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: 412-374-5005
e-mail: sterdia@westinghouse.com

Your ref: Project Number 740
Our ref: DCP/NRC1935

June 12, 2007

Subject: AP1000 COL Standard Technical Report Submittal of APP-GW-GLN-106, (TR 106), Revision 0

In support of Combined License application pre-application activities, Westinghouse is submitting AP1000 Standard Combined License Technical Report Number 106. This report identifies and justifies standard changes to the AP1000 Design Control Document (DCD). The changes to the DCD identified in Technical Report 106 are included in the proposed amendment to the AP1000 Design Certification Rule (DCD Revision 16). 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 NRC.

Pursuant to 10 CFR 50.30(b), APP-GW-GLN-106, Revision 0, "AP1000 Licensing Design Changes for Mechanical System and Component Design Updates," (Technical Report Number 106), is submitted as Enclosure 1 under the attached Oath of Affirmation.

It is expected that when the NRC review of Technical Report Number 123 is complete, the changes to the DCD identified in Technical Report 123 will be considered approved generically for COL applicants referencing the AP1000 Design Certification.

Questions or requests for additional information related to content and preparation of this report should be directed to Westinghouse. Please send copies of such questions or requests for additional information 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.

Westinghouse requests the NRC to provide a schedule for review of the technical report within two weeks of its submittal.

D079
D063

NRO

Very truly yours,

D. F. Hutchings for

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

/Attachment

1. "Oath of Affirmation," dated June 12, 2007

/Enclosure

1. APP-GW-GLN-106, Revision 0, "AP1000 Licensing Design Changes for Mechanical System and Component Design Updates," Technical Report Number 106

cc:	D. Jaffe	- U.S. NRC		1E	1A
	E. McKenna	- 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
	P. Fehring	- Westinghouse		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

B. 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

B. W. Bevilacqua
Vice President
New Plants Engineering

Subscribed and sworn to
before me this 12th day
of June 2007.

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

Debra McCarthy
Notary

ENCLOSURE 1

APP-GW-GLN-106, Revision 0

"AP1000 Licensing Design Changes for Mechanical System and Component Design Updates"

Technical Report 106

AP1000 DOCUMENT COVER SHEET

TDC: ________ Permanent File: ________ APY: ________

RFS#: ________ RFS ITEM #: ________

AP1000 DOCUMENT NO.	REVISION NO.		ASSIGNED TO
APP-GW-GLN-106	0	Page 1 of ~~49~~ 50 (ATP 6/5/07)	W- Quinn

ALTERNATE DOCUMENT NUMBER: TR-106 WORK BREAKDOWN #:

ORIGINATING ORGANIZATION: WEC-NPP

TITLE: **AP1000 Licensing Design Changes for Mechanical System and Component Design Updates**

ATTACHMENTS:	DCP #/REV. INCORPORATED IN THIS DOCUMENT REVISION: APP-GW-GEE-049, APP-GW-GEE-050, APP-GW-GEE-170, APP-GW-GEE-185, APP-GW-GEE-205, APP-GW-GEE-206, APP-GW-GEE-221, APP-GW-GEE-230, APP-GW-GEE-241, APP-GW-GEE-245, APP-GW-GEE-256, APP-GW-GEE-257, APP-GW-GEE-259, APP-GW-GEE-262, APP-GW-GEE-270,
CALCULATION/ANALYSIS REFERENCE:	

ELECTRONIC FILENAME	ELECTRONIC FILE FORMAT	ELECTRONIC FILE DESCRIPTION
APP-GW-GLN-106.doc	MSWord	

☒ 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 Eric S. Gillen	SIGNATURE/DATE Eric S. Gillen 6/5
PATENT REVIEW Mike Corletti	SIGNATURE/DATE M. M. Corletti 6/5/07

☐ WESTINGHOUSE PROPRIETARY CLASS 2

ORIGINATOR P. J. Fehring	SIGNATURE/DATE 6/4/07	
REVIEWERS A. J. Preston	SIGNATURE/DATE A J Preston 6/4/2007	
VERIFIER J. M. Iacovino	SIGNATURE/DATE (Sign) JM Iacovino/KR 6/4/07	VERIFICATION METHOD Page by page review
AP1000 RESPONSIBLE MANAGER K. P. Quinn	SIGNATURE* K. P. Quinn	APPROVAL DATE 6/4/07

* 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-GLN-106
Revision 0

June 2007

AP1000 Standard Combined License Technical Report

Title: AP1000 Licensing Design Changes for Mechanical System and Component Design Updates

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

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Brief Description of the change (what is being changed and why):

The changes within this Technical Report are a compilation of approved design changes to AP1000 Mechanical Systems and Component Designs that have not been previously submitted via Technical Report, under individual header. This document is sectioned to identify all Mechanical Systems and Components changes that have been approved by the Westinghouse Change Control Board, have not been submitted in previous Technical Reports, and have a direct impact on the Design Control Document (DCD). Each change will be individually identified within this document and correlated to the DCD, as appropriate. A list of these identified items is in Section II Table 1.1. It is expected that all changes described within this document will be incorporated into Revision 16 of the DCD.

Section I of this document is a determination of applicability.
Section II of this document details the justification for these changes.
Section III of this document identifies changes to the DCD.
Section IV of this document identifies the regulatory impact of these changes.

I. APPLICABILITY DETERMINATION

This evaluation is prepared to document that the changes described above are a departure from information in the AP1000 Design Control Document (DCD) that may be included in plant specific FSARs without prior NRC approval.

A.	Does the proposed change include a change to:		
	1. Tier 1 of the AP1000 Design Control Document APP-GW-GL-700	☐ NO ☒ YES	(If YES prepare a report for NRC review of the changes)
	2. Tier 2* of the AP1000 Design Control Document, APP-GW-GL-700	☐ NO ☒ YES	(If YES prepare a report for NRC review of the changes)
	3. Technical Specification in Chapter 16 of the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare a report for NRC review of the changes)
B.	Does the proposed change involve:		
	1. Closure of a Combined License Information Item identified in the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare a COL item closure report for NRC review.)
	2. Completion of an ITAAC item identified in Tier 1 of the AP1000 Design Control Document, APP-GW-GL-700	☒ NO ☐ YES	(If YES prepare an ITAAC completion report for NRC review.)

☐ The questions above are answered no, therefore the departure from the DCD in a COL application does not require prior NRC review unless review is required by the criteria of 10 CFR Part 52 Appendix D Section VIII B.5.b or B.5.c.

II. TECHNICAL DESCRIPTION AND JUSTIFICATION

This section provides a description and justification of DCD changes that are covered in this Technical Report. [1.0 Introduction] provides Table 1.1, which outlines each Design Change, it's revision, and what section of the DCD is impacted. [2.0 Design Change Descriptions] has items that are numbered in accordance with the numbering of Table 1.1. Each Design Change has it's own description in this section.

1.0 Introduction

TABLE 1.1
Summary of Design Changes Incorporated into APP-GW-GLN-106

No.	Title	Tier 1 DCD Impact	Tier/ Section Impacted
2.a	Design Change 049: Stainless Steel Surfaces for CA Modules	No	Tier 2 Sections 3.8.3.6, 6.1.1.3, Table 3.8.4-6
2.b	Design Change 050: Cask Handling Crane Upgrade	Yes	Tier 1 Section 2.3.5, Tables 2.3.5-1, 2.3.5-2, 2.3.5-3; Tier 2 Sections 9.1.5, 9.1.5.1, 9.1.5.2, 9.1.5.3, Table 3.2-3;
2.c	Design Change 170: Polar Crane Design	No	Tier 2 Tables 9.1-5, 9.1.5-2, 9.1.5-3;
2.d	Design Change 185: IHP Design	No	Tier 2 Figure 3.9-7;
2.e	Design Change 205: Correction of Dose Reduction features of O-Ring	No	Tier 2 Table 12.4-11;
2.f	Design Change 206: New Fuel Storage Pit Fuel Assembly Drop	No	Tier 2 Section 9.1.1.2.1
2.g	Design Change 221: Crane Capacity for New Fuel Handling Crane	No	Tier 2 Sections 9.1.1.1, 9.1.1.2, 9.1.1.2.1, 9.1.1.3;
2.h	Design Change 230: CRDM Material/ Manufacturing changes	No	Tier 2 Sections 4.5.1.1, 4.5.1.3;
2.i	Design Change 241: Cask Handling Crane Design	No	Tier 2 Section 9.1.5;

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

TABLE 1.1 (continued)
Summary of Design Changes Incorporated into APP-GW-GLN-106

No.	Title	Tier 1 DCD Impact	Tier/ Section Impacted
2.j	Design Change 245: RCP Flywheel Material Changes	No	Tier 2 Section 5.4.1.3.6.3;
2.k	Design Change 256: Maintenance Hatch Hoist Design	Yes	Tier 1 Section 2.3.5 Tables 2.3.5-1, 2.3.5-2, 2.3.5-3; Tier 2 Sections 9.1.5.1, 9.1.5.2, Table 3.2-3;
2.l	Design Change 257: RV Coating before Shipping	No	Tier 2 Sections 5.3.4.5, 19.34.2.1, 19.39.10.3, Appendix 19B;
2.m	Design Change 259: Revision of Load Follow Design Transient	No	Tier 2 Sections 3.9.1.1.1.4 3.9.1.1.1.19,Table 3.9-1;
2.n	Design Change 262: Non Safety Related Classification for AP1000 Fuel Handling Equipment	No	Tier 2 Sections 3.2.2.5, 3.2.2.6, Table 3.2-5, & Section 9.1.2.3
2.o	Design Change 270: Polar Crane and Cask Handling Crane Design References	No	Tier 2 Sections 9.1.5.1.2, 9.1.5.2, 9.1.5.2.1.1, 9.1.5.2.1.2, 9.1.5.2.2.2 Table 3.2-3
2.p	Fuel Handling Machine - Description	No	Tier 2 Section 9.1.4.3.3

Table 1.2 in Section III of this document, shows the locations of Sections Impacted to the DCD Revision 15.

