the commissioning of the plant is controlled, supervised, and carried out by SQEP personnel in accordance with written procedures.
- The roles and responsibilities relevant to the commissioning of the plant will be identified.
- The relevant safety-related CDM regulations [Reference 5] appointments will be made and implemented.
- Where other contractors are employed on commissioning activities, adequate arrangements will be made to cover the work.
- Records of commissioning undertaken will be retained by Westinghouse and provided to the Licensee.
- Suitable safety-related hold points will be introduced.

In addition, documents to describe the commissioning tests (for example, method statements), will be prepared, authorised and issued as appropriate. Local procedures to cover commissioning requirements, including any handover processes (for example, from construction to commissioning), will be made. Again these arrangements need to be confirmed as acceptable by the Licensee.

8.2 AP1000 Test Programme

The purpose of the tests is designed to demonstrate that the plant and associated safety systems provide suitable and sufficient protection against all potential faults.

The AP1000 verification test programme will be conducted in three phases: construction and installation testing; pre-operational testing; and startup testing; the latter two essentially being the commissioning of the plant. These phases will be aligned with the safety case documentation described in Section 5. It is expected that the Licensee will incorporate suitable hold points into the AP1000 test programme in addition to any hold points required by the regulator. Through contractual arrangements Westinghouse will provide support where applicable to the Licensee in addressing any issues which may arise to clear such hold points. In addition to the code requirements, inspections and tests are defined and established. These

will be included as a part of the plant handover process. Figure 8-1 provides a schematic of the testing programme.

Activities affecting the quality of safety equipment and systems and or services are conducted under the aegis of an approved quality assurance programme, which in the United States is dictated by 10 CFR 50 Appendix B, which also requires NQA-1.

The governing principle for defining the test programme is that a system is considered to be comprised of a number of components, and each component comprises a number of commodities. For all inspections conducted as a part of the installation programme, the inspection documents will define finite acceptance criteria, which are derived from engineering documents. For all testing, the acceptance criteria are finite in that no judgment on the part of the tester is required since the procedure provides definitive acceptance criteria.

8.2.1 Construction and Installation Tests

As mentioned in Section 7.4, construction and installation tests will be performed by SQEP personnel to determine that plant structures, systems, and components have been constructed or installed correctly and are operational. These tests will be identified and included into the construction and installation schedule. Tests in this context include such activities as non-destructive testing and cable termination inspection. The work is generally related to work process control activities; for example, a single weld data sheet identifying fit up, materials weld parameters, and work project schedule with signoffs at the applicable activity entry. (Any such testing onsite will be carried out by DAPS and SQEPs appointed by the Licensee in accordance with the requirements of Licence Condition 12, who may include WEC personnel. In respect of off-site testing and inspection it is expected that the Licensee will put in place suitable arrangements and QA processes which will incorporate the need for SQEP personnel.) Any deviations from or concessions to the design will need approval under the Licensee's arrangements under Licence Condition 20, bearing in mind that Westinghouse has the responsibility for the maintenance of the overall design integrity. There is no judgment involved in the inspection; it either meets pre-defined criteria or not. Personnel carrying out inspections under this programme will be qualified to that programme in accordance with Westinghouse procedures. Generally, they are expected to be quality control inspectors.

Provision will be made for inspection during construction to demonstrate that the required standard of workmanship has been made. Where there is the need for any remedial work to be carried out, this will be managed through Westinghouse change control procedures to ensure that the original design intent is achieved and in accordance with the Licensee's arrangements under Licence Condition 20.

In this programme, various electrical and mechanical tests are performed, including the following:

- Power cable insulation resistance testing
- Control cable point-to-point continuity testing
- Fiberoptic cable time domain reflectometer testing
- Initial equipment run and baseline recording
- Initial energization for switchgear, and the like
- Motor test
- Protection relay test
- Ovation[®] initial energization and cabinet retest
- Ovation[®] input calibration test
- Ovation[®] output test

- AC160 energization and cabinet retest
- AC160 input calibration and test
- AC160 output test
- Piping hydrostatic testing
- Flushing and cleaning

On a system basis, completion of this programme demonstrates that the plant systems are ready for preoperational testing. The findings of the testing will be documented and submitted to the Licensee in accordance with its arrangements and suitable records will be kept in accordance with Westinghouse's procedures which will align with and be delivered under the Licensee's arrangements.

8.2.2 Preoperational Testing

Preoperational testing is performed to demonstrate that equipment and systems perform in accordance with design criteria so that initial fuel loading and subsequent power operation can be safely undertaken. The commissioning in this context is defined as follows

The process during which plant components and systems, having been constructed or modified, are made operational and verified to be in accordance with design assumptions and to have met the appropriate safety criteria.

A programme/procedure detailing the instructions to conduct the tests is used to direct test activities, and to this end, a safety commissioning schedule will be produced. Depending upon the number of stages in the overall commissioning, a safety commissioning schedule and an associated safety commissioning report will be produced at the end of each stage. Such documents will be produced in accordance with the Licensee's arrangements. For preoperational testing (that is, testing at system level) to start, relevant component testing must be completed. Again, testing affecting the quality of safety systems and components is to be conducted in accordance with the requirements of U.S. NRC Regulatory Guide 1.68. [Reference 19] A detailed list of these tests is provided in Chapter 14 of the "AP1000 European Design Control Document" [Reference 2]. Test procedures will be generated from the design documents and requirements and will be approved in accordance with the established QA processes. This information will be part of the information transferred to the Licensee as part of knowledge transfer. Each procedure will include definitive acceptance criteria derived from engineering documents.

Significant systems level tests include the following:

- Secondary hydro

This is an ASME Section III test, which also incorporates some ASME B.31.1 piping. Materials nil ductility limitations require that the water must be heated to ensure the materials are at that temperature. The code requires a visual inspection of every weld.

- Primary hydro

This is an ASME Section III test. The same nil ductility limitations will apply, and the water must be heated, which can be done using the reactor coolant pumps. By definition, the safety valve arrangements are set at least 1.25 times design pressure.

- Hot functional test

For this test, the plant is heated up and operated without nuclear steam, but using the pumps to heat up the circuit. Part of this test is a mandatory reactor coolant pump run, thermal expansion tests, piping and supports, pressurizer shims, and the like. A few other items are included which can be done only with steam or at design temperature. This also includes certain materials passivation requirements.

- Containment vessel structural integrity test (SIT)/integrated leak rate test (ILRT)

These tests are conducted in sequence with the SIT preceding ILRT. The SIT test pressure is higher than that required for ILRT, and thus, this is done first.

The SIT is a code test required by NC 6000 of ASME Section III. The vessel is pumped up in excess of design pressure (this is allowed for an air test) and then after a short holding period at the test pressure, reduced to design pressure for an examination. The examination requires some form of visual inspection (or agreed alternative) for every weld seam while at the design pressure. In addition, part of the examination requires establishing that no permanent deformation has occurred.

The ILRT is the test that establishes the containment integrity as a system. It is also preceded by a local system leak rate test that establishes the integrity of the system through the containment out to the containment isolation valves.

The general objectives of the preoperational test programme are the following:

- Demonstrate that essential plant components and systems, including alarms and indications, meet appropriate criteria based on the design
- Provide documentation of the performance and condition of equipment and systems
- Provide baseline test and operating data on equipment and systems for future use and reference
- Operate equipment for a sufficient period to demonstrate performance
- Demonstrate that plant systems operate on an integrated basis

Plant operating, emergency, and surveillance procedures will be incorporated into the initial test programme procedures. These procedures are verified through use, to the extent practicable, during the preoperational test programme and revised if necessary, prior to fuel loading. This will form part of the Licensee's Operating Instructions acceptance process.

Plant equipment used in the performance of preoperational tests will be operated in accordance with appropriate operating procedures. This gives the plant operating staff an opportunity to gain experience in using these procedures and demonstrating their adequacy prior to plant initial criticality.

8.2.3 Startup Test Programme

The startup test programme begins with initial fuel loading after the preoperational testing has been successfully completed.

Startup tests can be grouped into four broad categories:

- Tests related to initial fuel loading

- Tests performed after initial fuel loading, but prior to initial criticality
- Tests related to initial criticality and those performed at low power (less than 5 percent)
- Tests performed at power levels greater than 5 percent

During performance of the startup test programme, the plant operating staff has the opportunity to obtain practical experience in the use of normal and abnormal operating procedures while the plant progresses through heatup, criticality, and power operations.

The general objectives of the startup test programme are as follows:

- Install the nuclear fuel in the reactor vessel in a controlled and safe manner
- Verify that the reactor core and components, equipment, and systems required for control and shutdown have been assembled according to design and meet specified performance requirements
- Achieve initial criticality and operation at power in a controlled and safe manner
- Verify that the operating characteristics of the reactor core and associated control and protection equipment are consistent with design requirements and accident analysis assumptions
- Obtain the required data and calibrate equipment used to control and protect the plant
- Verify that the plant is operating within the limits imposed by the Technical Specifications as detailed in Chapter 16 of the European DCD [Reference 2]. Further explanation of the Technical Specifications is also provided in Section 11 of the PCSR [Reference 8]

The commissioning will be sequenced so that the plant is never dependent upon untested systems, components or features.

