Westinghouse

Westinghouse Electric Company
Nuclear Power Plants
P.O. Box 355
Pittsburgh, Pennsylvania 15230-0355
USA

U.S. Nuclear Regulatory Commission
ATTENTION: Document Control Desk
Washington, D.C. 20555

Direct tel: 412-374-6306
Direct fax: 412-374-5456
e-mail: sterdia@westinghouse.com

Your ref: Project Number 740
Our ref: DCP/NRC1768 52-006

August 7, 2006

Subject: AP1000 COL Standard Technical Report Submittal

In support of Combined License application pre-application activities, Westinghouse is submitting Revision 0 of AP1000 Standard Combined License Technical Report Number 01. This report completes and documents, on a generic basis, activities required for COL Information Item 1.1-1 in the AP1000 Design Control Document. Changes to the Design Control Document identified in Technical Report Number 01 are intended to be incorporated into FSARs referencing the AP1000 design certification or incorporated into the design certification using supplemental rulemaking if Part 52 is revised to permit revision of the design certification. This report is submitted as part of the NuStart Bellefonte COL Project (NRC Project Number 740). The information included in this report is generic and is expected to apply to all COL applications referencing the AP1000 Design Certification.

The purpose for submittal of this report was explained in a March 8, 2006 letter from NuStart to the U.S. Nuclear Regulatory Commission.

Pursuant to 10 CFR 50.30(b), APP-GW-GLR-036, Revision 0, "Construction Plan and Startup Schedule," Technical Report Number 01, is submitted as Enclosure 1 under the attached Oath of Affirmation.

The Level 1 Schedule included in Technical Report 01 is based on current regulations and does not include provisions recommended in industry comments or proposals for changes to 10 CFR Part 52. These proposals would include issuing a limited work authorization significantly prior to issuing the COL. A limited work authorization would permit activities important to safety including nuclear island basemat excavation.

It is expected that when the NRC review of Technical Report Number 01 is complete, COL Information Item 1.1-1 will be considered complete for COL applicants referencing the AP1000 Design Certification.

Questions or requests for additional information related to the content and preparation of this report should be directed to Westinghouse. Please send copies of such questions or requests to the prospective applicants for combined licenses referencing the AP1000 Design Certification. A representative for each applicant is included on the cc: list of this letter.

Very truly yours,

A. Sterdis, Manager
Licensing & Customer Interface
Regulatory Affairs and Standardization

/Attachment

1. "Oath of Affirmation," dated August 7, 2006

/Enclosure

1. APP-GW-GLR-036, Revision 0, "Construction Plan and Startup Schedule", Technical Report Number 01, dated August 2006

cc:	S. Bloom	-	U.S. NRC	1E	1A
	S. Coffin	-	U.S. NRC	1E	1A
	G. Curtis	-	TVA	1E	1A
	P. Grendys	-	Westinghouse	1E	1A
	P. Hastings	-	Duke Power	1E	1A
	C. Ionescu	-	Progress Energy	1E	1A
	D. Lindgren	-	Westinghouse	1E	1A
	A. Monroe	-	SCANA	1E	1A
	M. Moran	-	Florida Power & Light	1E	1A
	C. Pierce	-	Southern Company	1E	1A
	E. Schmiech	-	Westinghouse	1E	1A
	G. Zinke	-	NuStart/Entergy	1E	1A

ATTACHMENT 1

"Oath of Affirmation"

ATTACHMENT 1

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

In the Matter of:	)
NuStart Bellefonte COL Project	)
NRC Project Number 740	)

APPLICATION FOR REVIEW OF
"AP1000 GENERAL COMBINED LICENSE INFORMATION"
FOR COL APPLICATION PRE-APPLICATION REVIEW

Bruce W. Bevilacqua, being duly sworn, states that he is Vice President, New Plants Engineering, for Westinghouse Electric Company; that he is authorized on the part of said company to sign and file with the Nuclear Regulatory Commission this document; that all statements made and matters set forth therein are true and correct to the best of his knowledge, information and belief.

Bruce W. Bevilacqua

Bruce W. Bevilacqua
Vice President

Subscribed and sworn to
before me this 7th day
of August 2006.

COMMONWEALTH OF PENNSYLVANIA
Notarial Seal
Debra McCarthy, Notary Public
Monroeville Boro, Allegheny County
My Commission Expires Aug. 31, 2009
Member, Pennsylvania Association of Notaries

Notary

ENCLOSURE 1

APP-GW-GLR-036, Revision 0

"Construction Plan and Startup Schedule"

Technical Report Number 01

AP1000 DOCUMENT COVER SHEET

TDC: ______ Permanent File: ______ APY: ______

RFS#: ______ RFS ITEM #: ______

AP1000 DOCUMENT NO.	REVISION NO.		ASSIGNED TO
APP-GW-GLR-036	0	Page 1 of 24	W-A. Sterdis

ALTERNATE DOCUMENT NUMBER: WORK BREAKDOWN #:

ORIGINATING ORGANIZATION: Westinghouse Electric Company

TITLE: **Construction Plan and Startup Schedule**

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

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
APP-GW-GLR-036.doc	Microsoft Word	

☒ WESTINGHOUSE CLASS 3 (NON PROPRIETARY)

Class 3 Documents being transmitted to the NRC require the following two review signatures in lieu of a Form 36.

LEGAL REVIEW	SIGNATURE/DATE
TOM WHITE	8-4-06
PATENT REVIEW	**SIGNATURE/DATE**
F. CAPENTINO	SIGNATURE ON FILE 8/4/2006

☐ 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.

ORIGINATOR	SIGNATURE/DATE	
M. Bruce	4th Aug, 2006	
REVIEWERS	**SIGNATURE/DATE**	
VERIFIER	**SIGNATURE/DATE**	**VERIFICATION METHOD**
WINTERS		PAGE BY PAGE
AP1000 RESPONSIBLE MANAGER	**SIGNATURE***	**APPROVAL DATE**
R. P. Vijuk		8/4/06

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

APP-GW-GLR-036
Revision 0

August 2006

AP1000 Standard Combined License Technical Report

Construction Plan and Startup Schedule

Westinghouse Electric Company LLC
P.O. Box 355
Pittsburgh, PA 15230-0355

TABLE OF CONTENTS

1 INTRODUCTION

1.1 COL INFORMATION ITEM 1.1-1

This technical report addresses AP1000 Design Control Document (DCD) (Reference 1) Combined License Information Item 1.1-1 on construction and startup schedule information. The information item is as follows:

1.1.7 Combined License Information

> Combined License applicants referencing the AP1000 certified design will provide the construction and startup schedule information.