2.0 Design Change Descriptions

2.a Design Change 049, Stainless Steel Surfaces for CA Modules:

Structural modules for the AP1000 consists of steel face plates connected by steel trusses. The primary purpose of the trusses is to stiffen and hold together the face plates during handling, erection, and concrete placement. Surfaces of the CA structural modules exposed to water are currently specified in the DCD as Nitronic stainless steel plate (ASTM A240 XM-29, S24000). Due to availability issues (the size of Nitronic stainless steel plate needed) surfaces specified to be Nitronic stainless steel plate has been changed to specify Duplex 2101 stainless steel which has similar corrosion resistance and ease of weldability.

The change to a generic fuel handling machine description has resulted in updates to the following subsections of the DCD:

- Tier 2 Sections 3.8.3.6, 6.1.1.3, Table 3.8.4-6

2.b Design Change 050, Cask Handling Crane Upgrade:

The AP1000 cask handling crane design was neither seismically qualified, nor single failure proof (SFP) to protect against dropping a cask. This event could cause significant plant damage, therefore a design change was initiated to upgrade the cask handling crane to SFP. This change is considered to reduce the possibility of a serious plant event.

The cask handling crane design change has resulted in updates to the following subsections of the DCD:

- Tier 1: Section 2.3.5, Tables 2.3.5-1, 2.3.5-2, 2.3.5-3
- Tier 2 Sections 9.1.5, 9.1.5.1, 9.1.5.2, 9.1.5.3, Table 3.2-3

2.c Design Change 170, Polar Crane Design:

The critical lift for the Polar Crane is the lifting of the Integrated Head Package from the Reactor Vessel Head to the in-containment storage stand during a refueling outage. The critical lift weight for the Polar Crane has been increased from 275 tons to 300 tons to ensure adequate lifting margin. The main hook on the Polar Crane will be used to install and remove the Reactor Coolant Pumps. The auxiliary hook on the Polar Crane has been reduced from 75 tons to 25 tons now that it no longer being used to install and remove the Reactor Coolant Pumps.

The polar crane design change has resulted in updates to the following subsections of the DCD:

- Tier 2: Tables 9.1-5, 9.1.5-2, 9.1.5-3

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

2.d Design Change 185, IHP Design:

One of the functions of the Integrated Head Package is to provide cooling to the CRDMs. A design change has been made to the CRDM cooling system to reduce the system pressure drop and CRDM air flow exit temperature. This has been achieved by removing the internal baffles that caused a high pressure drop. The CRDM airflow now is sucked in through the CRDM inspection doors, past the CRDMs and exits near the top of the IHP shroud. The airflow path is shown in the Figure 1 below. Figure 1 below supersedes the figure originally provided as part of the response to RAI TR61-01. TR 61 is Westinghouse document APP-GW-GLN-014, Revision 0 "AP1000 Integrated Head Package."

The IHP design change has resulted in updates to the following subsections of the DCD:

- Tier 2: Figure 3.9-7

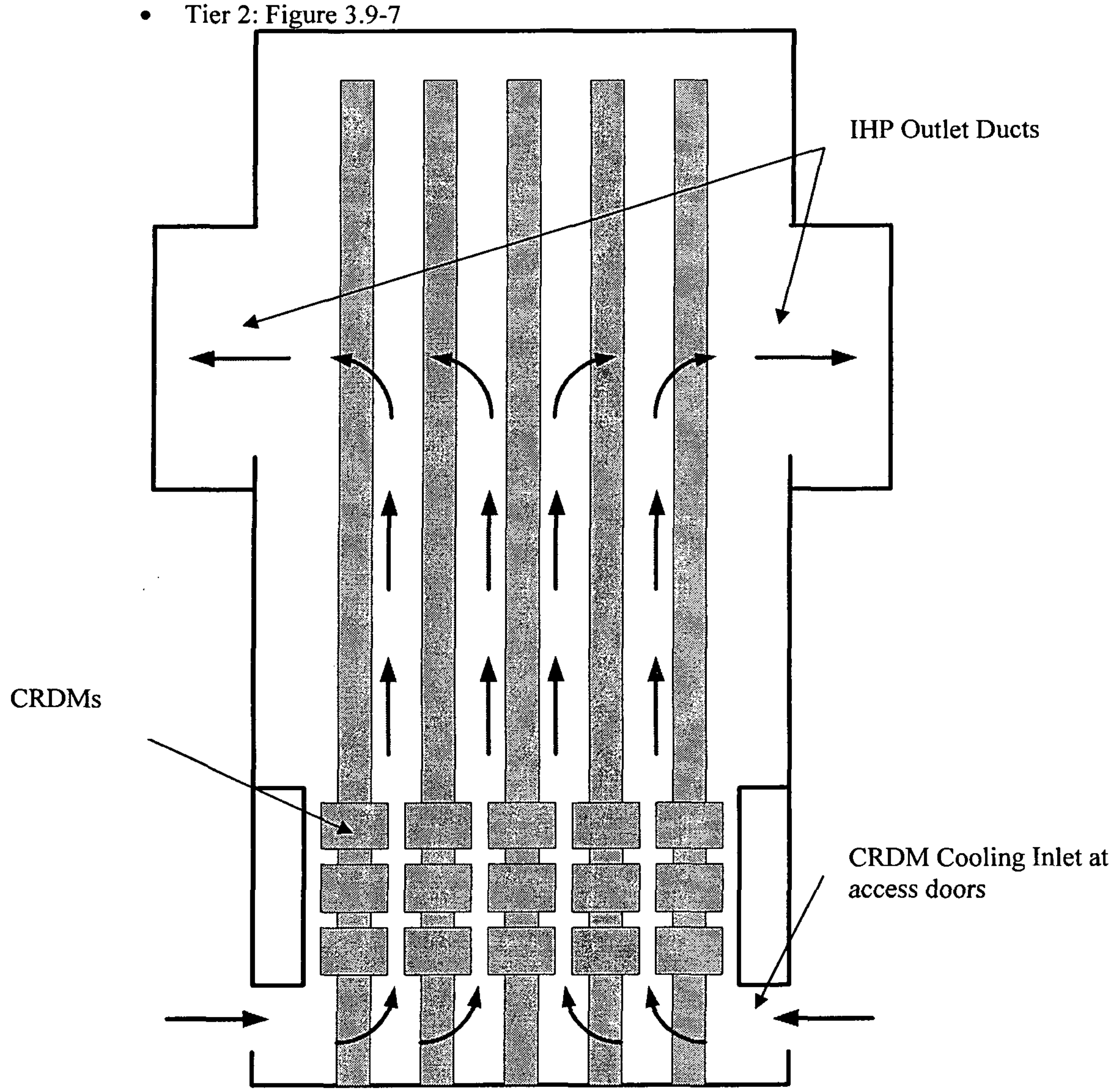


Figure 1 CRDM Cooling Air Flow Path in IHP

2.e Design Change 205, Correction of Dose Reduction features of O-Ring:

O-Rings must be held to the closure head flange during head lift. A design was developed in industry during the 1980's to replace the screw and tab O-ring holder called the "spring clip." This design was found to not be reliable and failed to hold the O-Ring in place. It has been abandoned, and the screw and tab design will be implemented in the AP1000 design.

The change in a design feature of the closure head O-ring has resulted in updates to the following table of the DCD:

- Tier 2: Table 12.4-11

2.f Design Change 206, New Fuel Storage Pit Fuel Assembly Drop:

Westinghouse ships its control rod assemblies in new fuel assemblies. DCD Revision 15 gives the bounding new fuel assembly drop onto the new fuel storage rack as a fuel assembly plus a handling tool. This is not the bounding drop weight. The bounding drop weight is a new fuel assembly plus control rod assembly and handling tool at their upper manufacturing tolerance (+1.5%). The bounding drop weight for the new fuel rack drop is 2,027 pounds. This drop weight was used in Westinghouse Calculation APP-FS02-Z0C-001, Revision 0, "Analysis of AP1000 fuel Storage Racks Subjected to Fuel Drop Accidents" and COLA Technical Report APP-GW-GLR-026, Revision 0, "New Fuel Storage Rack Structural/Seismic Analysis."

The design change to a new fuel storage pit fuel assembly drop has resulted in updates to the following subsections of the DCD:

- Tier 2: Section 9.1.1.2.1

2.g Design Change 221, Crane Capacity for New Fuel Handling Crane:

The Fuel Handling Jib Crane is used to move new fuel assemblies to the new fuel rack in the new fuel storage pit and to move new fuel assemblies stored in this rack to the new fuel elevator in the spent fuel pool. This crane is undergoing final design changes to optimize its operation. Westinghouse has changed from the name Fuel Handling Jib Crane to New Fuel Handling Crane as the final crane specified may not be a jib crane. The new fuel handling crane capacity has been increased to lift a new fuel assembly, control rod assembly and handling tool (total weight of 2,027 lbs.)

The design changes to the fuel handling crane have resulted in updates to the following subsections of the DCD:

- Tier 2: Section 9.1.1.1, 9.1.1.2, 9.1.1.2.1, 9.1.1.3

2.h Design Change 230, CRDM Material/ Manufacturing changes:

Approved Design Change Proposal (DCP) APP-GW-GEE-230, CRDM Material/Manufacturing Changes, Revision 2.