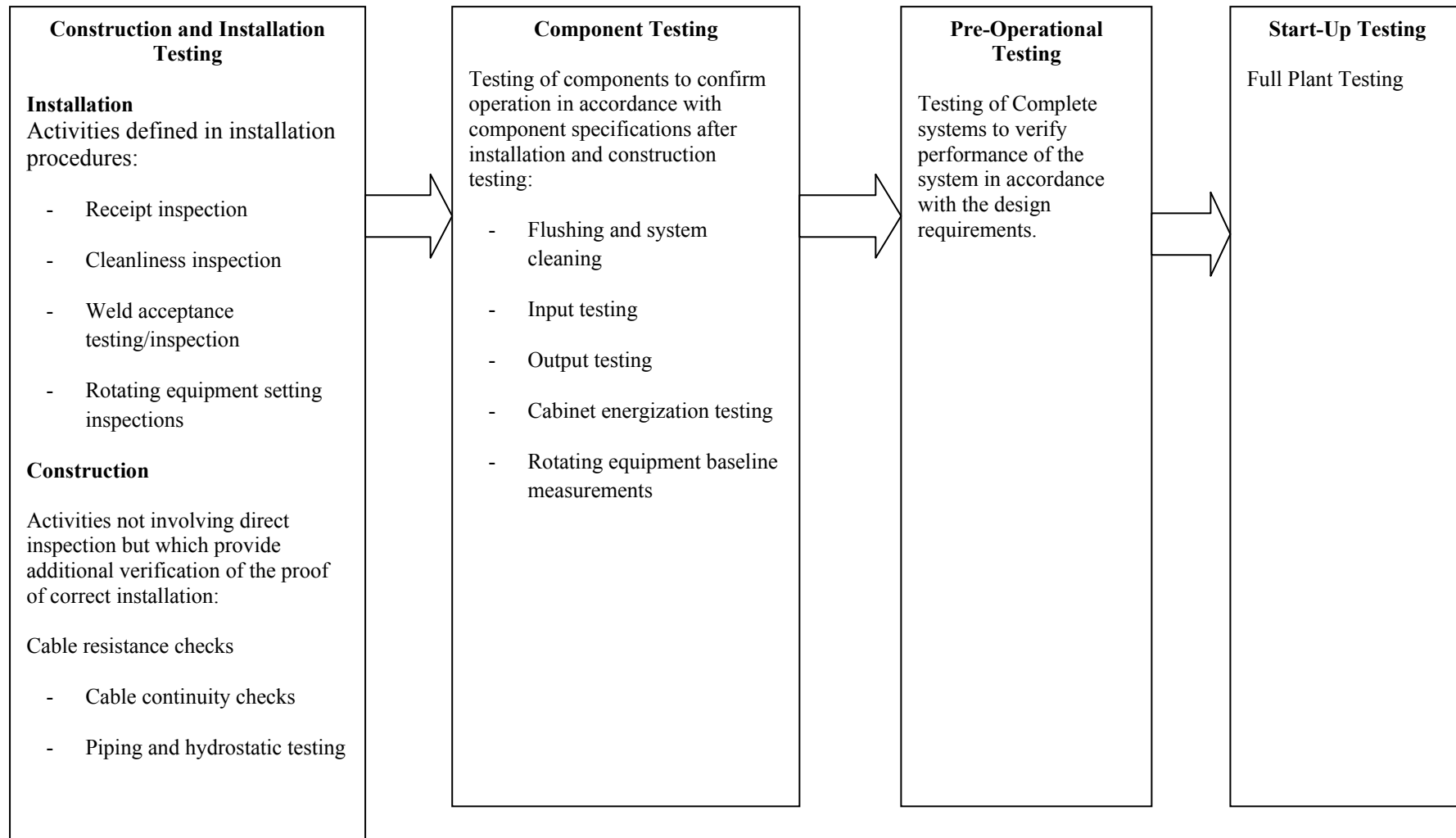


Figure 8-1. Nuclear Installation Testing

9.0 OPERATIONAL PHASE

9.1 Safe Operating Envelope and Operating Regime that Maintains Integrity of Envelope

The safety management during the operation of the plant will be the responsibility of the Licensee within the operating organisation. The primary safety management responsibility of the Licensee is the protection of the public and the operators from harm arising from ionising radiation or other causes. The Licensee will operate and maintain the plant in accordance with the licence granted by the HSE and will comply with relevant UK legislation.

The development of the operating envelope for the AP1000 is discussed in “Safe Operating Envelope and Operating Regime that Maintains Integrity of Envelope” [Reference 20], which provides a description of how the three key documents used in the development of the operating envelope link together. Essentially, a bounding set of postulated fault conditions have been identified and analysed. An associated list of equipment and assumptions has then been translated into plant operating setpoints, taking into account the actual equipment being used. The equipment and setpoints have then been used to generate the plant technical specifications.

Reference 20 provided brief descriptions of each of the documents used in the process, which are Chapters 15 and 16 of Reference 2 and the “Westinghouse Setpoint Methodology for Protection Systems – AP1000” [Reference 21].

These faults have been vigorously presented in the “AP1000 Fault Schedule for the United Kingdom” [Reference 23] whereby each initiating fault has been investigated, and in the diversity of the AP1000 design to mitigate the consequences of each initiating fault and avoiding core damage is illustrated.

The fault schedule lists, for each initiating fault and for each reactor state in which the fault can occur, the protection systems provided to mitigate the consequences of the fault. In each case, safety measures are identified against the postulated fault, and the operating limits and conditions for the relevant equipment, and set points are defined. This is discussed further in Section 5 of the PCSR [Reference 8].

Section 11 of the PCSR [Reference 8] discusses the Operational Management aspects and notes that the Technical Specifications are detailed in Chapter 16 of the European DCD [Reference 2]. The Technical Specifications compile the equipment conditions, signals, and operational requirements from all of the identified accident conditions. Each requirement within the Technical Specifications has two entries:

- The limiting condition for operation (LCO) and
- The surveillance requirements

Each LCO has three parts:

- Applicability, which explains when each LCO must be met
- Specification (addressed by the safety class for the safety system, structure or component)
- Action (what to do if the specification is not met).

Typically, the action is there to provide time to re-establish the specification within the acceptable range and what to do if the specification cannot be re-established. The action may require placing the plant in more secure conditions the longer the specification is not re-established. The importance of human interaction in this area is discussed in more detail in Reference 24 and includes any assumptions. These assumptions will be brought to the attention of the Licensee during the transfer of knowledge and training of the Licensee in the operability of the plant.

The surveillance requirements describe the tests, inspections, and records that require to prove that the specification is met, together with the frequency that a person performs the surveillance. Section 9.2 describes the expectations for the maintenance and outage schedule in more detail.

The AP1000 provides several analyses features:

- Ranges of normal operation
- Alarms
- Procedures
- Protection signals

An explanation of these features and how they interact is provided in “Safe Operating Envelope and Operating Regime that Maintains Integrity of Envelope” [Reference 20] and shown diagrammatically in Figure 9-1. Account is taken from the guidance provided in Reference 25.

These identified operating limits and conditions will be made available to the Licensee to demonstrate what is required to remain within the safe operating envelope. These safety measures can then be incorporated into the Licensee’s own arrangements.

9.2 Maintenance and Outage Schedules

Maintainability was “designed in” by extensive layout reviews by both the AP1000 design team and utility representatives. From the beginning of AP1000 development, the layout was generated in 3D computer-aided engineering (CAE) software. As each item (structure, equipment, pipeline, duct, and tray) was added to the design, it was checked for interferences, inspection access, and maintenance access. These evaluations were performed with utility involvement. Design decisions were made to minimise maintenance time, the need to work from heights and other risks while performing maintenance activities, and the accumulated dose. For the digital instrumentation and control systems in AP1000, self-diagnostics are included.

As mentioned in Section 9.1, the surveillance requirements describe the tests, inspections and records that are required to prove that the specification is met, along with the frequency that a person performs the surveillance.

It is a requirement of the Site Licence Conditions that plant ssc which may affect safety is regularly examined, inspected, maintained and tested as appropriate. While the Site Licence Conditions are aimed specifically at the nuclear and radiological aspects of safety, it is considered prudent to also include equipment related to nuclear, radiological, chemotoxic, environmental, and conventional safety (including fire safety). “Plant which may affect safety” is defined as safety systems, structures and components, with a Safety Class 1 & 2 designation. Arrangements for lesser safety equipment and Class 3 safety systems, structures and components may also be covered.

The safety systems, structures and components, which include the engineered protective systems, are provided to prevent the occurrence of high consequence radiological and non-radiological events to a member of the workforce or the public. They have been identified in Reference 23.

Identified safety systems, structures and components with a Safety Class 1 & 2 designation will be placed onto a maintenance schedule, and the potential Licensee will be provided with this information. Information will also be provided as to what each safety system, structure and component comprises; for example, whether it is a group of lined items, and the like. The maintenance schedule will also provide the test (maintenance) periodicity. Where these have been defined within the safety case, the test periodicity will be set equal or less than this. However, where no such periodicity is assumed, the test (maintenance) periodicities will be based on engineering judgement and at a level which will not compromise the reliability of the equipment. During the initial testing and consequential commissioning of the plant, every examination, inspection, maintenance and test (EIM&T) involving safety systems, structures and components with a Safety Class 1 & 2 designation will be carried out:

- By SQEP personnel, demonstrated via evidence on their training records
- In accordance with suitable written schemes
- Within the time interval specified in the maintenance schedule, and
- Under the control and supervision of a SQEP, appointed for that purpose in accordance with the operating organisations arrangements for Site Licence Condition 12.