This report addresses the AP1000 construction and startup schedule. The Plant (s) are stand alone in that there are no common facilities and each Plant should be dealt with as a separate entity. There will be benefits associated with multiple units on the same site. These benefits are outside of the scope of this document and may be offset by other factors.

The start date, scheduled completion date, and estimated commercial operation date of nuclear power plants referencing the AP1000 design certification are provided by the Combined License applicant or holder. The effect of limited work authorizations will also be addressed by the Combined License applicant or holder. The schedule information may be provided by a COL holder after the combined license is issued. A mark-up of the DCD to clarify the timing of providing the information is included in this report.

The information contained in this report will assist and guide the NRC in generic scheduling of inspection and review efforts.

1.2 GENERAL

The AP1000 is a logical extension of the AP600 basic design. Westinghouse in cooperation with the Department of Energy (DOE) and the Advanced Reactor Corporation (ARC) issued a definitive AP600 Construction Plan and Schedule Report, Document Number GW-GCL-001. The design completion was that established by the First-Of-A-Kind (FOAKE) design program which was in sufficient detail to support the development of a credible Construction Plan and Schedule.

In moving from the AP600 to the AP1000, the design changes to incorporate the power increases were restricted to only those areas which directly contribute to the increase in power without compromising safety. As a consequence of the power uprating, the physical size of the Reactor Vessel and the Steam Generators was increased, thus leading to a need to increase the volume of the Containment System. This was accomplished by increasing the height of the Reactor Vessel, Shield Building and Containment allowing the diameters of all these to remain the same. This limited the need for extensive piping modifications. In addition the Turbine Building size has been increased to accommodate a larger turbine.

The principles which guided the design of the AP600 and which are reflected in the Construction Plan and Schedule are applicable for the AP1000. The application of these principles is qualified by the overriding need to ensure that safety is never compromised. This principle is still applicable for the AP1000 upgrades.

These principles may be summarized:

- smaller and fewer components,
- more simple, less safety related components,
- constructability built into the design to minimize schedule bottlenecks encountered in earlier plant designs,
- minimize overall construction durations by maximizing parallel fabrication and construction activities,
- minimize on site work by the use of prefabricated modules including innovative structural steel/composite concrete modules,
- eliminate "field run" commodities including piping, tubing and supports,
- address schedule critical areas by the use of large structural modules, e.g., containment shell modules, composite structural modules,
- design for a large heavy lift facility on site and maximize its application,
- maximize benefits of a distributed control system to reduce cabling and raceway
- reduce testing durations due to extensive Factory Acceptance Testing (FAT) of the control logic using the simulator.

Note: Composite structural modules are a steel plate and section modules with concrete placed in them after installation. Structural credit is taken for the steel acting in composite with the concrete. The result of such modules is to reduce the reinforcing bar quantities to be installed

The shorter installation schedule demands an integrated approach to the management of the design, procurement and installation. A key factor in achieving this will be the Information Management System (IMS). The IMS provides a system for the control and monitoring of these activities.

The "cement" which binds plant information together is the AP1000 Work Breakdown Structure (WBS) and the plant numbering system. This provides the means to establish links between components/commodities, their systems and Plant locations and any parent child relationships via the Commodity Code Locators. Since the plant numbering system and the (WBS) are the same, the links are also valid for the documents. The engineering data is generated in accordance with the above premise and is published to a centralized data repository which is an Oracle based database with software to facilitate queries against the data.

This database provides the basis for the IMS. It may be used to identify additional fields of an administrative/control/schedule related nature. This data is also linked to the schedule via the WBS and the plant numbering system. Therefore, commodities can be identified to their room/area and/or system. Components forming a part of any module can also be identified by the module, component type, plant location or system. As the Preoperational and Component testing procedures are developed, the scope of each component within the test boundary will be identified. This facilitates a transition from a room and area based installation program to a Component and then Preoperational System Test program.

A key function of the IMS is to schedule components availability for fabrication, at the module fabricators facility, or on site, as components.

The centralized repository will also be the vehicle by which, receipt, inspection and installation progress will be entered, summarized and the progress transferred to the schedule. Queries will allow for timely tracking to identify areas where remedial action is required, such that it can be promptly scheduled and taken.

The centralized database will also, by the links to associated engineering data, facilitate the generation of Test Data Sheets.

As the scope of each test boundary is captured at system and component level within the IMS database, it can be used to establish the detail scope for system turnover.

2 TECHNICAL BACKGROUND

2.1 PRINCIPLES OF MODULARIZATION

The AP1000 was designed from the beginning with the aim of modularizing as much as was feasible. It is not a plant which was designed and then modularized. Equipment was designed to be located in specific areas in order that it could be included in modules. Where items within modules in a traditional design would typically be shielded by a "stick built" concrete wall, shielding in the form of steel or lead barriers have been designed and incorporated in the module.

The Plant design is formally captured in the approved engineered documents. In addition, the design is informally captured within the Plant Design system (PDS). PDS is a proprietary product which is used as a design engineering tool in the AP1000. The PDS files while not the formal record of the plant, reflect the current status. The term Plant Model in this context includes not only the PDS files but also the associated equipment database files.

Allocation of space within the plant has been a controlled process in order to eliminate interferences. The location of all components within the Plant is captured in the PDS model, as is the space occupied by modules (with the exception of reinforcing bar modules).

The Composite Structural Plate/concrete modules are steel plate modules with concrete placed on or within the module after installation. Structural credit is taken for the steel acting in composite with the concrete. The larger modules in this category include a number of rooms in the module which themselves have modules in them. These modules will be installed in their parent prior to its own installation.

The sequence of installation of modules has been developed in conjunction with the Plant Model. As the model reflects the physical configuration of the Plant, access space for the module to be taken to its Plant location can be allocated. Similarly, once the access space has been allocated, subsequent design efforts can be managed to keep the access clear.

Modules are categorized as follows:

- Reinforcing bar modules
- Composite structural plate/concrete modules
- Piping modules
- Structural steel modules
- Leave in place steel formwork modules
- Stairwell steel modules
- Raceway and miscellaneous modules
- Proprietary equipment skids
- Equipment modules

2.2 CONSTRUCTION OBJECTIVES AND METHODS

The primary objective was to create a robust and realistic schedule supporting a safe and rapid construction process.

The AP1000 schedule is based extensively on the AP600 Integrated Project Schedule. This schedule established the optimum sequence and logic which is reflected in the manner in which the scope of the modules has been developed. The logic was developed by essentially a backward pass exercise from Commercial Operation. The modularization plan was not only a means of minimizing on site work but also to address specific issues, areas of particular difficulty. Based upon the Westinghouse and its partners' experience, these areas of particular difficulty in the Construction have been addressed to minimize schedule impact.