The previous design of the control rod drive mechanisms (CRDMs) as described in Section 4.5 of the AP1000 Design Control Document (Rev. 15) was based on a design utilized in past Westinghouse plants to achieve a design life of 3 million steps. In order to meet the design life of 8 million steps it was necessary to make improvements to the CRDM design.

To improve the cycle life of the AP1000 CRDM's, the latches have been re-designed using a double tooth design constructed of solid stellite. The previous design utilized a single tooth design which was constructed of stainless steel hard-faced with stellite.

Aerospace Material Specification (AMS) in Section 4.5 have also been corrected to allow for current versions of the specifications to be used.

The CRDM material and manufacturing design change has resulted in updates to the following subsections of the DCD:

- Tier 2: Section 4.5.1.1, 4.5.1.3

2.i Design Change 241, Cask Handling Crane Design:

This change is to allow for the Cask Handling Crane to be operated by radio remote control, vice operator's cab, to allow for an unobstructed view of the load at all times. Special consideration was given to loads being lifted and lowered out of and into the truck/rail bay.

This change also specifies the addition of a Single Failure Proof Auxiliary Hoist (10 ton capacity) to aid in more safe load transfer operation in the Auxiliary Building.

The cask handling crane design change has resulted in updates to the following subsections of the DCD:

- Tier 2 Section 9.1.5

2.j Design Change 245, RCP Flywheel Material Changes:

Currently, Section 5.4.1.3.6.3 of the AP1000 Design Control Document (Rev. 15) specifies that the flywheel assembly will use endplates and a thin outer shell constructed of Alloy 690 to seal the structural components of the flywheel from primary reactor coolant. The Alloy 690 endplates and shell do not act as a pressure boundary or contribute to the structural integrity of the flywheel assembly per.

The canned motor reactor coolant pump supplier has proposed to change the material used to seal the flywheel assembly from primary coolant from Alloy 690 to another corrosion resistant alloy (Alloy 625). The material has been changed due to the need for a corrosion resistant alloy with a low CTE (coefficient of thermal expansion) that can be welded without requiring a PWHT (post weld heat treatment). Section 5.4.1.3.6.3 of the AP1000 Design Control Document will be updated to describe the canning material for the flywheel as a corrosion resistant alloy. Ni/Fe/Cr Alloy 600 will not be an acceptable material for this application. This change will be incorporated into the markup of the Section 5.4.1.3.6.3 already shown in and will help meet the intent of which was to create a generic reactor coolant pump design description that would facilitate other future reactor coolant pump suppliers.

The flywheel assembly design change has resulted in updates to the following subsections of the DCD:

- Tier 2: Section 5.4.1.3.6.3

2.k Design Change 256, Maintenance Hatch Hoist Design:

The Maintenance Hatch Hoist (10 ton capacity) is not specified in the DCD as single failure proof (SFP). For personnel and equipment safety reasons, this hatch design has been changed to be SFP.

The maintenance hatch hoist design change has resulted in updates to the following subsections of the DCD:

- Tier 1 Section 2.3.5, Tables 2.3.5-1, 2.3.5-2, 2.3.5-3
- Tier 2 Sections 9.1.5.1.1, 9.1.5.1.2, 9.1.5.2, Table 3.2-3

2.l Design Change 257, RV Coating before Shipping:

The DCD currently states that all carbon steel surfaces are painted with a heat-resistance paint before shipment. Heat resistant paint implies that the paint will stay on during operation. Paint is not desirable on the RV surface during operation due to the insulating and non-wettable propertites of paint. Paint provides insulation impeding heat transfer and a painted smooth surface cause DNB problems. Experience from the Replacement Reactor Vessel Closure Head Program has shown that external paint coatings have been difficult in removal. For the AP1000 design, paint will be replaced with strippable heat shrink wrapping to meet shipping requirements.

The change in reactor vessel coatings has resulted in updates to the following subsections of the DCD:

- Tier 2 Sections 5.3.4.5, 19.34.2.1, 19.39.10.3, Appendix 19B

2.m Design Change 259, Revision of Load Follow Design Transient:

During fatigue analyses of reactor internals component an evaluation of the reactor coolant system design transients was performed to determine the major impacts to the usage factor. The assessment of the design transients showed that the Unit Loading/Unloading at 5% of Full Power per Minute transients were one of the largest contributors to the fatigue usage factor. This transient represents load follow operations for the plant. The current definition of the transient is that the unit loading and unloading operations are represented by continuous and uniform ramp power changes of 5 percent per minute between 15% and 100% power. The number of loading and unloading operations is defined as 19,800 each, based on one swing per day during the 60-year life of the plant and on the asumption of a 90-percent availability factor.

The currently defined transient is very conservative in that it assumes a load follow scenario in which the plant cycles between 15 and 100% load every day the plant is in operation. The plant load follow scenario defined in the EPRI Utility Requirements Document (URD) (Reference 2, Chapter 1, Section 3.4.1.1) is that the plant starts at 100% power, ramps down to 50% in two hours, the power remains at 50% for two to ten hours, and then ramps up to 100% power in two hours. The power remains at 100% for the remainder of the 24-hour cycle. This load follow scenario is assumed to occur over 90% of the plant life (URD Chapter 1, Section 3.4.1.2) Both the ramp rate and the overall range of this load follow scenario are much more representative of possible plant load follow operations than the currently defined design transient.

To incorporate the more realistic design transient, the definition of the Unit Loading and Unloading transients is modified by defining two separate design transients. The currently defined Unit Loading and Unloading transients remain except that the number of occurences is decreased to 2000 over the life of the plant. Most Upset, Emergency, and Faulted Condition transients are assumed to result in an unloading to the no-load conditions. If these events occur, subsequent return to power must be at the normal loading rate. The 2000 occurences includes loading/unloading from normal plant startup and loading resulting from all service level B, C, and D transients that result in a reactor trip.

A new design transient is defined to cover the daily load follow operations. This transient is be defined as in the EPRI URD load follow scenario given above except that the 50% load changes are assumed to conservatively occur over one hour instead of two. The number of occurrences are revised to 17,800 over the plant life (that is 17,800 full cycles of unloading and loading between 50% and 100% power).

The combined number of occurrences for the unit loading and unloading transients and the daily load follow transient is 19,800 of the plant life, which is the same number of occurences currently allocated to the Unit Loading and Unloading transients.

The revision to the design transients results in changes to the following AP1000 DCD Revision 15 subsections:

- Tier 2 Subsection 3.9.1.1.1.4
- Tier 2 Subsection 3.9.1.1.1.19 (New subsection located after subsection 3.9.1.1.1.18)
- Table 3.9-1

2.n Design Change 262, Non Safety Related Classification for AP1000 Fuel Handling Equipment:

This change is made to re-classifying the fuel handling machine and spent fuel handling tool as AP1000 Class D Non Safety-Related, Seismic Category II from the existing DCD, Rev.15 Safety Class C, Seismic Category I.

Justification included verification that **ANSI/ANS 57.1**, Section 6.2, classifies all fuel handling equipment, excluding the portion of the Fuel Transfer Tube that serves as the primary reactor containment boundary, as Non-Nuclear Safety (NNS). Fuel handling equipment is to be designed and fabricated according to the applicable commercial codes and standards.

ANSI/ANS 51.1, Section 3.3.1.4, defines the Non-Nuclear Safety classification. The most applicable functions performed by NNS equipment that are listed in this section are:

A. Resist failure that could prevent any SC-1, -2, or -3 equipment from performing its nuclear safety function (Item e),
B. **Handle spent fuel, the failure of which could result in fuel damage such that significant quantities of radioactive material could be released from the fuel (Item j), and**
C. Ensure reactivity control of stored fuel (Item k),

ANSI/ANS 51.1, Section 4.13.1, discusses Fuel Storage and Handling safety functions. "The nuclear safety function of the fuel storage and handling systems is to ensure adequate cooling in the spent fuel pool to maintain stored fuel within acceptable temperature limits. **The Non-Nuclear Safety functions of the fuel storage system are to (1) control fuel storage positions to assure a geometrically safe configuration with respect to criticality, (2) ensure adequate shielding or irradiated fuel for plant personnel to accomplish normal operations, (3) prevent mechanical damage to the stored fuel that could result in significant release of radioactivity from the fuel, and (4) provide means for the safe handling of new and irradiated fuel assemblies."**

Per **ANSI/ANS 51.1,** Section 4.13.5, the design of fuel handling equipment should be per **ANSI/ANS 57.1.**

ANSI/ANS 51.1, Table A-1 below summarizes the classifications of the Fuel Storage and Handling System.

Table A-1 (Continued)
Equipment Classification

Section	Principal Equipment	Safety Class(a)	Quality Assurance Requirement(b)	Principal Construction Code(c)	Seismic Requirement(d)	Safety Class Definition Reference	Special Requirement Reference
4.13	Fuel Storage and Handling						
	a. New fuel storage racks	NNS	D	X	SSE	3.3.1.4k.	
	b. Spent fuel storage racks	NNS	D	X	SSE	3.3.1.4k.	
	c. Refueling machine	NNS	D	X	NA	3.3.1.4h.	
	d. Spent fuel storage pool	3	B	X	SSE	3.3.1.3j.	
	e. Vessels, filter and demineralizer	NNS	D	VIII	NA	3.3.1.4a.	
	f. Heat exchangers	3	B	III-3 and TEMA-C (***)	SSE	3.3.1.3j.	
	g. Piping and valves for cooling system	3	B	III-3	SSE	3.3.1.3j.	
	h. Pumps for cooling system	3	B	III-3	SSE	3.3.1.3j.	
	i. Piping and valves for demineralizer system	NNS	D	B31.1 (*)	NA	3.3.1.4a.	
	j. Fuel building	3	B	Table 3-8	SSE	3.3.1.3k.	