Records of any EIM&T will be made and kept by the potential Licensees in accordance with their arrangements. Any such EIM&T undertaken by Westinghouse will be recorded, and the information will be provided to the potential Licensees.

Any additions, deletions and amendments of the safety, significant systems, structures and components and their maintenance details from the maintenance schedule will be carried out by persons authorised to do so in accordance with the Licensee arrangements. Any changes will be in accordance with the Licensee change control procedures with input from Westinghouse when required, and consideration will be given to any impact on the safety analysis. This will include any changes to the test (maintenance) periodicities.

If any failure of the safety systems, structures or components occurs or during any EIM&T on a safety system, structure or component, or a matter is revealed that indicates that a safe operation or condition of the plant may be affected, this event will be notified, recorded, and investigated in accordance with the procedures of Westinghouse and potential Licensees.

In this aspect, the EIM&T will be carried out by a SQEP, the appropriate procedures will be followed, and ALARP the maintenance will be carried out within the defined intervals to the requirements given in the EIM&T schedule.

Westinghouse will identify any EIM&T of equipment which may be undertaken during routine shutdown, albeit that any such operation will be undertaken in accordance with the requirements of the EIM&T schedule and the arrangements of the Licensee in compliance with Site Licence Condition 30 (Periodic Shutdown).

The quality assurance arrangements for the systems, structures and components are part of the QMS. These will be graded depending upon the safety classification, as provided in AP1000 “UK Categorisation and Classification of Safety Systems, Structures and

Components Report” [Reference 40] and in line with the QA Programme as given in Chapter 17 of the European DCD [Reference 2]. In the discussion within the European DCD [Reference 2] on the QA arrangements, several codes and standards are used. An equivalence study has been carried out as part of the GDA submission to demonstrate the applicability of those codes and standards to the United Kingdom. This is provided in Reference 18, “AP1000 Equivalence/ Maturity Study of the U.S. Codes and Standards.

9.3 Organisational Arrangements for Moving to an Operational Regime

9.3.1 Procedures

Operating Instructions

Where appropriate, written instructions will be provided to the Licensee for operations which may affect safety during the installation, construction, commissioning, and operational phases, and will be written, validated and approved by SQEP personnel. More specifically, these focus mainly on the operating instructions, which are necessary to ensure that the conditions and limits identified in the safety case are implemented. Section 11.2 of the PCSR [Reference 8] provides further information relating to the operating instructions, which are vast and very comprehensive (50 volumes in total). Where the instruction controls an activity which presents a potential hazard to safety or the health of personnel, an appropriate risk assessment for that operation will be carried out. This may include a generic risk assessment, a risk assessment specific to the substances being used (“The Control of Substances Hazardous to Health [COSHH] Regulations 1994”) [Reference 26] or portable equipment (“Provision and Use of Workplace Equipment Regulations” [PUWER]) [Reference 27].

Where appropriate and in accordance with the Licensee arrangements, records will be kept to demonstrate that the operating instructions have been followed. It is expected that the Licensee will have a training programme in place to ensure that all personnel who carry out operations covered by operating instructions are competent to do so. Westinghouse will assist in this knowledge transfer process.

Manning Levels

Chapter 13 of the European DCD [Reference 2] provides recommended information relating to the preparation and plans for the operation of the AP1000. The purpose is to provide reasonable assurance that the Licensee will establish and maintain staff of sufficient size and technical competences that reasonable assurance of adequate protection of public health and safety is provided. Westinghouse would expect the Licensee to have suitable arrangements in place to:

- Control any changes to its organizational structure or resources, which may have an impact on safety, carried out in a transparent manner and which look at all aspects of management change.
- Prepare a baseline for the size and structure of the organisation
- Have a process in place for determining the minimum manning levels

Advice will be provided to the Licensee on the minimum manning levels that are considered to be required for the three key states of the plant:

- Number of SQEP personnel required for emergency shutdown from full operation

- Number of SQEP personnel for maintaining the plant in a safe condition post shut down
- Number of SQEP personnel needed for coping with identified accidents from the fault schedule and non-nuclear emergencies

In determining the minimum manning levels, consideration will be given to the following:

- All safety-critical tasks for the above states
- Minimum number of persons required to perform each task, accounting for coincident activities and any potential external interfaces
- Skill levels of the involved personnel
- Any time constraints (for example, tasks undertaken within a given timeframe to ensure that the plant remains inside the safety envelope)
- Lessons learned from previous shutdowns and emergency responses

This should include the level of manning required to respond to an onsite or offsite emergency and will be an input to the Licensee's Emergency requirements.

Where there is reliance upon the services of Westinghouse contracted personnel, the structure of that part of Westinghouse, the authorities, responsibilities and interfaces with the Licensees will be provided, and suitable instructions and procedures will be established.

9.3.2 Training

Personnel who have responsibility for an action which may affect safety have to be adequately trained for that purpose and is a requirement not only of the Site Licence, but also other UK legislation, including "The Ionising Radiations Regulations" (IRRs) [Reference 28] and Management of Health and Safety Regulations [Reference 29].

The Westinghouse EH&S manual [Reference 9] identifies the need to ensure that all people employed on behalf of Westinghouse are suitably qualified (for example, trained) and experienced for the tasks they are to perform. The responsibility of ensuring this lies with their immediate line manager. The appropriate Westinghouse Level II procedures relating to training will also be applied, as provided in Reference 7. With respect of training for all project personnel and any contracted personnel involved in the design, build, testing and commissioning of the AP1000, this is outlined below:

Core Safety Skills Training – Core safety skills training will be conducted for all project personnel. Training presented will be within a classroom environment or computer-based training (CBT). Training will include modules that target specific supervisory/management groups and craft populations. Competency testing will be established and tracked. The type of training which may be undertaken will be:

- New-hire orientation
- Site induction training, including response to emergencies
- Manual handling
- Fire prevention and control
- Emergency first aid
- IOSH working safely
- Environmental protection

- Radiation protection
- Confined spaces
- Working at heights
- Permits to work

Project Learning Centre –Personnel attending new-hire orientation training will also participate in training at a project learning centre. The learning centre training will involve classroom and hands-on exercises that use project simulated work environments to allow students to demonstrate and be tested on their understanding of the key concepts presented. Training developed will include specialized modules catered to individual craft groups, work teams, and management levels. Training presented will include exercises that are designed to challenge students regarding common error traps.

Safety leadership seminars will be presented to all project management and supervisory personnel (non-manual and manual). Key features of our approach include the following:

- Seminars will be specific to the individual leadership group levels and will be designed to present leading safety leadership approaches and will incorporate the experience and knowledge of participants.
- Mentors will be used who will team with participants following the training to enable continued learning and self-assessment in light of fellowship principles presented.
- Periodic followups will occur to assess programme performance, facilitate lessons learned, and encourage leadership growth.
- The requirement will be to carry out frequent safety walks and safety investigations and to engage in safety discussions with personnel responsible for the work.

Arrangements will be in place to:

- Ensure that personnel associated with the AP1000 project in the United Kingdom are adequately trained and have attended the appropriate level of training required by both Westinghouse and the Licensee. This may take the form of generic, site induction, or job specific training.
- Identify a training programme for each group of personnel onsite
- Identify the appropriate timescales for refresher training to ensure and maintain competency
- Maintain records of such training

In addition, Westinghouse will align their training requirements with the arrangements of the Licensee and align the procedure for maintaining appropriate training records with those of the Licensee. Implementation of the above arrangements will ensure that all personnel associated with the construction, installation, and commissioning of the AP1000 will be SQEP.

Where appropriate, Westinghouse will provide training to Licensee personnel in the safe operation and maintenance of the AP1000 to assist the Licensee in accordance with its requirements to ensure that only SQEP personnel perform any duties that may affect safety.

In addition, the Licensee will be expected to identify DAP to either carry out or directly supervise operations of the highest safety significance. If required, Westinghouse will assist in the training of such personnel.

9.3.3 Emergency Procedures and Services

The Westinghouse EH&S Manual [Reference 9] states that all facilities must be operated within their safe operating parameters so that it does not present a hazard to employees, the public, or the environment. In addition, all plants and facilities require an appropriate emergency plan to control and mitigate the impact of unforeseen circumstances. To this end, procedures will be developed to establish an integrated emergency response and crisis management at the project level. The Licensee is responsible for making and implementing emergency arrangements and will ensure that Westinghouse's procedures align. The procedures will ensure suitable consideration has been given to compliance with the "Radiation (Emergency Preparedness and Public Information) Regulations 2001" (REPPPIR) [Reference 30] and COMAH Regulations [Reference 31].

Such procedures will address implementing an effective response to any minor onsite incident ranging through to a major offsite incident. Where appropriate, external bodies whose assistance, co-operation, or services are required to fulfil those arrangements will be consulted during the preparation.

The arrangements will include:

- A requirement for rehearsals of the emergency arrangements to be carried out at suitable intervals. These will include fire, toxic, environmental spill, radiological, and medical emergencies.
- Identification of personnel who have nominated duties to be properly trained
- Provision of appropriate medical facilities
- Provision of appropriate emergency medical response
- Provision of comprehensive instructions to define the actions of required response personnel
- Provision of instruction to visitors as to their expected action

Further information on the regarding Emergency Preparedness is provided in Section 13 of the PCSR [Reference 8] and refers to the need for both an onsite and an offsite Emergency Plan and the emergency response facilities.