The major Construction objectives are based on a need to support a test program and are identified as:

- First structural concrete
- Large composite structural modules (CA 20 and CA 01) installed and set
- Turbine building structural concrete
- Turbine set
- Turbine lube oil flush
- Condensate flush/recirculation
- DCS first cabinets installed

- DCS cabinets, energized, cabled, and terminated I/O testing released
- RV and SG installed and set
- Critical load centers energized
- Start component testing
- Start flushing
- Flushing into the RV
- Start preoperational testing
- Containment complete
- Main steam and feedwater clean up
- Release for primary and secondary hydro
- Release for hot functional testing
- Containment SIT and ILRT

The elapsed time for the schedule from first Structural Concrete to Fuel Load can be as short as 36 months. This assumes that the Combined Operating License has been issued and the site preparation work associated with the COL has been completed.

The overall durations used in the detail schedule are based on Industry experience. Unit Installation Rates for commodities have been developed from Westinghouse's construction partners' experience. The sequence of events and logic reflect the innovations incorporated in the design.

Of particular significance to the Construction philosophy are the large structural modules. These are steel plate modules with concrete placed on or within the module. Structural credit is taken for the steel acting in composite with the concrete. Two of the structural modules, CA 20 and CA 01 are substantial structures weighing in excess of 750 and 500 tons respectively.

For sites that are not accessible from the sea it is assumed that large modules will be welded up as a single assembly on site from submodules fabricated offsite. The submodules have been "sized" to be shipped by rail to the site. The important criterion is to be able to lift the assembled module into position as a single assembly with the bulk of the equipment and commodities installed and tested in them prior to positioning. Concrete can then be placed in the structures in parallel with other installation work. Installation of formwork and slab supporting props, etc. are all eliminated for the areas and elevations covered by structural modules.

The same philosophy will be employed for Containment in that it will be prefabricated in a designated prefabrication area, on site in five sections. The sections will be sequentially installed and welded in position.

In order to support this philosophy a heavy lift crane will be employed. The total number of lifts which will be handled by this facility is estimated to exceed 30 separate lifts and includes the heavy NSSS equipment. The installation philosophy is to provide access through the top of the Containment for equipment installation. It is an essential part of the logic for this schedule. The location of the crane is designed into the Plant Layout: capacities and reach, etc. are based upon commercially available equipment.

In addition to Structural modules there are many equipment modules which incorporate their own structural frames. These can therefore be prefabricated and systematically hoisted into their Plant locations on pre-designed and installed support structure/embedments.

Piping and other commodities, where they are routed in the same areas, are concentrated in modules which have been designed to accommodate alignment tolerances.

A major consideration is the need to limit the number of personnel slated to work on Site at any one time. This is reflected in the number and size of the modules. Prefabricated modules are intended to facilitate parallel working and limit on site work. Resource constraints both in finite numbers and areas in which they can work have been factored into the schedule.

The design of the Plant will be to the extent that field run commodities will be largely eliminated. Commodities such as raceway (cable tray and conduit), small bore pipe and tubing, etc. will be issued to the constructor in the form of dimensioned drawings. Space control and allocation will remain under the control of the engineering group and the existing Design/Change Control System will be enforced throughout the Construction period.

Fixings/attachments for supports will be designed into the plant in the form of embedments or e.g., Richmond Inserts, Unistrut, etc. The intent is to eliminate as far as possible, the use of expansion anchors.

The distributed control system will reduce the number of control circuits and thus raceways in the Plant. Field bus connections together with remote Input/Output (I/O) cabinets will significantly reduce the cable lengths and types. This will reduce what were formally single twisted pairs cable for each signal to a single fiber optic cable carrying many signals. Signals may also be conditioned prior to transmittal and again many transmitted via a single fiber optic cable.

Improvements in the schedule durations and logic will be made as the design matures.

2.3 PLANT STARTUP OBJECTIVES

The overall objective of the Plant Startup is to provide a Plant which has been fully tested in accordance Regulatory Guide 1.68 and with the approved test procedures. This Startup program will capitalize on the modularization and the Distributed Control System both of which facilitate parallel work activities. The Protection System for the AP1000 is significantly smaller than for a conventional plant which is reflected in the testing durations.

The control system logic is implemented within the Distributed Control System (DCS) cabinet software. Cabinets will be Factory Acceptance Tested to verify the software has implemented the I&C design correctly and, that it has been properly integrated with the cabinet hardware. FAT tested cabinet combinations will be selectively tested against the Plant Model to properly integrate the control systems. This will eliminate much of the typical onsite problems which normally cannot be found until preoperational testing. The limited nature of the DCS cabling, extensive use of F/O cable, also reduces the cabling and thus the terminations, normally a source of significant problems.

The modularization program also provides the opportunity to preliminarily test many items at component test level. This will eliminate sources of potential error prior to beginning the formal testing after installation.

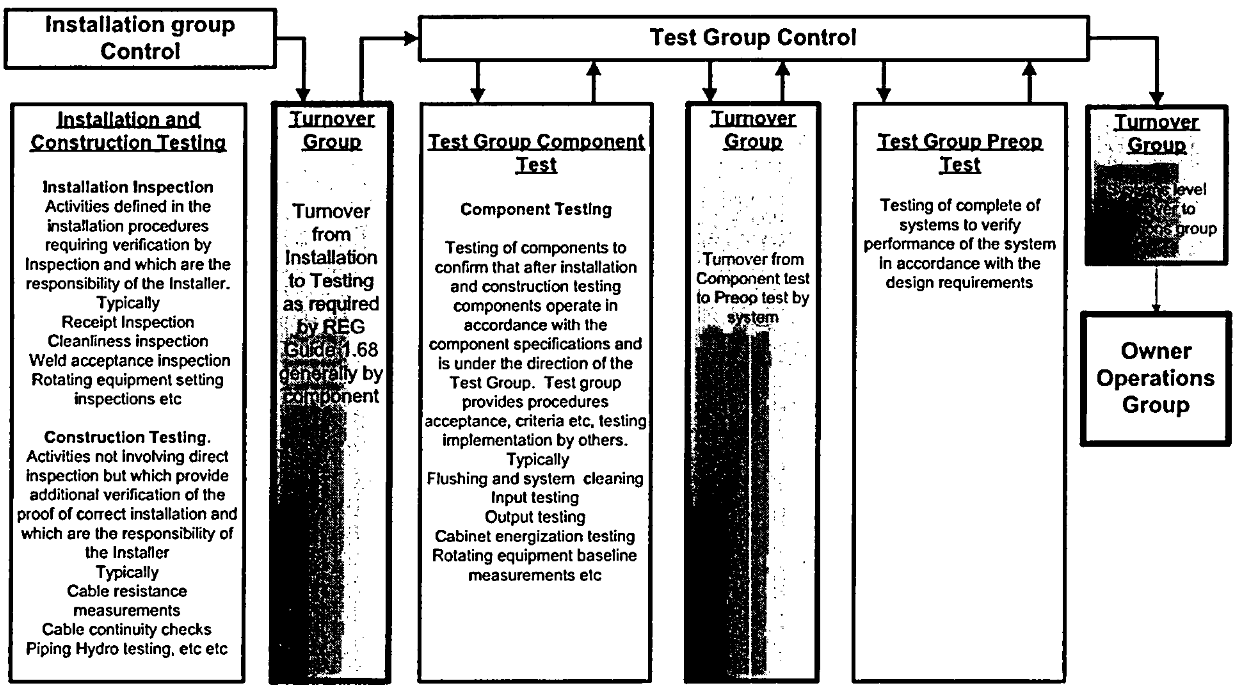
The major startup objectives are identified as:

- DCS Factory Acceptance Testing
- Module cleaning and component testing
- DCS Input/Output testing
- Systems flushing and cleaning
- Support systems preoperational testing
- Protection systems testing
- Containment Structural Integrity (SIT) and Integrated Leak Rate Testing (ILRT)
- Primary Systems Cold Hydro
- Hot Functional testing
- Fuel load
- Power Ascension/physics testing
- Performance Test

The Plant Startup will follow a well defined process from construction completion, through component testing to preoperational testing. Each turnover point requires a formal process for defining the scope of the turnover, status of completion, and effecting the transfer of jurisdictional control.

The interfaces and sequence is shown below.

Nuclear Installation, Testing and Turnover



The development of the Plant Model and its associated databases will include references to the Preoperational Test boundaries. The scope of each Preoperational Test will be developed from Operating Procedures, the System Specification Document (SSD) and the systems engineered documents, specifications etc. Once the scope of the test has been defined, the IMS database will be annotated at the component level with the appropriate Preoperational and Component Test references.

The simplistic logic on which the above is based, follows the WBS structure in that the complete plant consists of a number of systems, each system consists of a number of components, each component consists of a number of commodities. Components are uniquely identified within the plant documents, thus, the total scope of the test program is established in terms of components to be tested.

A system may be a fluid, electrical or HVAC system, a component may be a pump, fan, motor, etc. Commodities forming a part of a system may be piping, sensors, cable, etc.

There are commodities not directly related to systems but which are a necessary part of the Plan construction. These include such items as reinforcing bar, concrete, cable trays, etc. They form a part of the construction logic and are predecessors to the construction completion of the system related items. They are therefore not a part of the turnover process.

The IMS system will provide the "prime mover" for the Turnover process. The IMS database will be annotated with the system boundaries and the construction status. Queries based on the status of each boundary will be developed. Output from the IMS database will provide the controlled scope document listings for the test boundaries.

The Distributed Control System (DCS), besides significantly reducing the cabling provides benefits in the testing area.

The System Control logic is embedded with the software. The design of this software is captured in a database, Plant Wide Database (PWD) which itself is the platform for the automatic generation of the system software. Many of the documents produced for previous generation control systems may now be generated either from the PDS files or from the PWD, e.g. instrument loop drawings, control loop logic diagrams, etc.

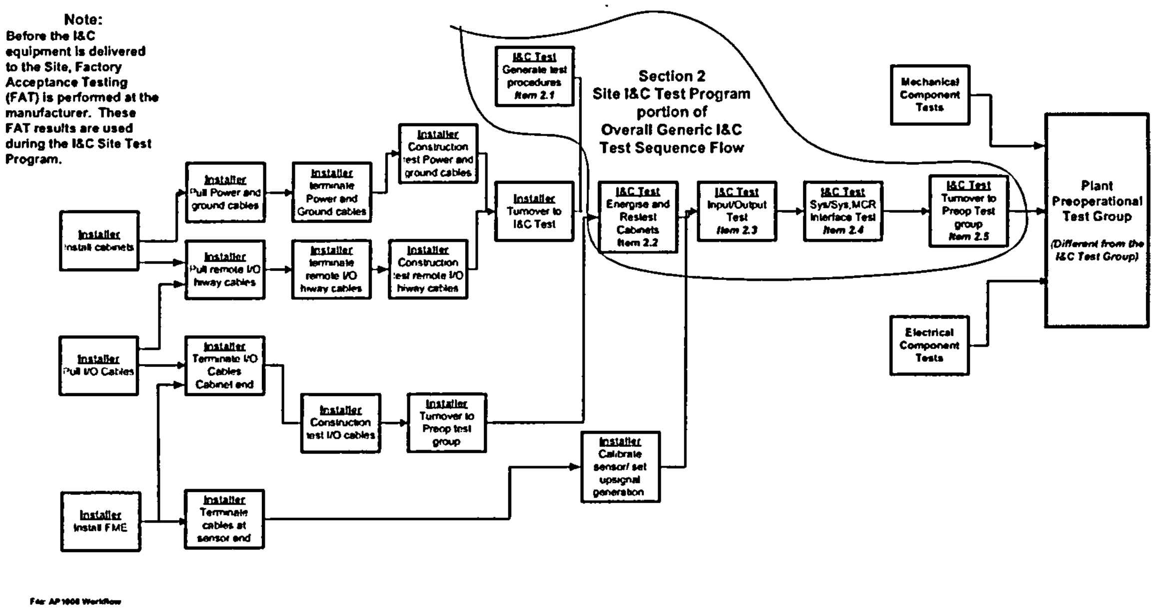
The most significant change is the fact that the software will be tested, particularly the logic, prior to shipment and installation at Site. The basis for the test will be the Control System Functional Design used to generate the software. The Platform for the test will be the simulator software which replicates the system operational requirements.

The Site Test program assumes the Control System Cabinets are components and they are tested as a part of the Component Test program. Each installed cabinet will be energized and tested to ensure it responds as it did when tested in the factory. Each field input will be tested from the sensor to the cabinet to verify the electrical units are correct at the terminal, and, the engineering units are correct within the cabinet. The Output will be similarly tested by "forcing" values to simulate an excursion at the output terminals and verifying that it took place at the correct terminal and is received at the correct actuator.