Most plant FSARs refer to the fuel handling equipment as a light load handling system, and they refer to ANSI/ANS 57.1, for guidance. FSARs also discuss the NRC required drop analyses previously performed for the fuel handling equipment. These analyses determine the impact of a dropped fuel handling tool or mast and a fuel assembly from a height greater than the maximum lift height of the hoisting system. The calculations consider drops with both vertical and horizontal orientations. It has been demonstrated by these analyses that the accidents do not exceed the 10 CFR Part 100 limits. For the AP1000 plant, this safety evaluation is specified for the spent fuel racks in DCD section 9.1.2.3. and for the light load fuel handling system in Section 15.7.4.

Most FSARs classify the fuel handling equipment as Non Safety-Related with some exceptions, on a plant specified basis. Examples from two advance plant designs were verified as follows:

The GE ESBWR Passive Plant DCD (FSAR) was verified that the safety classification for the Refueling Machine and the Fuel Handling Machine is Nonsafety-related and designated "N". Tier 2, Chapter 3, Table 3.2-1 list the RM and FHM as Nonsafety, Seismic Category II. Tier 2, Chapter 9, Table 9.1-4 list the RM and FHM as Nonsafety, Seismic Category II.

The ABB/CE System 80+ Advance Plant DCD (FSAR) was verified that the safety classification are as follows: According to Table 3.2-1 Classification of Structures, Systems, and Components most of the fuel handling system is listed as Non-Nuclear Safety and Seismic Category 2 or Non-Seismic. The only components that are listed otherwise are the following: Fuel Transfer Tube Quick Closure, Safety Class 2, Seismic Category I, Spent Fuel Racks, Safety Class 3, Seismic Category I, New Fuel Racks, Safety Class 3, Seismic Category I.

The design change for the safety and seismic classifications for AP1000 fuel handling equipment has resulted in updates to the following subsections of the AP1000 DCD:

- Tier 2 Sections 3.2.2.5, 3.2.2.6, Table 3.2-3, and Section 9.1.2.3.

2.o Design Change 270, Polar Crane and Cask Handling Crane Design References:

As the DCD reads now, the Polar crane design would adhere to strictly to ASME NOG-1. This design change corrects wording to state that the Polar crane is designed in accordance with the guidelines of NRC's approved NUREG-0554 supplemented by ASME NOG-1.

This proposed change is important to the size, and weight of the Polar crane as well as its static and seismic loads on the Containment Vessel. The current design utilizes a single failure proof (SFP) crane design that is accepted by the NRC as compliant with NUREG-0554 supplemented by ASME NOG-1. The current (original) wording of the DCD has not been updated to reflect the current design, and the purpose of this Design Change is to do so.

The Cask handling crane design basis will be revised to be consistent with the Polar crane wording. Note that the cask handling crane design was updated to be single-failure proof and seismic by approved change noted in item 2a of this document. It states this crane is designed in accordance with NUREG-0554, however the words "supplemented by NOG-1" were not included.

This change also corrects wording for the Polar crane be changed from "pendant controls" to "remote control" as a secondary means of control. This would ensure consistency in design and operations of the two single-failure proof cranes (Polar and Cask handling).

The Polar crane and Cask Handling Design References design change has resulted in updates to the following subsections of the DCD:

- Tier 2 Sections 9.1.5.1.2, 9.1.5.2, 9.1.5.2.1.1, 9.1.5.2.1.2, 9.1.5.2.2.2
- Tier 2 Table 3.2-3

2.p Fuel Handling Machine, Generic Description:

Tier 2 DCD Section 9.1.4.3.3 change as follows: "*The fuel handling machine ~~is the same design~~ has the same design functions as the refueling machine and includes the same safety features*." This change is made to provide flexibility in the design of the fuel handling system.

The change to a generic fuel handling machine description has resulted in updates to the following subsections of the DCD:

- Tier 2 Section 9.1.4.3.3

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

III. DCD MARK-UP

This section identifies the items previously discussed in Section II of this document. These changes to the AP1000 DCD Revision 15 are necessary to incorporate, and the following pages identify each change.

Table 1.2
Impacted DCD Sections

Impacted Section			Page of TR106		Impacted Section			Page of TR106
Tier 1	Section	2.3.5	Pg. 15		**Tier 2**	Section	9.1.1.3	Pg. 30
	Table	2.3.5-1	Pg. 15			Section	9.1.2.3	Pg. 30
	Table	2.3.5-2	Pg. 16			Section	9.1.4.3.3	Pg. 30
	Table	2.3.5-3	Pg. 17			Section	9.1.5	Pg. 30
Tier 2	Section	3.2.2.5	Pg. 18			Section	9.1.5.1.1	Pg. 31
	Section	3.2.2.6	Pg. 18			Section	9.1.5.1.2	Pg. 31
	Table	3.2-3	Pg. 19			Section	9.1.5.2	Pg. 32
	Section	3.8.3.6	Pg. 21			Section	9.1.5.2.1.1	Pg. 32
	Table	3.8.4-6	Pg. 21			Section	9.1.5.2.1.2	Pg. 32
	Section	3.9.1.1.1.4	Pg. 22			Section	9.1.5.2.2	Pg. 33
	Section	3.9.1.1.1.19	Pg. 22			Section	9.1.5.2.2.1	Pg. 33
	Table	3.9-1	Pg. 23			Section	9.1.5.2.2.2	Pg. 33
	Figure	3.9-7	Pg. 24			Section	9.1.5.2.2.3	Pg. 34
	Section	4.5.1.1	Pg. 26			Section	9.1.5.3	Pg. 36
	Section	4.5.1.3	Pg. 26			Table	9.1-5	Pg. 37
	Section	5.3.4.5	Pg. 27			Table	9.1.5-2	Pg. 38
	Section	5.4.1.3.6.3	Pg. 27			Table	9.1.5-3	Pg. 39
	Section	6.1.1.3	Pg. 28			Table	12.4-11	Pg. 40
	Section	9.1.1.1	Pg. 28			Section	19.34.2.1	Pg. 41
	Section	9.1.1.2	Pg. 28			Section	19.39.10.3	Pg. 41
	Section	9.1.1.2.1	Pg. 28			Appendix	19B	Pg. 41

TIER 1

Revise Section 2.3.5 as follows:

2.3.5 Mechanical Handling System

Design Description

The mechanical handling system (MHS) provides for lifting heavy loads. The MHS equipment can be operated during shutdown and refueling.

The component locations of the MHS are as shown in Table 2.3.5-3.

1. The functional arrangement of the MHS is as described in the Design Description of this Section 2.3.5.
2. The seismic Category I equipment identified in Table 2.3.5-1 can withstand seismic design basis loads without loss of safety function.
3. The MHS provides the following safety-related functions:

a) The containment polar crane prevents the uncontrolled lowering of a heavy load.

b) The cask handling crane prevents the uncontrolled lowering of a heavy load.

~~b)~~**c)** The equipment hatch hoist prevents the uncontrolled lowering of a heavy load.

d) The maintenance hatch hoist prevents the uncontrolled lowering of a heavy load

Revise Table 2.3.5-1 as follows:

Table 2.3.5-1

Equipment Name	Tag No.	Seismic Cat. I	Class 1E/ Qual. for Harsh Envir.	Safety Function
Containment Polar Crane	MHS-MH-01	Yes	No/No	Avoid uncontrolled lowering of heavy load.
Cask Handling Crane	**MHS-MH-02**	**Yes**	**No/No**	**Avoid uncontrolled lowering of heavy load.**
Equipment Hatch Hoist	MHS-MH-05	Yes	No/No	Avoid uncontrolled lowering of heavy load.
Maintenance Hatch Hoist	**MHS-MH-06**	**Yes**	**No/No**	**Avoid uncontrolled lowering of heavy load.**

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise Table 2.3.5-2 as follows:

Table 2.3.5-2
Inspections, Tests, Analyses, and Acceptance Criteria

Design Commitment	Inspections, Tests, Analyses	Acceptance Criteria
1. The functional arrangement of the MHS is as described in the Design Description of this Section 2.3.5.	Inspection of the as-built system will be performed.	The as-built MHS conforms with the functional arrangement as described in the Design Description of this Section 2.3.5.
2. The seismic Category I equipment identified in Table 2.3.5-1 can withstand seismic design basis loads without loss of safety function.	i) Inspection will be performed to verify that the seismic Category I equipment identified in Table 2.3.5-1 is located on the Nuclear Island.	i) The seismic Category I equipment identified in Table 2.3.5-1 is located on the Nuclear Island.
	ii) Type tests, analyses, or a combination of type tests and analyses of seismic Category I equipment will be performed.	ii) A report exists and concludes that the seismic Category I equipment can withstand seismic design basis loads without loss of safety function.
	iii) Inspection will be performed for the existence of a report verifying that the as-installed equipment including anchorage is seismically bounded by the tested or analyzed conditions.	iii) A report exists and concludes that the as-installed equipment including anchorage is seismically bounded by the tested or analyzed conditions.
3.a) The containment polar crane prevents the uncontrolled lowering of a heavy load.	Load testing of the main and auxiliary hoists that handle heavy loads will be performed. The test load will be at least equal to the weight of the reactor vessel head and integrated head package.	The crane lifts the test load, and lowers, stops, and holds the test load with the hoist holding brakes.
3.b) The cask handling crane prevents the uncontrolled lowering of a heavy load.	**Load testing of the main hoist will be performed. The test load will be at least equal to the weight of the spent fuel shipping cask.**	**The crane lifts the test load, and lowers, stops, and holds the test load with the hoist holding brakes.**

3.c) The equipment hatch hoist prevents the uncontrolled lowering of a heavy load.	Testing of the redundant hoist holding mechanisms for the equipment hatch hoist that handles heavy loads will be performed by lowering the hatch at the maximum operating speed.	Each hoist holding mechanism stops and holds the hatch.
3.d) The maintenance hatch hoist prevents the uncontrolled lowering of a heavy load.	**Testing of the redundant hoist holding mechanisms for the maintenance hatch hoist that handles heavy loads will be performed by lowering the hatch at the maximum operating speed.**	**Each hoist holding mechanism stops and holds the hatch.**
4. The ~~spent fuel shipping~~ cask **handling** crane cannot move over the spent fuel pool.	Testing of the ~~spent fuel shipping~~ cask **handling** crane is performed.	The spent fuel shipping cask crane does not move over the spent fuel pool.