9.3.4 Radiological Protection

The AP1000 design incorporates radiation exposure reduction principles to keep the worker and public doses ALARP. Section 12 of the PCSR [Reference 8] discusses the normal operational radiological aspects of the design and operation of the AP1000. It covers the radiation protection principles, radiation sources, design features for radiation protection, and provisions for radiation monitoring. The majority of the supporting analysis and evidence to demonstrate that radiation protection has been adequately considered in the AP1000 design is contained in Reference 2, Section 11 and 12.

As discussed in Section 12 of the PCSR, the management of radiological protection in the United Kingdom is governed by “The Ionising Radiations Regulations 1999” [Reference 28] and its associated Approved Code of Practice. In addition, the Site Licence also requires the Licensee to make and implement adequate arrangements to assess the average effective dose equivalent (including any committed effective dose equivalent) to specified groups of employees and to notify the Nuclear Installations Inspectorate (NII) if the doses exceed the level specified. The Licensee should demonstrate the means of checking the calculation of the average effective dose equivalent, ensuring that no “dilution” of the average has occurred by careful choice of the classes. To this end, distinction will be made between employees of the Licensee and contractors (of which Westinghouse personnel will be one.) While it is the responsibility of the Licensee to provide these arrangements, Westinghouse personnel may also be designated as “Classified Workers.” Thus, in accordance with the requirements of the IRRs [Reference 28], there is a requirement under Regulation 15 to co-operate by the exchange of information. This is also required by Regulation 11 of “The Management of Health and Safety at Work Regulations 1999” [Reference 29].

Thus, Westinghouse will ensure that adequate arrangements are in place to comply with the requirements of the IRRs [Reference 28] and any arrangements of the Licensee.

To this end, Westinghouse will ensure that where appropriate:

- Radiation Protection Advisors and Supervisors have been appointed.
- Suitable local rules are in place.
- Suitable information and training is provided.
- Any exposure to ionising radiation received by classified workers and any other specified persons are assessed by an approved dosimetry service.
- Records of doses are made and kept for all such personnel.
- Provision will be made for the keeping and transport of any sealed sources.
- Suitable PPE will be made available.
- Any personnel receiving excessive doses are reported to the HSE.

9.3.5 Documents and Record Management

The safety case documentation process is outlined in Section 5. The Project Quality Plan for the UK GDA [Reference 7] provides a list of the Westinghouse Project Procedures References in Appendix B, among which are those for Document Control and Quality Assurance Records. Thus, these procedures will be used throughout the GDA process. In addition the Licensee will be required to make adequate records to demonstrate compliance with the conditions attached to the Site Licence. To this end, Westinghouse will ensure that where required, and in addition to the safety documentation, it will retain and/or make available any documents and records associated with the installation, construction, and commissioning of the AP1000 in line with the contractual arrangements and implementation of the Design Authority.

It is appreciated that to align with the requirements of the Site Licence, plant safety documentation is required to be retained for a period of 30 years following the

decommissioning and decontamination of the plant. Thus, arrangements will be made with the Licensee to fulfil these requirements. Where this is not the case, reasoned justification will be made.

In this context, documents are defined as including all paper documents and all electronically stored information. Records are defined as documents retained as evidence for legal, regulatory, business, or stakeholder purposes against a formally approved procedure or instruction.

Where there is the requirement for Westinghouse to retain any documents and records associated with plant safety, suitable arrangements will be made and implemented. These will include an archiving policy.

The Westinghouse document management arrangements are in Level II procedures, Sections 3.5 and 6. A list of all the relevant procedures to be applied throughout the UK AP1000 GDA project is given in Reference 7. This includes an explanation of the Electronic Document Management System, which is the master repository for all records relating to the AP1000. The key features are provided below.

- Suitable storage and ready retrieval of records
- Records are retained for an agreed period and remain readable and retrievable.
- Incorporates adequate emergency procedures and arrangements for the protection of records
- Only authorised persons alter records.
- Where required, documents are marked with the appropriate security markings.

Specific procedures relating to the UK documentation are provided in References 32 and 33.

Once the safety case is transferred to the Licensee, they will implement their own Site Licence arrangements, which will include a Record Schedule listing; for example, the reason for keeping the record, the record title, the record owner, the storage location, the medium for storage, and the retention period.

Typical activities for which records may be made are:

- To demonstrate compliance with the Site Licence Conditions (Conditions LC5, 6,7, 14 and 25 have specific record requirements)
- To demonstrate compliance with regulatory requirements and authorisations
- To demonstrate compliance with any quality requirements.

Typical records may include:

- Records of operation, inspection maintenance of any plant that may affect safety
- Quantity and location of all radioactive materials on the Licensed site
- Record of any nuclear matter consigned off site

9.3.6 Nuclear Material Arrangements

Prior to any active commissioning, as part of the licensing requirements, the Licensee will have to have adequate arrangements in place to ensure that the introduction and storage of any nuclear materials is controlled. If specified by the Executive (that is, the HSE) a Consent will have to be obtained prior to any nuclear matter being brought on to the site. Such arrangements will also have to be in place for the operations with new and spent fuel and radioactive waste. Such arrangements will include ensuring that there is an adequate safety case, suitable records of the nature of the material, and its storage location on plant. Such facilities are expected to have appropriate criticality safety controls in place. This is normally carried out by having criticality certificates in place which detail the safety measures in place to prevent an accidental criticality outside of the reactor core. Where appropriate, the European Atomic Energy Community (EURATOM) will be informed of any imports/exports, and arrangements will be expected to be in place for EURATOM verification. While this is clearly a requirement of the Licensee, Westinghouse will ensure any necessary compliance to these requirements during commissioning activities.

Severe Accident Management Guidance

Severe Accident

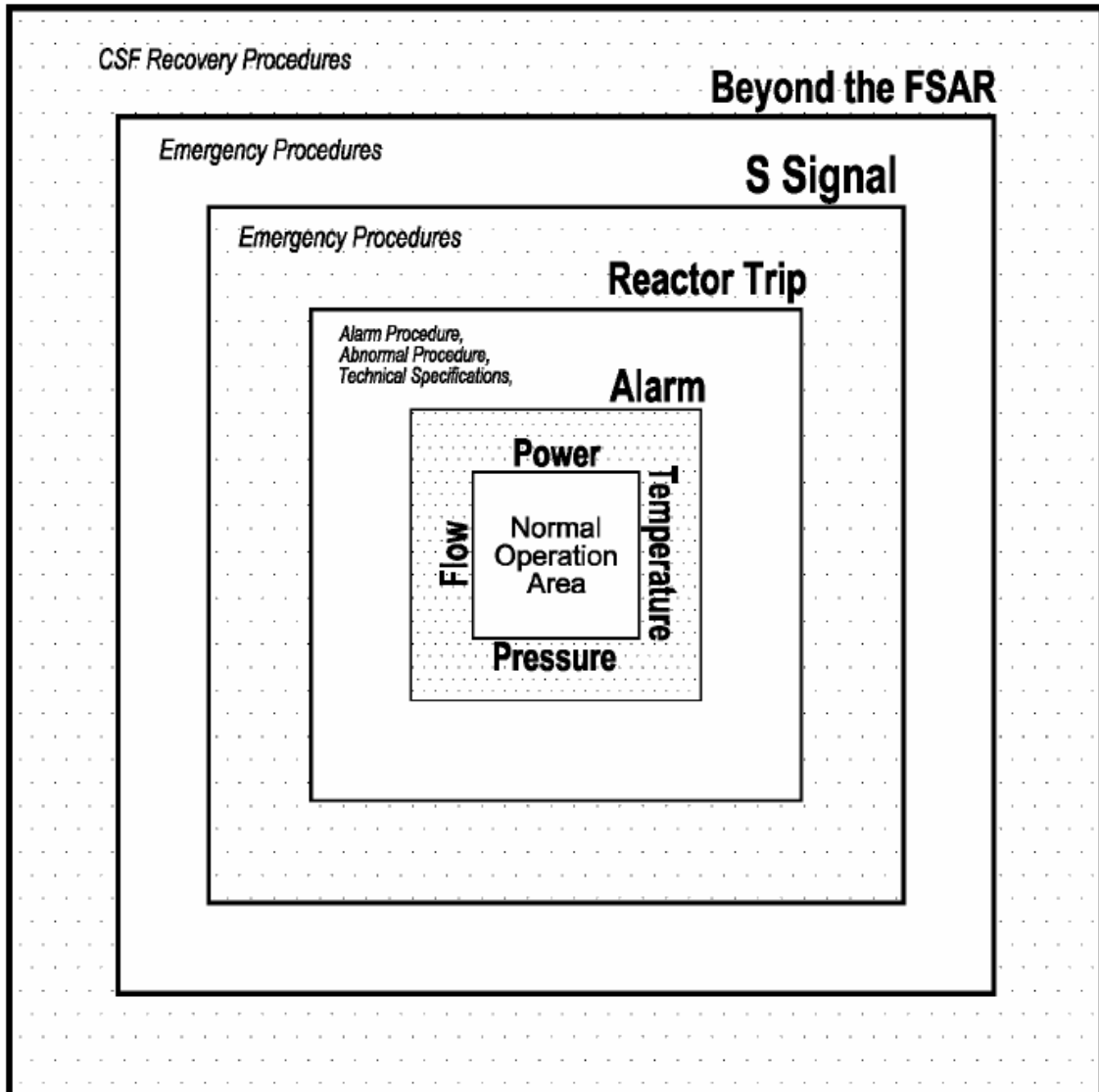


Figure 9-1. Operational Aids

10.0 DECOMMISSIONING

As mentioned in Section 16 of the PCSR [Reference 8] the decommissioning activities to be undertaken for the AP1000 are highlighted. These reference back to the European DCD [Reference 2] Chapter 20 and the “Technical Specification for Decommissioning Strategy for the AP1000 Generic Design Assessment Aker Solutions” [Reference 34]. Thus, any decommissioning will be in line with “Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999” [Reference 35] or any other legislative requirements at the time. Again, the onus will be on the Licensee to make and implement adequate arrangements for the safe decommissioning of any facility. Both the Nuclear Reactors Regulations [Reference 35] and the Site Licence Conditions require the Licensee to obtain consent from the NII prior to commencing any decommissioning unless agreed otherwise, and suitable safety cases must be in place.