As the program enters the Preoperational Test Program, the DCS can support meaningful testing prior to the installation and testing of the Main Control Room (MCR). The DCS architecture includes a communications network identified as "Real Time Data Network". This will be systematically expanded as cabinets are connected and the supporting infrastructure is in place. The signals put on the Real Time Data Network are a function of the software within the cabinet controllers and can be read at any location where a suitable connection can be made. The exception to this are the hard wired Protection System System signals which will be conventionally tested.. When the MCR is finally placed in service, thread path testing to confirm the signals are received within the MCR will be conducted as a part of the test program. The interfaces with the MCR and the DCS will have been previously tested as a part of the Factory Acceptance Test program.

The figure shown below illustrates the correlation of the I&C Test process within the umbrella of the overall test program.

Overall I&C Test Sequence Flow



A similar logic flow applies to the mechanical and electrical disciplines repeating the Construction/ Construction Test release to Component test, release to Preoperational Test sequence. Only the I&C sequence is shown here.

Primary system and component flushing and cleaning can have a significant impact on the schedule is Typically for a conventional Plant this is an 18 month effort requiring approximately 150,000 m^3 of demineralized water. This program is also dependant upon the Refueling Water Storage Tank being available early in the program, which is impractical for the AP1000. The module program lends itself to a program of flushing before shipment (or installation for large modules assembled on site) thus limiting the in-situ flushing of the primary coolant boundary to a small number of clean up flushes in the Primary Systems and the reactor Vessel.

To be effective the construction program must recognize the need to maintain cleanliness during Construction operations. The number of field welds is greatly reduced on the AP1000 due to the reductions in the overall pipe quantities and the use of prefabricated pipe modules. Internal cleaning of pipework as the installation of the plant progresses will be accomplished by access through valves, etc. In addition, special care will be taken to equip open pipe ends with robust closures to prevent the ingress of contaminants.

3 CONSTRUCTION METHODS

3.1 CIVIL

Extensive use will be made of prefabricated reinforcing bar modules. The basemat and the Containment reinforcing bar cradles are typical examples.

The greatly reduced quantities of concrete, concrete structures, requiring conventional reinforcing and form work techniques contribute to the overall reduced duration.

Special attention has been focused on the early phases of the Civil construction to eliminate the congestion in the basement area. During the initial stages of construction the conventionally built walls are on the critical path along with the interface with the shield building walls above grade elevation. Typically in this area, due to the concrete curing requirements, at least 3 slabs and their associated walls must be poured before any area can be released for mechanical and electrical work. The AP1000 uses a single outfitted structural composite module (CA 20) from the basemat to the spent fuel operating deck. Once the module has been secured, other work may be carried out while concrete is poured in the spaces between the structural plates.

The optimum schedule logic assumes the shield building walls will be poured in 3 separate sections rather than a monolithic concrete lift of some 16 to 18 feet. This allows critical path work to proceed in the area local to the Auxiliary building as opposed to waiting for the reinforcing bar and concrete work to be completed for the whole shield building.

A similar composite structural module to CA 20, CA01, has been designed for the major internal structures of the Containment.

Floor slabs incorporate "Q Decking" or other similar permanent support structures to eliminate the need for temporary formwork and will support the loads imposed by wet concrete. This is generally supported from the steel wall structures or from embedments specifically designed for this purpose. This eliminates the need for temporary floor slab supports.

Reinforcing bar sizing and densities have been designed not only to provide structural integrity but also to facilitate construction of the design. The source of concern is related to the height of concrete lifts, viz. to pour concrete without voids. Concrete mixes will be designed for specific applications and mock ups will be use, when appropriate, to address areas of particular complexity.

Interfaces between the large structural modules and adjacent reinforcing bars will be accomplished by either embedding custom support pads designed for the permanent plant loads or by reinforcing bar dowels over which the module will be located. The dowels being at least the developed length of the bars such that the final installed unit acts as a composite structure with its support base.

Large modules will be designed with lifting points incorporated in the design, and, where required, custom lifting frames will be supplied. Specific detail engineered instructions for each lift will be generated from which the installer will generate their detail work implementing instructions.

Wherever practical and, in conjunction with the Constructor, slip forming and other advanced construction techniques will be incorporated into the work processes.

3.2 MECHANICAL

The bulk of the mechanical equipment will be incorporated into modules or designed into skids supplied to a detail specification to perform specific functions, e.g., instrument air compressors, etc.

These will be supplied as complete, including control schemes, where appropriate, ready for installation.

Mechanical modules may take the form of composite equipment, piping, HVAC, raceway, etc. again ready for installation. The factory scope for these modules will include extensive testing, particularly flushing and cleaning. Some modules are subparts of larger more complex modules and are appropriately scheduled.

The Containment Vessel for the AP1000 is a freestanding steel pressure vessel. For a conventional plant this is fabricated in situ using small plates. For the AP1000 it is planned to prefabricate it in 5 pieces on site, transport each section to the heavy lift crane, and, hoist each section into position for welding. This eliminates much of the critical path welding/NDE and facilitates sand blasting and painting in the fabrication area, leaving only the in situ welding areas to be completed.

Piping of all sizes, including tubing is designed and their supports designed and located to the fixings provided as a part of the design. Piping which is supplied on modules and or skids, is connected to the piping system by make-up pieces. The make-up pieces are designed such that, within the installation tolerances, the lengths will accommodate the weld fit up tolerances for the applicable piping codes.

•

3.3 ELECTRICAL AND I&C

The provision of permanent power to facilitate Preoperational testing is critical but only at the point where motors a must be operated in their permanent Plant configuration. Pumps which must be operated to support flushing can be operated in a temporary electrical configuration. To support such functions specific load centers may be energized. Temporary controls, etc. may be provided to protect the equipment via the DCS or by a separate temporary control system. These controls are provided over and above the permanent plant protection for the equipment during flushing, e.g. loss of suction head due to plugged strainers etc.

DCS cabinets may be energized using permanent or temporary power to support cabinet energization/retests and input output testing.

Electrical and I&C cabinets will be installed on predesigned and installed attachment points.

Raceway and associated supports are detail designed including the location and attachment points for supports. Raceway on modules will be similarly treated. Effectively there will be no field run raceway, it is designed, routed, and supported.

3.4 PLANT STARTUP

The Startup program will reflect the requirements of Chapter 14 of the DCD. Systems not a part of the protection system will be tested as a part of a comprehensive test program which is directed by appropriately generated, reviewed and approved procedure.

The plant startup will capitalize upon the modularization program in that modules will arrive flushed and cleaned, and, where practical, cabling will be installed and checked out.

The reduced need of primary systems flushing, due to the less plant piping and the modularization program will require for critical system proof flushes to verify the primary systems meet the cleanliness requirements.