Revise Table 2.3.5-3 as follows:

Table 2.3.5-3		
Component Name	**Tag No.**	**Component Location**
Containment Polar Crane	MHS-MH-01	Containment
Cask Handling Crane	MHS-MH-02	Auxiliary Building
Equipment Hatch Hoist	MHS-MH-05	Containment
Maintenance Hatch Hoist	**MHS-MH-06**	**Containment**

TIER 2

Revise Section 3.2.2.5 as follows:

Section 3.2.2.5 – Equipment Class C –

- ~~Handle~~ Maintain spent fuel integrity, the failure of which could result in fuel damage such that significant quantities of radioactive material could be released from the fuel and results in offsite doses greater than normal limits (for example,~~ new and spent fuel racks, the bridge, and the hoist~~ Spent Fuel Pool, Fuel Transfer Tube Isolation Valve)

Revise Section 3.2.2.6 as follows:

Section 3.2.2.6 – Equipment Class D –

- Handle spent fuel, the failure of which could result in fuel damage such that limited quantities of radioactive material could be released from the fuel ~~such as fuel handling tools~~ (for example, ~~fuel handling tools, the bridge, the hoist~~, Fuel Handling Machine, Spent Fuel Handling Tool, new and spent fuel racks).

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise Table 3.2-3 as follows:

TABLE 3.2-3 (SHEET 5 OF 65)
AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
Storm Drain System (DRS)					Location: Various
System components are Class E					
Demineralized Water Treatment System (DTS)					Location: Turbine Building
System components are Class E					
Demineralized Water Transfer and Storage System (DWS)					Location: Various
n/a	Condensate Storage Tanks	D	NS	API 650	
n/a	Valves Providing DWS AP1000 Equipment Class D Function	D	NS	ANSI 16.34	
DWS-PL-V244	Demineralized Water Supply Containment Isolation - Outside	B	I	ASME III-2	
DWS-PL-V245	Demineralized Water Supply Containment Isolation - Inside	B	I	ASME III-2	
DWS-PL-V248	Containment Penetration Test Connection Isolation	B	I	ASME III-2	
DWS-PY-C01	Containment Demineralized Water Supply Penetration	B	I	ASME III, MC	
Balance of system components are Class E					
Fuel Handling and Refueling System (FHS)					Location: Containment and Auxiliary Building
FHS-FH-02	Fuel Handling Machine	~~C~~ D	~~I~~ II/NS	AISC	
FHS-FH-52	Spent Fuel Assembly Handling Tool	~~C~~ D	~~I~~ II	AISC	
FHS-FS-01	New Fuel Storage Rack	D	I	Manufacturer Std.	
FHS-FS-02	Spent Fuel Storage Rack	D	I	Manufacturer Std.	
FHS-FT-01	Fuel Transfer Tube	B	I	ASME III Class MC	
FHS-MT-01	Spent Fuel Pool	C	I	ACI 349	ACI 349 Evaluation of Structural Boundary Only
FHS-MT-02	Fuel Transfer Canal	C	I	ACI 349	ACI 349 Evaluation of Structural Boundary Only

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise Table 3.2-3 as follows:

TABLE 3.2-3 (SHEET 7 OF 65)

AP1000 CLASSIFICATION OF MECHANICAL AND FLUID SYSTEMS, COMPONENTS, AND EQUIPMENT

Tag Number	Description	AP1000 Class	Seismic Category	Principal Construction Code	Comments
Gland Seal System (GSS)					Location: Turbine Building
System components are Class D					
Generator Hydrogen and CO_2 Systems (HCS)					Location: Turbine Building
System components are Class E					
Heater Drain System (HDS)					Location: Turbine Building
System components are Class E					
Hydrogen Seal Oil System (HSS)					Location: Turbine Building
System components are Class E					
Incore Instrumentation System (IIS)					Location: Containment
n/a	IIS Guide Tubes	A	I	ASME III-1	
n/a	Thimble assemblies	D	NS	Manufacturer Std.	
Main Turbine and Generator Lube Oil System (LOS)					Location: Turbine Building
System components are Class E					
Mechanical Handling System (MHS)					Location: Various
MHS-MH-01	Containment Polar Crane	C	I	ASME NOG-1	
MHS-MH-02	**Cask Handling Crane**	**C**	**I**	**ASME NOG-1**	
MHS-MH-05	Equipment Hatch Hoist	C	I	Manufacturer Std.	
MHS-MH-06	Maintenance Hatch Hoist	~~D~~C	I	Manufacturer Std.	
Balance of system components are Class E					
Main Steam System (MSS)					Location: Turbine Building
System components are Class E					
Main Turbine System (MTS)					Location: Turbine Building
System components are Class E					
Passive Containment Cooling System (PCS)					Location: Containment Shield Building and Auxiliary Building
PCS-MT-01	Passive Containment Cooling Water Storage Tank	C	I	ACI 349	See subsection 6.2.2.2.3 for additional design requirements
PCS-MT-03	Water Distribution Bucket	C	I	Manufacturer Std.	See subsection 6.2.2.2.3 for additional design requirements

Revise paragraph in Subsection 3.8.3.6 as follows:

3.8.3.6 Materials, Quality Control, and Special Construction Techniques

Subsection 3.8.4.6 describes the materials and quality control program used in the construction of the containment internal structures. The structural steel modules are constructed using A36 plates and shapes. ~~Nitronic 33~~**Duplex 2101** (American Society for Testing and Materials **A**240, designation ~~S24000, Type XM 29~~**S32101**) stainless steel plates are used on the surfaces of the *modules in contact with water during normal operation or refueling. The structural wall and floor* modules are fabricated and erected in accordance with AISC-N690. Loads during fabrication and erection due to handling and shipping are considered as normal loads as described in subsection 3.8.4.3.1.1. Packaging, shipping, receiving, storage and handling of structural modules are in accordance with NQA-2, Part 2.2 (formerly ANSI/ASME N45.2.2 as specified in AISC N690).

Revise Table 3.8.4-6 as follows:

Table 3.8.4-6

MATERIALS USED IN STRUCTURAL AND MISCELLANEOUS STEEL

Standard	Construction Material
ASTM A1	Carbon steel rails
ASTM A36/A36M	Rolled shapes, plates, and bars
ASTM A108	Weld studs
ASTM A123	Zinc coatings (hot galvanized)
ASTM A240	~~Nitronic 33~~**Duplex2101** stainless steel (designation ~~S2400, Type XM 29~~**S32101**)
ASTM A307	Low carbon steel bolts
ASTM A325	High strength bolts
ASTM A354	Quenched and tempered alloy steel bolts (Grade BC)
ASTM A588	High-strength low alloy structural steel
ASTM-F1554	Steel anchor bolts, 36, 55, and 105-ksi Yield Strength

Revise paragraph in Subsection 3.9.1.1.1.4 as follows:

3.9.1.1.1.4 Unit Loading and Unloading at Five Percent of Full Power per Minute

The unit loading and unloading operations are conservatively represented by continuous and uniform ramp power changes of 5 percent per minute between the 15 percent and 100 percent power levels. This load swing is the maximum possible that is consistent with operation under automatic reactor control. The reactor temperature will vary with load prescribed by the reactor control system. ~~The number of loading and unloading operations is defined as 19,800 each, based on one swing per day for the 60-year design objective and on the assumption of a 90 percent availability factor.~~

~~The AP1000 features a rod control system that provides a load follow capability without requiring a change in the boron concentration in the coolant. Thus, the reactivity gain available from temperature reduction is not required for load follow, and reduced temperature return to power is not applicable to the AP1000.~~

The number of loading and unloading operations is defined as 2000 each for the 60-year plant design objective. The 2000 occurrences includes the plant loading and unloading for the normal plant startup/shutdown, and loading resulting from all service levels B, C and D transients that result in a reactor trip.

Add Subsection 3.1.1.1.19 after Subsection 3.9.1.1.1.18 as follows:

3.9.1.1.1.18 Reactor Coolant System Makeup

The chemical and volume control system makeup subsystem is used to accommodate normal minor leakage from the reactor coolant system. On a low programmed pressurizer level signal one of the chemical and volume control system makeup pumps starts automatically in order to provide makeup. The pump automatically stops when the pressurizer level increases to the high programmed setpoint. The addition of the makeup water to the reactor coolant system via the chemical and volume control system purification loop and attendant changes in reactor coolant system parameters constitute the reactor coolant system makeup design transient. The total number of occurrences of the makeup transient is 2820, which corresponds to once per week during the plant design objective of 60 years assuming a 90 percent availability factor for the plant.

3.9.1.1.1.19 Daily Load Follow Operations

During the load follow operations, the plant power is reduced from the 100 percent power to 50 percent at a prescribed rate and remains there for a specified time and then the power ramps up to 100 percent power at a prescribed rate. Power remains at 100 percent power for the reminder of the 24-hour cycle. The reactor coolant temperature will vary with load as prescribed by the reactor control systems.

The AP1000 features a rod control system that provides a load follow capability without requiring a change in the boron concentration in the coolant. Thus, the reactivity gain available from temperature reduction is not required for load follow, and reduced temperature return to power is not applicable to the AP1000.