Section 16 of the PCSR [Reference 8] outline the proposed staged decommissioning process provided in the European DCD [Reference 2] and the provisions made for safety during the decommissioning process within the design itself, by:

- Making the design simpler and reducing the number of components
- Incorporating features for protection to minimise radiation exposure.
- Incorporating features for protection against spread of contamination
- Incorporating features to facilitate decommissioning

Thus, in the decommissioning strategy, these provisions can be included.

PART 3 HEALTH AND OCCUPATIONAL SAFETY ARRANGEMENTS FOR PROJECT EXECUTION (INSTALLATION/CONSTRUCTION AND COMMISSIONING)

11.0 SITE SAFETY MANUAL

The Site Safety Manual provides the EHS features supplied under the power plant construction contract. Whilst these aspects are not specific to demonstrating the nuclear and environmental safety of the project, it is appreciated that any actions carried out during this stage may have an impact on the overall safety of the plant. Thus it is considered prudent to provide the expectations and standards on the conventional safety that Westinghouse expects to be implemented during the construction phase. The construction scope for the AP1000 will typically be subcontracted by Westinghouse to a competent and experienced in-country or international Architect-Engineer (AE)/Contractor. As part of the selection process for the AE/Contractor, a significant selection discriminator is its safety performance record on similar job sites and the content and application of its EHS Manual.

The AE will develop a site-specific EHS programme to govern all aspects of protecting the environment and the health and safety of project/site employees during construction. The arrangements will have to be acceptable to the Licensee and reflect their requirements.

It is appreciated that as there will be more than one employer present during the construction phase, suitable cooperation and coordination arrangements will be in place, as required by Regulation 11 of “The Management of Health and Safety at Work Regulations 1999” [Reference 29].

Section 4 describes the key features of any good EHS system and performance. It also mentions that active involvement by senior management in encouraging the correct safety culture will be actively encouraged. As part of a good QMS, senior managers will be actively involved in promoting an appropriate culture and behavioural skills. Thus, they will be expected to carry out behavioural safety observations, participate in employee briefs, and participate in safety workshops and event investigations.

The following sections describe the EHS features to be supplied under the power plant construction contract.

11.1 Medical Services

A medical services centre will be established onsite that integrates all project-related medical capabilities including: fitness for duty (FFD), minor injury treatment, occupational testing/evaluations (that is, physicals, pulmonary function tests, and blood tests), physical therapy, and emergency medical response. Project medical services will facilitate timely medical services to project personnel and enhance the short-term/long-term care of injured personnel. Onsite medical personnel will implement medical treatment protocols and recordkeeping. Periodic recordkeeping reviews will be undertaken that will incorporate matrices to track and close improvement actions.

A wellness programme will be used for improvement of worker nonoccupational health and safety. This will be accomplished through the use of nonoccupational health and safety and will entail the use of nonoccupational medical screening (that is, blood pressure, diabetes, and heart disease) and off-the-job safety initiatives.

Medical case management will be used to actively care for and support post-injury treatment and case management, and early return-to-work programmes. An onsite medical case manager will work with local as well as regional medical expertise to ensure the best

available care is provided to workers to speed their return to full duty. The medical case manager will also work closely with the project insurance company to facilitate efficient case management and case closure.

11.2 Construction Fire Prevention Programme

The AE/Contractor will establish a project fire prevention programme that is directed toward avoiding the inception of fire, protecting employees and property, and ensuring the continuity of efficient operations. This programme will typically include the following:

- Fire risk assessments
- Establishment of site-specific procedures governing the prevention and protection against fire events
- Fire prevention training of all personnel through new-hire orientation and specialty training (that is, fire watch)
- Use of fire monitors or fire watches for hot work
- Establishment of a fire response team that is trained and properly equipped
- Inclusion of fire prevention as a component to the project inspection programme

Fire prevention inspections will be carried out by SQEP personnel in the following areas:

- Establishment of fire plans
- Fire equipment inspections
- Tool and equipment inspections
- Material inspections
- Work area inspections

The requirements of the “Fire Precautions (Workplace) Regulations 1999” [Reference 36] will be incorporated into the fire prevention programme.

11.3 Accident Reporting and Analysis

Section 3.3 of the Westinghouse EH&S Manual [Reference 9] sets out the arrangements for the recording, reporting, and investigating events involving Westinghouse personnel. This is considered to be an essential element of the continual improvement processing. The prime objective from an EH&S viewpoint is to determine the root causes, take the appropriate corrective action, and ensure that there is appropriate Learning from Experience (LFE). Westinghouse UK personnel currently utilise the Springfields Fuels Limited (SFL) system for the recording, reporting and investigation of such events. Thus, it is intended that this process will be expanded to include the AP1000 programme within the UK. The SFL system is incorporated into the SFL Licensing arrangements for compliance with Licence Condition 7 (Incidents on the Site).

In addition, the learning gained from events is part of the overall Operational Experience Feedback (OEF) process. Reference 9, Section 3.10 explains that OEF is an essential element of the overall process of continual improvement. The aim is to achieve “avoidance of loss through learning” by applying “best practice” operating standards and by learning from each other’s operating experiences. This is applied throughout Westinghouse, both within the

United Kingdom and U.S. Further information is provided in “Organisational Learning Process at Westinghouse, Continuous Improvement from Lessons Learned” [Reference 37].

While during the construction and commissioning phases, or indeed any activities on the Licensed site, Westinghouse personnel will have to comply with the Licensee arrangements for incidents onsite, Westinghouse will also implement its own procedures.

In this context, “incidents” is taken to mean any matter which may affect the construction safety, safe operation or condition of a plant. Hence, in addition to applying to accidents and occurrences, it also applies to events of safety interest or concern. These include human errors or failures of plant or procedures that cause near misses or abnormal occurrences. Lessons learned from the licensing, construction, and commissioning of other AP1000 plants in the U.S. and China will be fed into the UK processes.

Westinghouse will expect the AE/Contractor to establish an accident/incident/near-hit database, which incorporates established investigation processes. Lower magnitude events will be elevated as appropriate regarding the level of investigation and reporting for tracking and trending.

The project team will use an expanded database structure to track and trend leading and lagging indicators. The statistics and trending database will enable accessibility by operational supervision to allow report generation on demand and access to operating experience. The database will also be used as part of the project accountability.

The output from this database will be used to supplement personnel training onsite, typically through tool-box talks.

Incorporation of contractors within these systems has been successfully established at SFL where the major contractors play a useful role in the annual meeting with the regulators on the safety performance of the site.

Arrangements will also be put in place to meet the requirements for “The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995” (RIDDOR) [Reference 38].

11.4 Fitness for Duty

WEC will expect the AE/Contractor to implement a fitness-for-duty (FFD) programme, compliant to the UK requirements and client expectations. This will include pre-employment for cause and periodic random testing.

11.5 Planning

As mentioned in Section 9.3.1, risk assessments will be undertaken prior to the commencement of any work. This will be in accordance with “The Management of Health and Safety at Work Regulations 1999” [Reference 29], which requires that employers carry out suitable and sufficient risk assessments. To this end, risk assessments may be a standalone document or prepared to support other documents depending upon the work being undertaken. The risk assessments will be required to support Permit to Work Systems, Safe Systems of Work, Method Statements, and the like. The types of activities undertaken to write and implement the information in the risk assessments will be by:

Constructability Reviews – EHS professionals will participate in constructability reviews for the purpose of hazard/risk reduction and elimination. Their participation in the reviews will be tracked as a schedule item and will address topics including the following:

- General fall protection with a focus on anchorages (that is, working at height)
- Material staging/handling
- Temporary staging
- Temporary facilities; high risk activities
- Manual Handling
- Lone Working

Work Task/Activity Reviews – Work task/activity development will include reviews and signoff by safety professionals prior to a release to work. EHS professionals will be involved with work task/activity walk-downs with supervision. Issues reviewed will include the following:

- Material handling
- Working at heights
- Temporary facilities
- Fire protection/prevention
- Job hazard analysis (JHA) completion
- Rigging and other high risk activities

Job Hazard Analysis – JHAs will be developed for all work packages. JHAs function to provide a work package level review of safety and health risks, and strategies to be used to reduce or eliminate those risks. Project safety professionals will provide assistance/support of the development of JHAs by operational supervision. Each work package will incorporate safety signoff to ensure appropriate work package risk assessment and risk reduction for the scope of work.