The IMS will provide an accurate and controlled means of establishing the detail scope, content and status of system test boundaries. During the startup operations the IMS will also support the Startup Tagging system and will provide a means of confirming the turnover and test status of equipment and systems.

The significantly smaller and passive protection system, and, the comprehensive testing to be carried out in the factory will dramatically reduce the onsite test durations. This will not reduce the rigor of the preoperational test program but will provide a system with a significantly reduced risk of error and thus site remedial action, leading to reduced schedule durations

The DCS will be tested as previously described in this document. The architecture of the DCS supports the need to be able to duplicate selected Main Control Room functions from remote locations. Interfaces with the Main Control Room will be fully tested again for the Protection System and, for the remainder, the interface will be tested on a threadpath or controller to controller basis.

Personnel conducting testing will be certified in accordance with established requirements.

3.5 CONSTRUCTION DOCUMENTATION

The Plant configuration is captured within the formal engineered documents stored in Electronic Data Management System (EDMS), the plant model, PDS and associated data files.

Both of these systems will be made available for the Constructor to develop their implementing level documents. The Change Control System will require action from the Constructor when a document or file which is under design configuration control has been used to generate a Construction level document.

Similarly Test Data Sheets at Component Test level will be generated from the Foundation and/or PWD databases with many of the permissive type applications built into the process for their generation.

4 SUMMARY OF SCHEDULE

The overall Construction duration from the first structural concrete to the start of fuel load can be as short as 36 months for the "nth" Plant. Other variables outside of the Standard Plant scope which are site specific are also assumed to be not on the critical path.

Primavera has been used as the planning tool.

The URD Volume III, Chapter 1 Section 7.2 established the schedule goals and requirements for the AP100 project schedule. Section 7.2.1 of the above referenced document requires a detail schedule which integrates, design, construction, inspection and startup. The AP1000 integrated project schedule is a CPM logic integrated schedule at level III of the Westinghouse WBS made up of over 5500 activities. The schedule includes site selection and licensing, site specific engineering, procurement and fabrication of equipment, commodities and modules, construction and construction testing, preoperational testing and startup through to power escalation and commercial operation.

Attachment A to this document is a summary schedule at Westinghouse level 1 WBS.

The durations have been developed with input from Constructors. The sequence at detail level particularly in the Civil area may be changed based upon the preferences of the actual constructor selected. The activities have been resource loaded and flattened to keep the on site labor levels at or below 3000 operatives on site at any one time. This the level beyond which the preferred efficiency may decline...

The logic required to start the Plant is in general, embedded in preoperational test procedures. This logic has been interfaced with the practical considerations for the construction down to the component level. The juncture at which the focus of completion changes from an installation lead room and area logic to a component and then systems lead completion is established in the schedule. The detail activities have been rolled up into "hammocked" activities for both the installation and testing and the logic ties between them established.

Based on the logic and durations Primavera generated the critical path schedule. This was reviewed and revised as appropriate, on the basis of the resource loading restrictions, test logic, etc. and the final schedule developed.

In addition to the design driven logic, requirements from the (URD) were been incorporated into the design and the installation.

The logic built into the schedule recognizes the benefits of the modularization and DCS *systems* which is reflected in the logic and reduced durations.

The smaller footprint of the design and the use of modules have reduced the schedule risk from inclement weather, however, the Containment installation is vulnerable and a temporary cover may be used. This is needed not only for personnel protection but also for maintenance of the proper conditions for welding.

The modularization program in some areas limits contingency planning. However, contingencies in terms of revised logic, e.g. installing modules with selected equipment to be installed later, revising the overall size and scope of the module etc. are a part of the this process. Contingency plans for late delivery of some major components have been investigated and options to minimize adverse impacts developed.

5 REGULATORY IMPACT

5.1 FSER IMPACT

The FSER (Reference 2) does not discuss the AP1000 generic construction and startup schedule. In FSER Chapter 14 the startup testing is discussed. The write-up in Chapter 14 of the FSER is not impacted. The conclusions in Chapter 14 of the FSER are not altered.

The schedule and work plan incorporates the mandatory requirements for ITAACs within its structure.

The information provided in this document and change to the DCD has no effect on design function. This change has no effect on analysis or analysis method. This change has no effect on procedures that control how DCD described SSC design functions are performed or controlled. This change has no effect on Tier 1 information.

The information contained in this document does not require changes to the evaluation of the response to postulated accident conditions. The information does not require changes to the structural or safety analysis of any safety related equipment.

The information contained in this document does not require an additional test or experiment or changes to testing.

5.2 IMPACT ON RESOLUTION OF A SEVERE ACCIDENT ISSUE

10 CFR Part 52, Appendix D, Section VIII. B.5.a. provides that an applicant for a combined license who references the AP1000 design certification may depart from Tier 2 information, without prior NRC approval, if it does not require a license amendment under paragraph B.5.c.

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

SECURITY ASSESSMENT

The information and subject changes will not alter barriers or alarms that control access to protected areas of the plant. The information and subject changes will not alter requirements for security personnel. Therefore, the information and proposed change do not have an adverse impact on the security assessment of the AP1000.

6 DCD MARKUP

The following DCD markups identify how COL application FSARs should be prepared to incorporate the subject change:

Revise Section 1.1.5 as follows:

1.1.5 Schedule

The scheduled completion date and estimated commercial operation date of nuclear power plants referencing the AP1000 design certification are provided by the Combined License applicant or holder.

Revise Section 1.1.7 as follows:

1.1.7 Combined License Information

~~Combined License applicants referencing the AP1000 certified design will provide the~~ Generic construction and startup schedule information for the AP1000 certified design is provided in APP-W-GLR-036 (Reference 1).

Add Section 1.1.8 as follows:

1.1.8 References

1. **APP-GW-GLR-036, AP1000 Standard Combined License Technical Report, "Construction Plan and Startup Schedule"**

7 REFERENCES

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

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

Attachment A – Level 1 Summary Schedule

Assumptions included in the following schedule (Figures A1 –A4)

- Site clearing and support activities start prior to an NRC COL final safety evaluation
- Excavation of the basemat requires a limited work authorization from the NRC
- The limited work authorization comes after the hearings and shortly before COL is issued.
- The review of the COL application includes 18 months for staff review and 12 months for hearings and final license activities.
- This schedule does not reflect industry comments or proposals for changes to Part 52 to advance schedule for issuing a limited work authorization for basemat excavation and other activities important to safety.