The number of daily load follow operations is specified as 17,800 times during the plant design objective of 60 years. One swing of load follow operation consists of one power ramp down from steady-state 100 percent power to 50 percent power and one power ramp up from steady-state 50 percent power to 100 percent power.

Revise Table 3.9-1 as follows:

Table 3.9-1 (Sheet 1 of 2)
REACTOR COOLANT SYSTEM DESIGN TRANSIENTS

Event	Cycles
Level A Service Conditions	
Reactor coolant pump startup and shutdown (cycles of start and stop)	3000
Heatup at 100°F per hour	200
Cooldown at 100°F per hour	200
Unit loading between 0 and 15 percent of full power	500
Unit unloading between 0 and 15 percent of full power	500
Unit loading at 5 percent of full power per minute	**2000**
Unit unloading at 5 percent of full power per minute	**2000**
Step load increase of 10 percent of full power	3000
Step load decrease of 10 percent of full power	3000
Large step load decrease with steam dump	200
Steady-state fluctuation and load regulation Initial Random Load regulation	 1.5×10^5 4.6×10^6 750,000
Boron concentration equalization	2900
Feedwater cycling at hot shutdown Mode 1 Mode 2	 3000 15,000
Core lifetime extension	40
Feedwater heaters out of service	180
Refueling	40
Turbine roll test	20
Primary-side leakage test	200
Secondary-side leakage test	80
Core makeup tank high-pressure injection test	5
Passive residual heat removal tests	5
Reactor coolant system makeup	2820
Daily load follow operations	**17,800**
Level B Service Conditions	
Loss of load (without reactor trip)	30
Loss of offsite power	30

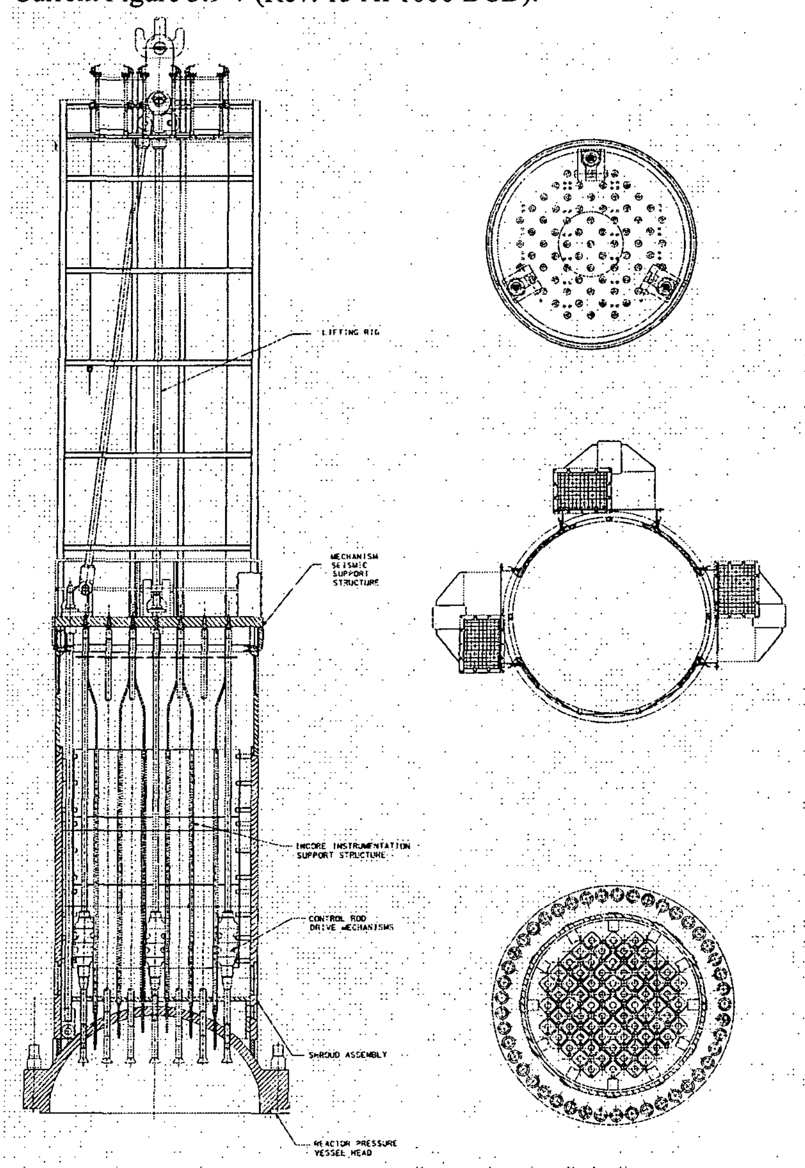
Document Number: APP-GW-GLN-106 **Revision Number:** 0

Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

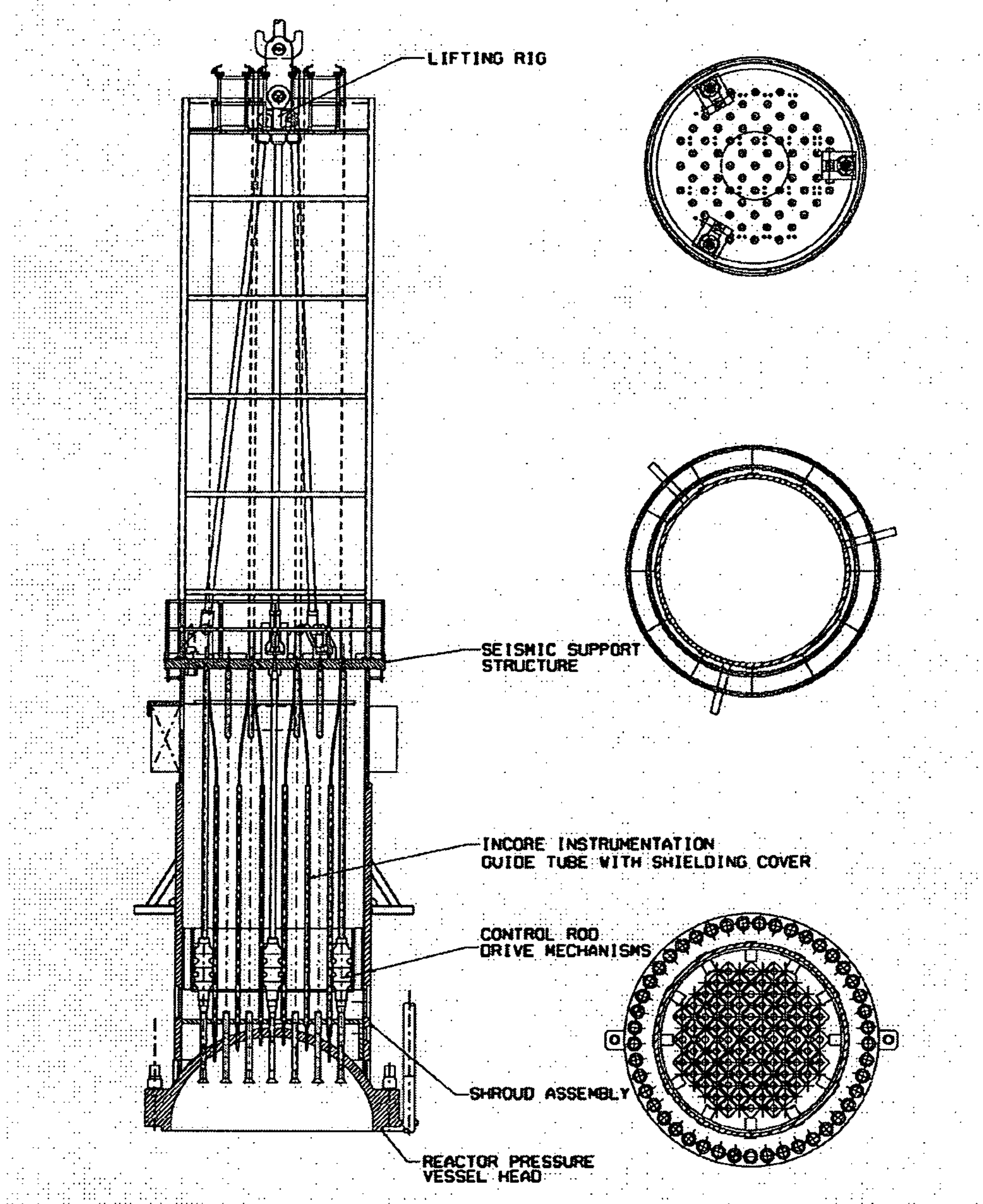
Reactor trip from reduced power	180
Reactor trip from full power	
With no inadvertent cooldown	50
With cooldown and no safeguards actuation	50
With cooldown and PRHR actuation	20

Revise Figure 3.9-7 as follows:

Current Figure 3.9-7 (Rev. 15 AP1000 DCD):



Updated Figure 3.9-7:



Revise paragraph in Subsection 4.5.1.1 as follows:

4.5.1.1 Materials Specifications

Internal latch assembly parts are fabricated of heat-treated martensitic and austenitic stainless steel. Heat treatment is such that stress-corrosion cracking is not initiated. Components and parts made of stainless steel do not have specified minimum yield strength greater than 90,000 psi. Magnetic pole pieces are immersed in the reactor coolant and are fabricated from Type 410 stainless steel. Nonmagnetic parts, except pins and springs, are fabricated from Type 304 stainless steel. A cobalt alloy or qualified substitute is used to fabricate **latch, link, and** link pins. Springs are made from nickel-chromium-iron alloy (Alloy 750). Latch arm tips **fabricated from stainless steel may be surfaced**~~are clad~~ with a suitable hard facing material to provide improved resistance to wear. Hard chrome plate ~~and hard facing are~~is used selectively for bearing and wear surfaces.