Job Safety Analysis (JSA) – JSAs provide a more detailed shiftly review of safety and health risks, and strategies to be used to mitigate those risks at the job location. JSAs provide a real-time field review of the work activity.

Pre-Job Briefings – Pre-job briefings will be used to ensure integration of the safety analysis process (JHA and JSA) into the planning and execution of the field work. Project safety professionals will actively participate in these briefs.

In addition, Westinghouse and any AE/Contractors will be expected to comply with the Licensee arrangements.

11.6 Recognition and Rewards

An incentive programme provides positive reinforcement for the behaviours and activities that support a strong, effective safety and health programme. Such an incentive programme based upon leading indicators not lagging indicators establishes a positive accountability for workers and crews. Leading indicators (for example, observed use of personal protective equipment [PPE], safety practices, participation during pre-job briefs, and use of JSAs/TSAs) reinforce the behaviours that reduce the risk of accidents. Lagging indicators (for example, first aids, recordables, near misses, and equipment damage) reinforce the underreporting of injuries. Though lagging indicators will be tracked and trended, their use will be minimised regarding a project incentive programme. Examples of incentive programmes are listed below:

- Spot Crew Incentives – This would be given to craft work crews for observed positive safety and human performance. Work crews selected would be evenly spread among the trade groups on site. This incentive would be available to all manual craft personnel on site inclusive of subcontractors.

Weekly Crew Incentive – This would be given to one select crew each week for achieving defined safety/human performance objectives (for example, completion and quality of TSA, confirmation of field review of work by foreman/supervisor, observed good safety and human performance field practices, submission of safety/performance improvement suggestion, and observation of crew member going above and beyond programme expectations). This incentive would be available to all manual craft personnel onsite inclusive of subcontractors.

Best Practice/Improvement Incentive – A criteria-based award given to individuals who submit best practices/process improvement recommendations. Best practices/improvements submittals would be screened against a selection and award criteria.

Annual Event Support/Motivation Speaker – During one of the quarterly site-wide lunches, a speaker will be brought in once a year.

Miscellaneous Safety Incentives – These incentives would be presented at the discretion of safety management.

11.7 Accountability

Individual accountability will be established for all project manual and non-manual personnel, and these accountabilities and responsibilities will be part of the “arrangements” for the installation, construction and commissioning phases; that is, part of the QMS. Key leading and lagging indicators will be used as the measurement criteria, which will be used to encourage desired performance and correct substandard performance. The accountability programme for each project will do the following:

- Establish leading and lagging metrics for the project specific to the management/supervisory tier and craft work group
- Provide training regarding needed skills sets and expectations
- Monitor performance and provide feedback
- Reward according to performance.

Examples of leading EHS indicators that could be used include the following:

- Project Safety Assessment (audit)
- JSA average scoring
- Behavioral participation by employee trained
- Near-miss reporting per 10,000 hours
- Training hours per 10,000 hours

Lagging EHS indicators that can be used can include the following:

- First aid injuries
- Near-miss reports
- Recordable injuries (TRIR)

- Lost time accidents (LTAs)

On at least a monthly basis, LFE and accountability reviews will be conducted to provide the opportunities for direct correction of substandard behaviour and reinforcement of desired behaviour. Reviews will be structured around the project management tiers and appropriate craft labour skill groups.

This information will be provided to the Licensee, who may wish to consider such information at their Nuclear Safety Committee meetings.

11.8 Worker Participation

Project safety committees incorporating management and safety representatives appointed under “The Management of Health and Safety Regulations 1999” [Reference 29] and “Safety representatives and safety committee regulations” [Reference 39] will be established to encourage participation by the workforce in all aspects of programme implementation.

The key aspects required by Reference 39 are:

- Appointment and training of safety representatives
- Function of the safety representatives
- Inspection of the workplace
- Investigation and inspections following notifiable accidents, occurrences, and diseases
- Inspection of documents and provision of information
- Safety committees

To this end, Westinghouse will establish safety committees that will conduct audits, review statistical performance, develop/review initiatives, propose revision/new policy, review programme implementation, and facilitate programme element implementation.

In addition, workers will be encouraged to participate in behavioural safety programmes.

11.9 Audits and Assessments

Westinghouse will establish an integrated audit and assessment regime that will:

- Comply with ISO 9001, ISO 14001, and IAEA GS-R-3 requirements
- Identify any compliance deficiencies that require corrective action
- Identify areas for improvement

An audit strategy will be established to ensure all aspects of the procurement, construction, and commissioning of the AP1000 are covered, and it may include supplier audits, internal audits, customer audits, and company audits. In addition it is expected that the Licensee will ensure that Westinghouse’s audit process and programme reflect the Licensee’s requirements. In addition, the following will be carried out:

Job Site Inspections – Job site safety inspections at the project level will be conducted minimally on a weekly basis. The results of these inspections will be collated into a project database for the tracking and closure of action items, and for trending of leading indicators. These inspections may be carried out jointly between management and labour representatives.

Area Safety Monitors – At the project level, the AE/Contractor will use area safety monitors/coordinators to directly focus on specific geographic areas of the project. Use of the monitors/coordinators will be needs driven, but their use will focus on elevated risk areas, such as scaffold erection tasks, steel erection, demolition, and rigging/lifting areas. Use of monitors/coordinators will not be limited to EHS, but will include fire protection, control point access checks, radiation protection, and workers practices. Monitors/coordinators will include safety and nonsafety personnel. All monitors/coordinators will receive training appropriate to their assigned duties.

EHS Programme Reviews by Management – On an annual basis, EHS programme reviews will be conducted. These programme reviews will be conducted by outside, non-project personnel and will assess programme implementation and performance.

Subcontractor safety performance reviews will be done on at least a monthly basis to assess performance against subcontractor expectations. Performance will be tracked and accountability maintained.

Project incident review committee – This committee will consist of operational management and EHS Managers and Safety Representatives appointed that will support the investigation/evaluate of significant incidents or events. Activities will include ensuring appropriate technical resources are used to support investigation needs, reviewing collected data and investigation reports, conducting additional data collection/interviews to support committee needs, developing preliminary and final reports, dispositioning incidents, and developing and implementing corrective actions and lessons learned.

Additional reviews to be conducted will include, but not be limited to, readiness reviews for major evolutions, project startup review, and quarterly focus reviews by the regional safety manager.

Issue Tracking – As safety-related issues are identified from field audits and other sources, they will be entered into a tracking matrix to ensure tracking and closure. Periodic status reports will be published and distributed on the project issues.

11.10 Environment

The “UK AP1000 Environment Report” [Reference 4] has been prepared to consolidate and summarise the environmental information presented in the European DCD [Reference 2]. Chapters 3 and 4 of this report provide the Radioactive and Non-Radioactive Management Systems for the AP1000. In addition, Sections 14 & 15 of the PCSR [Reference 8] discusses the environmental aspects of the AP1000 and provides a high level summary of radioactive waste management.

During the construction and commissioning phases, the AE/Contractor will develop a project-specific plan to ensure compliance with national and local environmental requirements. Focal areas of the plan will include, as a minimum, the following:

- Spill response and control
- Hazardous waste management
- Water management
- Erosion control
- Environmental noise abatement
- Client site-specific reporting requirements
- Local wildlife and flora

- Waste reduction

It is recognized that during such operations incorrect storage and handling of certain oils, chemicals and other potentially polluting materials have led to numerous pollution incidents on industrial sites. Thus, during the design Westinghouse will apply Best Available Techniques (BAT) to prevent or reduce fugitive emissions to water or land, and will ensure that there are procedures available for dealing with leaking or damaged containers to reduce the risk of pollution, taking into account the hazards of the substance and expect the Licensee to apply BAT during the construction and commissioning phases.

It is recognized that the Licensee will also require an Authorisation under the “Radioactive Substances Act 1993”, Reference 41. Westinghouse and any subcontractors will ensure that their arrangements align with those of the Licensee. The Licensee will have to ensure that any radioactive material and waste onsite is adequately controlled to and any leak is detected and reported. This aspect is essentially covered by applying BAT to all such materials. However, during the construction, installation, and commissioning of the AP1000, there will also need to be similar arrangements in place to cover other hazardous materials which may have an environmental impact. In addition, Westinghouse and any subcontractor will minimise both radioactive and non-radioactive waste and will implement suitable arrangements to this effect.

11.11 Project-Specific or Site-specific Issues

Project safety procedures will be developed to incorporate requirements and expectations of the client and UK legislation. Various aspects of the project safety and assurance procedures have been discussed elsewhere in this document.

11.12 Other EHS Initiatives

- Human Performance Database – Work human performance issues will be tracked in a database. Prior to work assignments, workers will be assessed against a human performance database. Workers identified as experiencing an elevated number of human performance issues will be selected for enhanced training or, if performance is significantly adverse, assignment to non-at-risk activities or denial of employment. Assessments against the human performance database will occur prior to or during in-processing.
- Physical Demands Assessments – The AE/Contractor will use “physical demands” assessments of workers to determine worker abilities to perform minimum essential functions required for anticipated job assignments. In this way, workers will be appropriately matched to job functions they are capable of doing. The AE/Contractor will make all reasonable accommodations to enable workers opportunities for employment.
- Communication – The project will use multiple means of communication on the project to convey safety performance, incident information, incentive awards, safety focus initiatives, and the like. Means used to communicate project information can include newsletters, bulletins, site kiosks, posters, tool-box talks, project intranet, and bulletin boards.