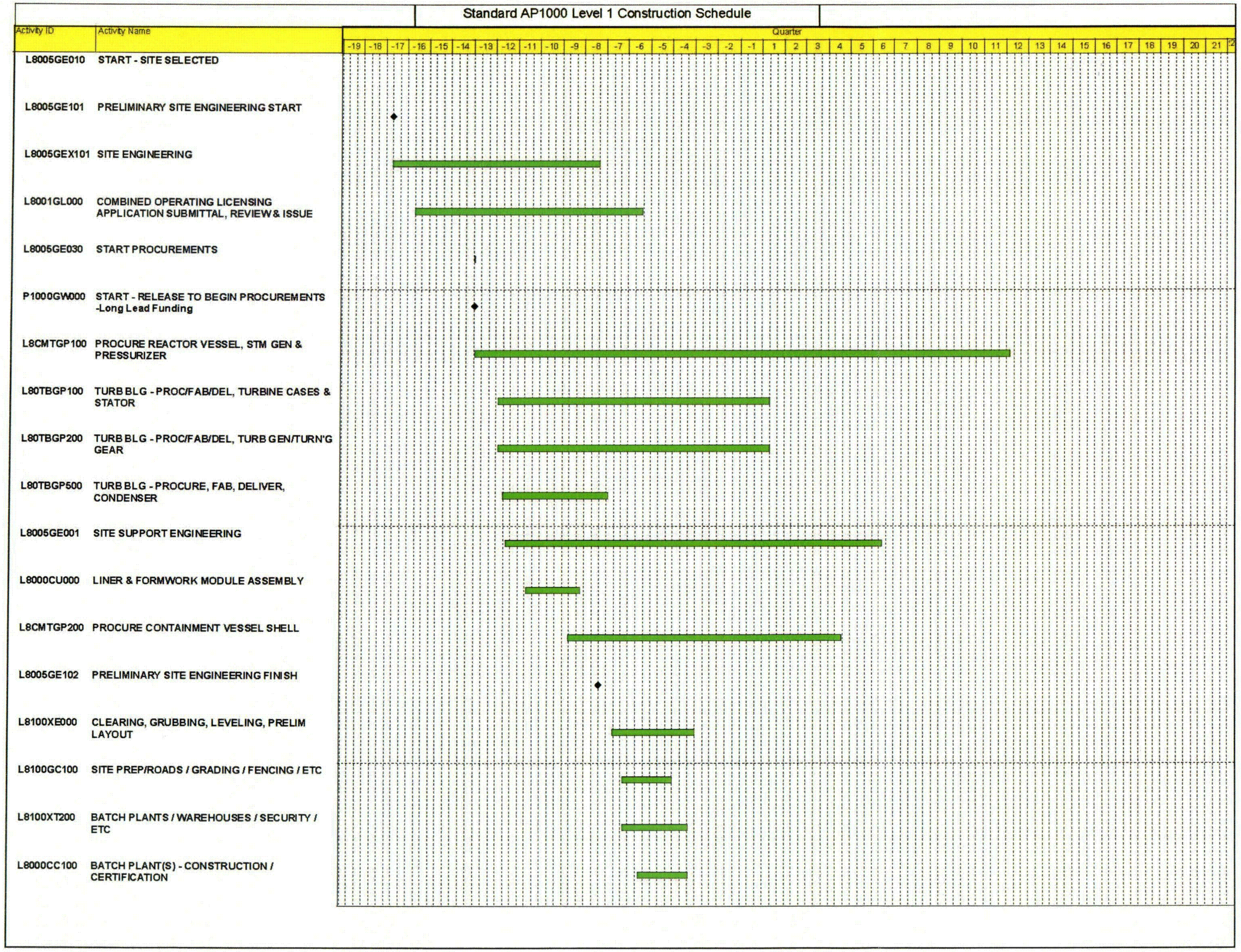

Standard AP1000 Level 1 Construction Schedule
Activity ID
Activity Name
Quarter
-19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
L8005GE010 START - SITE SELECTED
L8005GE101 PRELIMINARY SITE ENGINEERING START
L8005GEX101 SITE ENGINEERING
L8001GL000 COMBINED OPERATING LICENSING APPLICATION SUBMITTAL, REVIEW & ISSUE
L8005GE030 START PROCUREMENTS
P1000GW000 START - RELEASE TO BEGIN PROCUREMENTS -Long Lead Funding
L8CMTGP100 PROCURE REACTOR VESSEL, STM GEN & PRESSURIZER
L80TBGP100 TURB BLG - PROC/FAB/DEL, TURBINE CASES & STATOR
L80TBGP200 TURB BLG - PROC/FAB/DEL, TURB GEN/TURN'G GEAR
L80TBGP500 TURB BLG - PROCURE, FAB, DELIVER, CONDENSER
L8005GE001 SITE SUPPORT ENGINEERING
L8000CU000 LINER & FORMWORK MODULE ASSEMBLY
L8CMTGP200 PROCURE CONTAINMENT VESSEL SHELL
L8005GE102 PRELIMINARY SITE ENGINEERING FINISH
L8100XE000 CLEARING, GRUBBING, LEVELING, PRELIM LAYOUT
L8100GC100 SITE PREP/ROADS / GRADING / FENCING / ETC
L8100XT200 BATCH PLANTS / WAREHOUSES / SECURITY / ETC
L8000CC100 BATCH PLANT(S) - CONSTRUCTION / CERTIFICATION

Figure A1


Activity ID
Activity Name
Quarter
-19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
L8100XG700 FINAL GRADING / ROADS / DRAINAGE / CRANE PATH / ETC
L8020GL100 COMBINED OPERATING LICENSE RECEIPT
L85NIXE000 EXCAVATE - NUCLEAR ISLAND BASEMAT EL. 60'-6
L8100XT300 ASSEMBLY PLATTEN/CONTAINMENT VESSEL ERECT PADS
L8000CM000 REBAR MODULE ASSEMBLY
L8000TP100 FLUSHING - ALL Modules & Systems
L8001TA100 OPERATOR TRAINING
N0003CC000 PLACE CONCRETE NUCLEAR ISLAND BASEMAT
L80TBCR100 TURB BLG-FLR REB,EMBEDS,CONCR PLCMNTS TO EL 161'
T2203CC042 #1 - PLACE TURBINE BLG BASEMAT (CL 18-20)
C2163SU200 SET AND ALIGN CA20 MODULE ON BASEMAT A6
L80TBKT000 TURB BLG - FIELD ASSEMBLE CONDENSERS
L80TBKT100 TURB BLG - INSTALL CONDENSERS
L80TBMG100 TURB BLG -FLD ASSEM-SET STATOR,TURB GEN, TRNG GR
L8CMTSM200 SET CONTAINMENT VESSEL BOTTOM HEAD & GROUT
L8100CWS60 COOLING TOWER ERECTION WITH INTERNALS
L80TBCU100 TURB BLG - TURBINE PEDESTAL CONC PLACEMENT
L8DGBZ1000 DIESEL GENERATOR BUILDING CONSTRUCTION
L80TBSS200 TURB BLG - ROOF MODS, STEEL, CONCR & ROOFING