Revise paragraph in Subsection 4.5.1.3 as follows:

4.5.1.3 Other Materials

~~When~~**For the** cobalt alloy ~~is~~ used to fabricate **latch, link, and** link pins in the latch ~~assembly~~**assemblies**, ~~the material is ordered in the solution-treated, cold-worked condition. S~~stress-corrosion cracking has not been observed in this application. Where hardfacing material is used in the latch assembly, a cobalt base alloy equivalent to Stellite-6 or qualified low or zero cobalt substitute is used. Low or zero cobalt alloys used for hardfacing or other applications where cobalt alloys have been previously used are qualified using wear and corrosion tests. The corrosion tests qualify the corrosion resistance of the alloy in reactor coolant. ~~Cobalt free~~**Low Cobalt or cobalt free** wear resistant alloys considered for this application include those developed and qualified in industry programs.

The springs in the control rod drive mechanism are made from nickel-chromium-iron alloy (Alloy 750), ordered to Aerospace Material Specification (AMS) 5698~~E~~ or AMS 5699~~E~~ with additional restrictions on prohibited materials. Operating experience has shown that springs made of this material are not subject to stress-corrosion cracking in pressurized water reactor primary water environments. Alloy 750 is not used for bolting applications in the control rod drive mechanisms.

Revise Subsection 5.3.4.5 as follows:

5.3.4.5 Shipment and Installation

The reactor vessel is shipped in a horizontal position on a shipping skid with a vessel-lifting truss assembly. All vessel openings are sealed to prevent the entrance of moisture, and an adequate quantity of desiccant bags is placed inside the vessel. These are usually placed in a wire mesh basket attached to the vessel cover. All carbon steel surfaces~~, except for the vessel support surfaces, are painted with a heat-resistant paint~~ **are protected with a temporary protective covering** before shipment.

The closure head is also shipped with a shipping cover and skid. An enclosure attached to the ventilation shroud support ring protects the control rod mechanism housings. All head openings are sealed to prevent the entrance of moisture, and an adequate quantity of desiccant bags is placed inside the head. These are placed in a wire mesh basket attached to the head cover. All carbon steel surfaces are ~~painted with heat-resistant paint~~ **are protected with a temporary protective covering** before shipment.

Revise the markup of Rev. 15 AP1000 Design Control Document presented in APP-GW-GLN-016, Rev. 0, AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump.

5.4.1.3.6.3 Flywheel Integrity

The reactor coolant pump flywheel assemblies are fabricated from **a heavy metal alloy and stainless steel. Heavy alloy segments are fitted to a stainless steel hub; these segments are not relied upon structurally. The segments may be held into place by an interference fit retainer cylinder placed over the outside of the assembly. The assembly is hermetically sealed from primary coolant by Alloy 690 endplates and an outer thin shell.**~~high-quality, depleted uranium alloy castings or forgings. Castings are poured using a process to minimize the formation of voids, cracks, or other flaws. The forging process is also controlled to minimize the formation of flaws. Subsequent to casting or forging, the flywheel is heat treated by solution annealing in a vacuum furnace and slowly cooled. This heat treatment minimizes the potential for residual stresses. The heat treatment process also removes hydrogen from the material to reduce the potential for hydrogen embrittlement.~~

Revised Subsection 5.4.1.3.6.3:

5.4.1.3.6.3 Flywheel Integrity

The reactor coolant pump flywheel assemblies are fabricated from **a heavy metal alloy and stainless steel. Heavy alloy segments are fitted to a stainless steel hub; these segments are not relied upon structurally. The segments may be held into place by an interference fit retainer cylinder placed over the outside of the assembly. The assembly is hermetically sealed from primary coolant by corrosion resistant endplates and an outer thin shell.** <u>Ni/Fe/Cr Alloy 600 is not used for this application.</u>~~high-quality, depleted uranium alloy castings or forgings. Castings are poured using a process to minimize the formation of voids, cracks, or other flaws. The forging process is also controlled to minimize the formation of flaws. Subsequent to casting or forging, the flywheel is heat treated by solution annealing in a vacuum furnace and slowly cooled. This heat~~

~~treatment minimizes the potential for residual stresses. The heat treatment process also removes hydrogen from the material to reduce the potential for hydrogen embrittlement.~~

Revise paragraph in Subsection 6.1.1.3 as follows:

6.1.1.3 Specifications for Nonpressure-Retaining Materials

The walls of the in-containment refueling water storage tank may be fabricated of ~~ASTM A240 Type XM-29~~**ASTM/ASME A240/SA-240**. This is a **chromium, molybnenum and** nitrogen-strengthened austenitic stainless steel with higher ultimate tensile and yield strengths than type 304 and 316 stainless steel. This material can be welded using ~~E240~~ **a matching Duplex 2101 (2304 or 2209)** filler metal by either the shielded metal arc welding or gas tungsten arc welding methods. This material is used for applications where the higher strength allows reductions in weight and material costs. The material has a resistance to intergranular stress corrosion cracking similar to or better than type 304 and 304L stainless steel.

Revise paragraph in Subsection 9.1.1.1 as follows:

9.1.1.1 Design Bases

The requirements of ANS 57.1 are addressed in subsection 9.1.4. The rack is designed to withstand nominal operating loads and safe shutdown earthquake seismic loads defined in Table 9.1-1. The new fuel storage rack is designed to meet seismic Category I requirements of Regulatory Guide 1.29. Refer to subsection 1.9.1 for compliance with Regulatory Guides. The rack is also designed to withstand the maximum uplift force of the **new** fuel handling ~~jib~~ crane.

Revise paragraph in Subsection 9.1.1.2 as follows:

9.1.1.2 Facilities Description

~~A jib~~ **The new fuel handling** crane is used to load new fuel assemblies into the new fuel rack and transfer new fuel assemblies from the new fuel pit into the spent fuel pool. The capacity of the ~~jib~~ **new fuel handling** crane is limited to 2000 lbs. The new fuel pit is not accessed by the fuel handling machine or by the cask handling crane. This precludes the movement of loads greater than fuel components over stored new fuel assemblies.

Revise Subsection 9.1.1.2.1 as follows:

9.1.1.2.1 New Fuel Rack Design

A. Design and Analysis of the New Fuel Rack
The new fuel storage racks are purchased equipment. The purchase specification for the new fuel storage racks will require the vendor to perform confirmatory dynamic and stress analyses. The seismic and stress analyses of the new fuel rack will consider the various conditions of full, partially filled, and empty fuel assembly loadings. The rack will be evaluated for the safe shutdown earthquake condition against the seismic Category I requirements. A stress analysis will be performed to verify the acceptability of the critical load

components and paths under normal and faulted conditions. The rack rests on the pit floor and is braced as required to the pit wall structures.

The dynamic response of the fuel rack assembly during a seismic event is the condition which produces the governing loads and stresses on the structure. The new fuel storage rack is designed to meet the seismic Category I requirements of Regulatory Guide 1.29.

Loads and Load Combinations

The applied loads to the new fuel rack are:

- Dead loads
- Live loads - effect of lifting the empty rack during installation
- Seismic forces of the safe shutdown earthquake
- Fuel assembly drop accident
- **New** ~~Fuel~~ fuel handling ~~jib~~ crane uplift - postulated stuck fuel assembly

Table 9.1-1 shows loads and load combinations considered in the analyses of the new fuel rack.

The margins of safety for the rack in the multi-direction seismic event are produced using loads obtained from the seismic analysis based on the simultaneous application of three statistically independent, orthogonal accelerations.

B. **New** Fuel Handling ~~Jib~~ Crane Uplift Analysis
An analysis will be performed to demonstrate that the racks can withstand a maximum uplift load of 2000 pounds. This load will be applied to a postulated stuck fuel assembly. Resultant rack stresses will be evaluated against the stress limits and will be demonstrated to be acceptable. It will also be demonstrated that there is no change in rack geometry of a magnitude which causes the criticality criterion to be violated.

C. Fuel Assembly Drop Accident Analysis

In the unlikely event of dropping a fuel assembly, accidental deformation of the rack will be determined and evaluated in the criticality analysis to demonstrate that it does not cause the criticality criterion to be violated. The analysis considers only the case of a dropped new fuel assembly.

For the analysis of a dropped fuel assembly, two accident conditions are postulated. The first accident condition conservatively assumes that the weight of a fuel assembly**, control rod assembly** and handling tool (~~1875~~ **2027** pounds total) impacts the top of the fuel rack from a drop height of 3 feet. Both a straight drop and an inclined drop will be included in the assessment. Calculations will be performed which demonstrate that the impact energy is absorbed by the dropped fuel assembly, the rack cells, and the rack base plate assembly.

The second accident condition assumes that the dropped assembly**, control rod assembly** and **handling** tool (~~1875~~ **2027** pounds **total**) falls straight through an empty cell and impacts the rack base plate from a drop height of 3 feet above the top of the rack. An analysis will be performed that will demonstrate the impact energy is absorbed by the fuel assembly and the rack base plate. The resulting rack deformations will be evaluated in the criticality analysis to demonstrate that the criticality criteria are not violated.

D. Failure of the **New** Fuel Handling ~~Jib~~ Crane
The **new** fuel handling ~~jib~~ crane is a seismic Category II component. The crane and the attachment to the building structure is evaluated to show that the crane does not fall into the new fuel storage pit during a seismic event.

E. Internally Generated Missiles
The fuel handling area does not contain any credible sources of internally generated missiles.

Stress analyses will be performed by the vendor using loads developed by the dynamic analysis. Stresses will be calculated at critical sections of the rack and compared to acceptance criteria referenced in ASME Section III, Division I, Article NF3000.