PART 4 REFERENCES AND GLOSSARY OF TERMS

12.0 REFERENCES

1. “New nuclear power stations, Generic Design Assessment,” Guidance to Requesting parties, Version 3, Health and Safety Executive (HSE), August 2008.
2. “AP1000 European Design Control Document,” EPS-GW-GL-700, Revision 1
3. “UK AP1000 Probabilistic Risk Assessment,” UKP-GW-GL-022, Revision 0
4. “UK AP1000 Environmental Report,” UKP-GW-GL-790, Revision 2.
5. “The Construction (Design and Management) Regulations,” No. 320, U.K. Statutory Instruments – Health and Safety, 2007.
6. “Westinghouse Electric Company Quality Management System.”
7. “Project Quality Plan for the UK Generic Design Assessment,” UKP-GW-GAH-001,
8. AP1000 Pre-Construction Safety Report, UKP-GW-GL-732, Revision 2.
9. Westinghouse Environment, Health and Safety Manual, Issue 1, February 12, 2003.
10. “Preparation of UK Licensing Documentation in Regulatory Submission, UKP-GW-GAP-011.
11. Technical Assessment Guide, “Principles for the Assessment of a Licensee’s ‘Intelligent Customer Capability,’” T/AST/049, Issue 002, HSE, 23/10/06.
12. “Successful health and safety management,” HSG 65, HSE, 1997.
13. Maintaining the Design Integrity of Nuclear Installations throughout their Operating Life, INSAG-19, A Report by the International Nuclear Safety Advisory Group, IAEA, December 2003.
14. “Safety Assessment Principles for Nuclear Facilities,” Revision 1, HSE, 2006 Edition.
15. “Safe and Simple: The Genesis and Process of the AP1000 Design,” APP-GW-GER-005, Revision 1.
16. “Change Control for the AP1000 Programme,” NSNP 3.4.1
17. “Design Reviews,” Westinghouse Electric Company, Westinghouse Procedure WEC 4.12, Revision 12, Nuclear Services Policies and Procedures, February 29, 2008.
18. “AP1000 Equivalence/Maturity Study of the U.S. Codes and Standards,” UKP-GW-GL-045
19. “Initial Test Programmes for Water-Cooled Nuclear Power Plants,” U.S. NRC Regulatory Guide 1.68.
20. “Safe Operating Envelope and Operating Regime that Maintains Integrity of Envelope,” UKP-GW-GL-736, Revision 1.

-
21. "Westinghouse Setpoint Methodology for Protection Systems – AP1000," WCAP-16361-P, May 2006.
 22. "Nuclear Safety Criteria for the Design of Stationary Pressurized Water Reactor Plants," American National Standards Institute N18.2, August 1973.
 23. "AP1000 Fault Schedule for the United Kingdom," UKP-GW-GLR-003, Revision 0.
 24. "AP1000 Human Factors Program and Assessment for the United Kingdom," UKP-GW-GL-042, Revision 1
 25. "Severe Accident Management Programmes for Nuclear Power Plants," IAEA Safety Std, NS-G-2.15, 30 July, 2009.
 26. "The Control of Substances Hazardous to Health Regulations, 1994," Statutory Instrument 1994 No. 3246.
 27. The Provision and Use of Work Equipment Regulations (PUWER), Statutory Instrument 1992 No. 2932.
 28. "The Ionising Radiations Regulations 1999," Statutory Instrument 1999 No. 3232.
 29. "The Management of Health and Safety Regulations 1999," Statutory Instrument 1999 No. 3242.
 30. "Radiation (Emergency Preparedness and Public Information) Regulations 2001," Statutory Instrument 2001 No. 2975.
 31. "The Control of Major Accident Hazards Regulations 1999," Statutory Instrument 1999 No. 743.
 32. "The Procedure for the Creation, Handling and Processing of Protectively Marked Documents," UKP-GW-GAP-016.
 33. "Guidance on the Use of the AP1000 Correspondence Tracking System Database in SmartPlant Foundation," APP-GW-GDP-001, Revision D.
 34. "Technical Specification for Decommissioning Strategy for the AP1000 Generic Design Assessment Aker Solutions," 63000333-000-000-0005, Revision 2, August 2008.
 35. "Nuclear Reactors (Environmental Impact Assessment for Decommissioning) Regulations 1999," Statutory Instrument 1999 No. 2392.
 36. "Fire Precautions (Workplace) Regulations 1999," Statutory Instrument 1999 No. 1877.
 37. "Organisational Learning Process at Westinghouse, Continuous Learning from Lessons Learnt," AP1000, Revision 2, Westinghouse Electric Company, 04/01/09.
 38. "The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995," Statutory Instrument 1995 No. 3163.
 39. "Safety Representatives and Safety Committees Regulations 1977," Statutory Instrument 1977 No. 500.

-
40. “UK Safety Categorisation and Classification of Safety Systems, Structures and Components Report,” UKP-GW-GL-044, Revision 0.
 41. “Radioactive Substances Act” 1993, Statutory Instrument 1993
 42. Technical Assessment Guide, “Function and Content of a Safety Management Prospectus”, T/AST/072-Issue 1, HSE, 12 May 2009.

13.0 GLOSSARY OF TERMS

AE	Architect/Engineer
AGSSC	AP1000 GDA Submission Steering Committee
ALARA	As Low As Reasonably Achievable
ALARP	As Low As Reasonably Practicable
ASME	American Society of Mechanical Engineers
BAT	Best Available Techniques
BS OHSMS	British Standard Occupational Health and Safety Management System
CAE	Computer Aided Software
CBT	Computer-based Training
CDM	Construction, Design and Management
COMAH	Control of Major Accident Hazards Regulations
COSHH	Control of Substances Hazardous to Health
CTS	Correspondence Tracking System
DAP	Duly Authorised Persons
DCD	Design Control Document
D-RAP	Design Reliability Assurance Programme
EHS	Environment, Health and Safety
EIM&T	Examination, Inspection, Maintenance and Test
EUROATOM	European Atomic Energy Community
FFD	Fitness For Duty
GDA	Generic Design Assessment
HSE	Health and Safety Executive
IEEE	Institute of Electrical & Electronics Engineers, Inc.
ILRT	Integrated Leak Rate Test
IOSH	Institute of Occupational Safety and Health
IRR	Ionising Radiations Regulations
ISAR	Industrial Safety Accident Rate
ITAAC	Inspection, Tests, Analyses and Acceptance Criteria
JHA	Job Hazard Analysis
JSA	Job Safety Analysis
JPO	Joint Project Office
LCO	Limiting Condition for the Operation
LCSR	Plant Life Cycle Safety Report
LFE	Learning From Experience
LTA	Lost time Accident
ND/EA	Nuclear Directorate/Environment Agency
NII	Nuclear Installation Inspectorate
NPP	Nuclear Power Plants
NRC	U.S. Nuclear Regulatory Commission
OEF	Operational Experience Feedback
PCSR	Pre-Construction Safety Report
PPE	Personnel Protective Equipment
PRA	Probabilistic Risk Assessment
PUWER	Provision and Use of Workplace Equipment Regulations
PWR	Pressurised Water Reactor
QMS	Quality Management System
REPPIR	Radiation (Emergency Preparedness and Public Information) Regulations
RIDDOR	Reporting of Diseases and Dangerous Occurrences Regulations
RSA	Radioactive Substances Act
SAMG	Severe Accident Management Guidance
SAPs	Safety Assessment Principles

SCR	Safety Commissioning Report
SCS	Safety Commissioning Schedule
SFL	Springfields Fuels Limited
SIT	Structural Integrity Test
SMS	Safety Management Systems
SQEP	Suitably Qualified and Experienced Persons
ToR	Terms of Reference
TRIR	Total Recordable Injury Rate
TSA	Task Safety Analysis
UK	United Kingdom
WEC	Westinghouse Electric Company

ATTACHMENT 1

Attachment 1

Terms of Reference for AP1000 GDA Submission Steering Committee (AGSSC)



Terms of Reference for AP1000 GDA Submission Steering Committee (AGSSC)

Purpose:

The AGSSC's purpose is to:

- Advise Westinghouse on the development of GDA submissions to the UK regulators;
- Review agreed GDA submissions to the regulators.
- For GDA submissions made prior to the inauguration of the Committee, retrospective reviews may be undertaken at the discretion of Westinghouse and the utilities;
- Advise, prior to their submission to the regulators, whether an acceptable safety case has been made for proposed changes to the AP1000 design frozen for the UK GDA process.

Recommendations of the Committee shall be on the basis of a unanimous utilities' position.

Westinghouse is not bound by the recommendations of the AGSSC, although Westinghouse would provide an explanation to the Committee if they intend to reject any or all of the recommendations proffered by the Committee.

The Committee will liaise, and be advised, as appropriate on technical matters by the separate existing European Passive Plant (EPP) group.

The AGSSC will be disbanded on completion of the GDA process.

Membership

The Steering Committee will be comprised of:

- 1 named representative, plus an alternate from each of the utilities supporting Westinghouse in the GDA process.
- 2 representatives from Westinghouse who are the licensing leads.