Figure A2


Activity ID
Activity Name
Quarter
-19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
L80TBPL000 TURB BLG - INSTALL CWS PIPING AND WATER BOXES
L8CMTSM100 CONTAINMENT VESSEL RING(S) ASSEMBLY
L8200GC100 PERMANENT SITE FACILITIES
C1103CA010 SET/ALIGN STRUCTL MODULE CA01
L8CMTSM107 SET/WELD CONTAINMENT RING # 1 (EL 104')
L80RWZ1000 RADWASTE BUILDING CONSTRUCTION
L8CMTTX100 FLUSH, HYDRO, START UP, & TEST SYSTEMS START
L8000TP000 HYDRO TESTING - ALL BUILDINGS
C1223PL070 PLACE MAIN LOOP PIPING
L8000TE000 CHAPTER 14 PRE-OPERATION ACTIVITIES
C1223MV070 SET - REACTOR VESSEL
C1103MB010 SET & Align STEAM GENERATOR 1 & 2
L8CMTKQ200 REACTOR INTERNALS & LOOP PIPING & Hydro (Pri Hydro)
L8CMTKQ100 SET REACTOR VESSEL, STEAM GEN & PRESSURIZER
L8000EL000 PERMANENT POWER
S0EC9TE120 ECS ENERGIZE MCC'S PERM POWTURB 117' & 135'
L80TBTX100 TURB BLG - HYDRO,FLUSH AND START UP & TESTING
L8000TP200 HEAT-UP / HOT FUNCTIONAL TEST
L8000TX400 STR'L INTEG.(SIT) & IN SERV LEAK RATE TEST(ILRT)

Figure A3

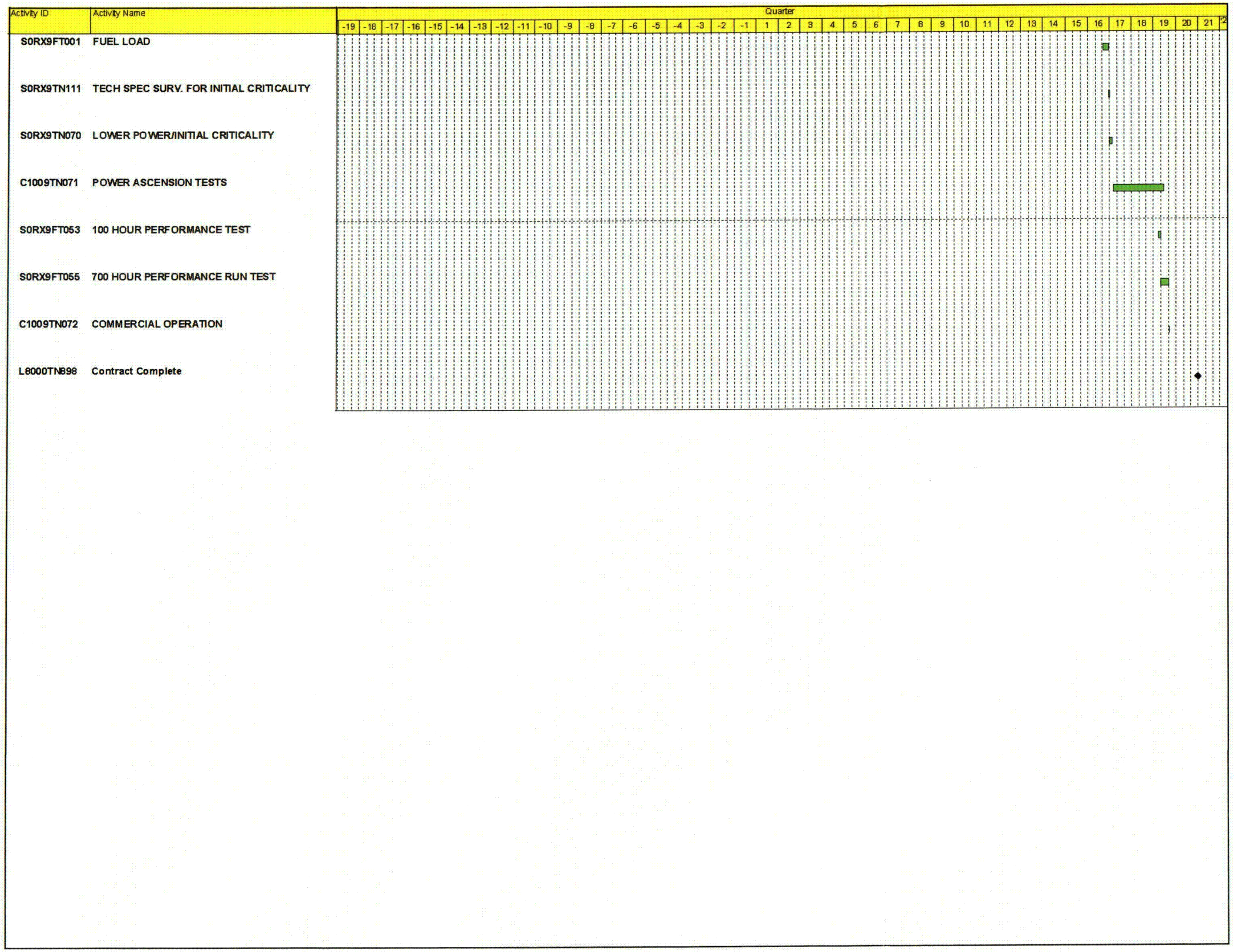

Activity ID
Activity Name
Quarter
-19 -18 -17 -16 -15 -14 -13 -12 -11 -10 -9 -8 -7 -6 -5 -4 -3 -2 -1 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
S0RX9FT001 FUEL LOAD
S0RX9TN111 TECH SPEC SURV. FOR INITIAL CRITICALITY
S0RX9TN070 LOWER POWER/INITIAL CRITICALITY
C1009TN071 POWER ASCENSION TESTS
S0RX9FT053 100 HOUR PERFORMANCE TEST
S0RX9FT055 700 HOUR PERFORMANCE RUN TEST
C1009TN072 COMMERCIAL OPERATION
L8000TN898 Contract Complete

Figure A4