The AGSSC representatives will have sufficient expertise to advise Westinghouse on the safety of the AP1000 design and its safety documentation and also represent their company position to Westinghouse.

The AGSSC Chairman and Deputy Chairman will be utility members, and elected by majority vote of the utilities and Westinghouse at the first Committee meeting. Each organisation is entitled to only a single vote.

Westinghouse will provide an administrative secretary for the Committee.

The Steering Committee may invite further representatives from the utilities, Westinghouse or external organisations to attend its meetings from time to time or otherwise assist its business.

Reporting

Formal records of the AGSSC proceedings will include meeting agendas and minutes plus proposals and submissions considered by the Committee. Minutes of the Committee will be agreed by Committee members.

Where items discussed by the Committee relate to sensitive information as specified by the Office of Civil Nuclear Security (OCNS), these items will be covered within a protectively marked annex, with distribution and storage controlled within the procedures set out in Westinghouse's Security Plan.

Meetings

The Steering Committee will meet as often as is necessary to achieve its purpose. Meetings will be convened with reasonable notice, normally with a minimum of 2 weeks notice.

Quorum

The AGSSC will be quorate with at least one representative from 4 utilities plus Westinghouse. The requirements for a quorum may be reviewed by the AGSSC from time to time, including where there is a change in the number of utilities supporting Westinghouse in the GDA process.

Where members cannot make it to a meeting in person, it is desirable for them:

- To be represented by telephone or video-conference, or
- Their position to be made known in writing; or
- Their position to be made known in advance of the meeting to the Chairman.

Signed by AGSSC representatives:

Name	Signature	Company
M Carreter		Endesa
M Ang		E.ON
M Prieto		Iberdrola
J Kisalu		RWE
L Ceulers		GDF Suez
B Persson		Vattenfall
D Popp		Westinghouse

ATTACHMENT 2

Attachment 2

SAMPLE DESIGN REVIEW CHECKLIST

Subject	_____	Design Review No.	_____
Type	_____	Chairman	_____
			(Name)
Chairman	_____		_____
	(Signature)		(Date)

Respond to each question by marking the block in front of the question “YES”, “NO” or “N/A”. Items that are questionable or incomplete should be marked “NO” and explained briefly. Items marked “N/A” should reflect lack of relevance or applicability to this particular Design Review.

A. Design Objectives

- ___ 1. Is there a clear statement as to what the design is intended to do or achieve?
- ___ 2. Are the design objectives consistent with the customer specification(s) & contract requirements?
- ___ 3. Is there a quantitative or qualitative assessment that shows that the intent of the design is likely to be accomplished?
- ___ 4. Have questions of patentability or patent infringement been considered in developing the design?
- ___ 5. Have “lessons learned” from similar programmes been considered?
- ___ 6. Has an adequate design plan been prepared to cover the entire scope of the project?

B. Design and Operating Margin Review

- ___ 1. Are the design and operating margins identified?
- ___ 2. Are the defined margins acceptable for the structure, system, and component?
- ___ 3. Have any elements of the design that positively or negatively impact design or operating margin of interfacing structures, systems or components been identified and addressed?
- ___ 4. Are there any opportunities associated with the design to increase plant margin?

Attachment 2 (cont.)

SAMPLE DESIGN REVIEW CHECKLIST

C. Functional Requirements

- 1. Are the functional requirements for the design clearly identified and complete, e.g., does it cover all aspects of the equipment to be designed?
- 2. Are assumptions adequately described and reasonable?
- 3. Have appropriate regulatory, performance, and warranty requirements been invoked for the design?
- 4. Have pertinent interface requirements (e.g., shipping, storage, handling, installation) been established?
- 5. Have requirements for interface with existing plant structures defined?
- 6. Have the functional requirements captured all customer requirements?
- 7. Have requirements for installation been defined?
- 8. Have in-service inspection or maintenance requirements for the design been defined?
- 9. Have the applicable design, analysis, materials, welding, etc. Codes been defined?
- 10. Has the equipment to be modified, discarded, reused, and supplied new been defined?

D. Design Requirements and Design Bases

Are the design requirements and design bases appropriate, complete, and quantitative (e.g., with specific acceptance criteria or limits) including (but not limited to):

- 1. Interfaces with other components or systems (e.g., handling, storage, shipping, dimensional, voltage, temperature, speed, weight, and mounting) defined?
- 2. All structural loads defined, e.g., deadweight, live, pressure, seismic, accident, etc?
- 3. All thermal loads and requirements defined?
- 4. All lifting, shipping, and installation loads defined?
- 5. Required structural load combinations and allowables defined for all components?
- 6. Limits for all components under normal operating conditions, accident conditions, and shipping and handling conditions (temp., pressure, etc.) defined?

Attachment 2 (cont.)

SAMPLE DESIGN REVIEW CHECKLIST

- 7. Limits on the cumulative effect of cyclic loadings (e.g., fatigue) on systems, structures, or components defined?
- 8. Have provisions for the effects of vibration of structural members due to the action of fluid flow considered (e.g., fretting wear at contact points, hold down spring vibration) in the requirements?
- 9. Requirements for environmentally induced effects on materials or components (e.g., oxidation, corrosion, water chemistry)?
- 10. Regulatory requirements and industry standards (e.g., OSHA, NRC, IEEE, ASME).
- 11. Are material requirements defined?
- 12. Has potential corrosion susceptibility of the materials employed in the design been considered and included in the requirements?
- 13. T&H requirements & limits defined?
- 14. Radiation or dose requirements & limits defined?
- 15. Required customer inputs received & verified?

E. Design Evaluation

- 1. Do the design criteria satisfy all customer and regulatory requirements?
- 2. Have “lessons learned” from similar projects been evaluated for applicability?
- 3. For each functional & design requirement, does the design approach being taken appear to be on a success path to meeting them?
- 4. Has an adequate design compliance matrix been prepared to be employed in subsequent design reviews?

F. Quality

- 1. Are quality assurance aspects of design work being addressed in accordance with all applicable procedures?
- 2. Are the appropriate quality assurance requirements being invoked as specified in the customer’s order (e.g., customer representation at design reviews)?
- 3. For subcontracted items, has a Surveillance Plan been completed and is it adequate for the intended purpose?

Attachment 2 (cont.)

SAMPLE DESIGN REVIEW CHECKLIST

G. Customer Considerations

- 1. Is customer notification required because of impact of new or revised design on current product, including software?
- 2. Is the customer acceptance of the design necessary?
- 3. Has customer been informed of the design, when determined to be necessary?
- 4. Has customer acceptance been obtained, if required? If not, what steps are planned to gain acceptance?
- 5. Have customer requirements been defined & incorporated into design documents, e.g., specs, interface drawings, etc?

H. Safety and Licensing Considerations

- 1. Do the design features or methods avoid increasing the probability of occurrence or consequences of an accident or malfunction of equipment important to safety?
- 2. Does the product require licensing by NRC, and does the development schedule allow reasonable time for this licensing effort?
- 3. Have safety in fabrication and construction been considered?
- 4. Have personnel safety concerns been adequately considered and resolved?

I. Repairability & Maintenance

- 1. Have design features adequately addressed specific functional requirements for repair, inspection, or maintenance of the product?
- 2. Do criteria for repair facilitate simple, economical and prompt correction of product deficiencies?
- 3. Are periodic maintenance & inspection requirements specified and easy to achieve?
- 4. If a tooling development programme is required to provide equipment to perform repairs, or maintain equipment, have functional requirements for tooling been provided to organizations responsible for its design and operation?

Attachment 2 (cont.)

SAMPLE DESIGN REVIEW CHECKLIST

J. Pre- and/or In-Service Inspection

- 1. Is periodic inspection required?
- 2. Have inspection requirements been specified?
- 3. Have acceptance criteria been defined for required inspections?
- 4. Are interface organizations that may be ultimately involved in an inspection programme familiar with the design features?
- 5. If a tooling development programme is required to provide equipment to perform required inspections, have functional requirements for tooling been provided to organizations responsible for its design and operation?

K. Installation/Assembly

- 1. Have customer requirements/responsibilities/interfaces for assembly and installation been defined?
- 2. Are installation and assembly requirements defined and adequate?
- 3. Have provisions for lifting and handling been addressed?
- 4. Have transportation requirements been defined and are adequate?
- 5. Have packaging requirements been defined and are adequate?
- 6. Have critical plant interfaces been verified and/or is there a plan in place to obtain this information?
- 7. Have ALARA (As Low As Reasonably Achievable) radiation exposure reduction principles been applied by virtue of planning, shielding, or design as it would affect personnel during installation/assembly, as required?

L. Safety & Human Performance Considerations

- 1. Have Field Service and/or Construction Personnel reviewed the design for ease of installation, maintenance and inspection?
- 2. Are design features incorporated for error prevention (e.g., positive locking features, initial thread preparation)?
- 3. Has ease of field installation or use been considered (e.g., minimum number of tools required, standard hex sizes, standard thread pitches, weight)?

Attachment 2 (cont.)

SAMPLE DESIGN REVIEW CHECKLIST

- 4. Have sharp edges, pinch points, etc. been minimised?
- 5. Does the design utilize fasteners that can easily be handled by workers in protective clothing?
- 6. Are assembly and installation procedures adequate?
- 7. Have fasteners (e.g., pins, threaded parts) been captured (e.g., locking cups, tack welds) to ensure that foreign material is excluded?