Revise paragraph in Subsection 9.1.1.3 as follows:

9.1.1.3 Safety Evaluation

The racks are also designed with adequate energy absorption capabilities to withstand the impact of a dropped fuel assembly from the maximum lift height of the **new** fuel handling ~~jib~~ crane. Handling equipment (spent fuel shipping cask crane) capable of carrying loads heavier than fuel components is prevented from traveling over the fuel storage area. The fuel storage racks can withstand an uplift force greater than or equal to the uplift capability of the **new** fuel handling ~~jib~~ crane (2000 pounds).

Revise section 9.1.2.3 as follows:

9.1.2.3 Safety Evaluation

The design and safety evaluation of the spent fuel racks is in accordance with Reference 5. The racks, being Equipment Class ~~3~~ **D** and seismic Category I structures, are designed to withstand normal and postulated dead loads, live loads, loads resulting from thermal effects, and loads caused by the safe shutdown earthquake event.

Revise section 9.1.4.3.3 as follows:

9.1.4.3.3. Fuel Handling Machine – Description:

The fuel handling machine ~~is the same design~~ has the same design functions as the refueling machine and includes the same safety features.

Revise section 9.1.5 as follows:

9.1.5 Overhead Heavy Load Handling Systems

Heavy load handling systems consist of equipment which lift loads whose weight is greater than the combined weight of a single spent fuel assembly and its handling device. This equipment is part of the mechanical handling system (MHS) and is located throughout the plant. The principal equipment is the containment polar crane and the ~~spent fuel shipping~~ cask **handling** crane. Other such equipment includes the reactor coolant pump handling machine, bridge cranes, miscellaneous monorail hoists and fixed hoists. Table 9.1-5 lists the heavy load handling systems located in the safety-related areas of the plant, specifically the nuclear island.

Revise section 9.1.5.1 as follows:

9.1.5.1.1 Safety Design Basis

Section 3.2 *identifies safety and seismic classifications for mechanical handling system* equipment. Heavy load handling systems are generally classified as nonsafety-related, nonseismic systems. The components of single-failure-proof systems necessary to prevent uncontrolled lowering of a critical load are classified as safety-related.

The polar crane**, cask handling crane,** ~~and the~~ **containment** equipment hatch hoists **and containment maintenance hatch hoist** are single-failure-proof systems and are classified as seismic Category I. They are designed to support a critical load during and after a safe shutdown earthquake. ~~Although not single-failure-proof, the containment maintenance hatch hoist is classified as seismic Category I.~~ The equipment and maintenance hatches are required to be operational after a safe shutdown earthquake.

9.1.5.1.2 Codes and Standards

The mechanical handling system conforms to the applicable codes and standards listed in Section 3.2. The **polar crane and** cask handling cranes ~~is~~ **are** designed according to NUREG-0554 (Reference 11) **supplemented by ASME NOG-1 (Reference 12) for a Type I single failure proof crane.** ~~and o~~Other overhead cranes **and hoists handling heavy loads** are designed according to ASME NOG-1 ~~(Reference 12). Other cranes and hoists handling heavy loads are designed according~~ **and** to the applicable ANSI standard.

NUREG-0612 references ANSI B30.2 (Reference 9) and CMAA-70 (Reference 7) for the design of cranes in safety-related areas, and references NUREG-0554 (Reference 11) for the design of single-failure-proof cranes. **ASME NOG-1 also provides design guidance consistent with that provided by NUREG-0554 for the design of single-failure-proof cranes.** The design of AP1000 cranes ~~is based on ASME NOG-1 (Reference 12) and~~ complies with the requirements of NUREG-0612. ~~ASME NOG-1 also provides design guidance consistent with that provided by NUREG-0554 for the design of single-failure-proof cranes.~~
~~The spent fuel shipping cask crane is designed according to the requirements of ASME NOG-1 for a Type III crane. The spent fuel shipping cask crane is also designed to meet the applicable requirements of ANSI/ANS-57.1 (Reference 6) and ANSI/ANS-57.2 (Reference 4), except as described in Table 9.1.5-1.~~

Revise section 9.1.5.2 as follows:

9.1.5.2 System Description

Table 9.1-5 lists heavy load handling systems in the nuclear island. The polar crane ~~is~~ **and cask handling cranes are** designed according to the requirements of **NUREG-0554 supplemented by** ASME NOG-1 for a Type I, single-failure-proof crane. A description of these ~~polar~~ cranes is provided in this subsection. The **containment** equipment hatch hoist **and maintenance hatch hoist** ~~system~~ incorporates single-failure-proof features based on NUREG-0612 guidelines. Based on the conservative design of these heavy load handling systems and associated special lifting devices, slings, and load lift points (~~See~~ **see** subsection 9.1.5.2.3), a load drop of the critical loads handled by the polar crane ~~or the equipment hatch hoist~~**, cask handling crane, and containment equipment hatch hoist** is unlikely. Except for the containment polar crane ~~and the equipment hatch hoists~~**, cask handling crane,** ~~and~~ **containment**~~,~~ **equipment hatch hoist, and containment maintenance hatch hoist,** the heavy load handling systems are not single-failure-proof.

Revise section 9.1.5.2 .1.1 as follows:

9.1.5.2.1.1 System Operation

The polar crane lifts a variety of loads for refueling and maintenance, such as the reactor vessel integrated head package, reactor internals, and the reactor coolant pump components. The crane is designed to withstand the containment environmental conditions during all modes of plant operation, including pressurization and depressurization of the containment. The crane is designed to operate only during shutdown periods.

Movements of the bridge, trolley, main, and auxiliary hoists can be controlled from the operator's cab or from ~~a pendant suspended from the crane~~ **remote control**. Both the ~~pendant and~~ cab **and remote** controls include a main power control switch. The ~~pendant~~ **remote control** is equipped with a keylock switch that inhibits control from the cab. Motion control push buttons in the cab and on the ~~pendant~~ **remote** return to the OFF position when released.

Bridge, trolley, and hoist speeds, and speed controls are in accordance with ASME NOG-1. All speeds are variable. Speed controls permit precise positioning of the load.

The crane can be used for steam generator replacement. The structural design of the bridge is sufficient to support the steam generator, which is a noncritical load. A special hoist on a temporary trolley may be used for the steam generator replacement. Steam generator replacement is not intended to be accomplished with single-failure-proof equipment.

Revise section 9.1.5.2.1.2 as follows:

9.1.5.2.1.2 Component Descriptions

The polar crane is designed according to **NUREG-0554 supplemented by** ASME NOG-1. Table 9.1.5-3 lists the design characteristics of this crane. This subsection describes how the code requirements are implemented in the design of key safety-related components. Associated lifting devices and load lift points are also described.

Add Sections 9.1.5.2.2

9.1.5.2.2 Cask Handling Crane General Description

The cask handling crane is a bridge crane mounted on two runway rails supported by the auxiliary building fuel handling area east and west wall structures. The bridge consists of two welded steel box girders held together with structural end beams. The two end beams are supported by wheeled trucks that travel on top of the runway rail.

The trolley is mounted on wheeled trucks which move by tractive power over rails secured to the crane girders. The trolley provides structural support for the crane hoisting machinery. Devices are installed to preclude derailment of the bridge or trolley under seismic loading. The hoist is electrically powered and raises and lowers loads by reeving wire rope through sheaves that are an integral part of the load block. A hook is attached to the load block.

9.1.5.2.2.1 System Operation

The cask handling crane lifts the spent fuel shipping cask from the cask transporter in the loading bay, into the fuel handling area of the auxiliary building, places the cask in the cask washdown and cask loading pits, is used to remove and replace the cask lid, and lowers the loaded cask onto the cask transporter. The crane is designed to operate in the fuel handling area environmental conditions, and is typically used only when fuel movement activities associated with refueling the reactor are not in progress.
Movements of the bridge, trolley, main, and auxiliary hoists can be controlled from a radio remote control or from a pendant suspended from the crane. Both the pendant and radio remote controls include a main power control switch. The pendant is equipped with a keylock switch that inhibits control from the radio remote control. Motion control push buttons on the radio remote control and on the pendant return to the OFF position when released.

Bridge, trolley, and hoist speeds, and speed control are in accordance with ASME NOG-1. All speeds are variable. Speed controls permit precise positioning of the load.

9.1.5.2.2.2 Component Descriptions

The cask handling crane is designed according to NUREG-0554 supplemented by ASME NOG-1. Table 9.1.5-1 lists the design characteristics of this crane. This subsection describes how the code requirements are implemented in the design of key safety-related components. Associated lifting devices and load lift points are also described.

Hoist System
The hoisting rope is wound around the drum in a single layer. If the rope becomes dislodged from its proper groove, the crane drives are automatically shut down and the brakes are set. Features are also provided to contain the drum and prevent disengagement of the gearing in the event of drum shaft or bearing failure. A control brake and two redundant holding brakes are provided.

Two separate, redundant reeving systems are used, so that a single rope failure will not result in the dropping of the load. Two wire ropes are reeved side-by-side through the sheave. Each cable passes through an equalizer that adjusts for unequal cable length. The equalizer is also a load transfer safety system, eliminating sudden load displacement and shock to the crane in the unlikely event of a cable break. Overtravel protection is provided (see subsection 9.1.5.2.1.4); however, even in the event of hook overtravel in the raising direction to the point the load block contacts the crane structure, the ropes cannot be cut or crushed.

The load block provides two separate load attachment points; the main hook is a two-pronged sister hook with safety latches.

Auxiliary Hoist System
The auxiliary hoist system is similar to that of the main hoist.

Special Lifting Devices
Special lifting devices for critical and non-critical loads are designed to meet the applicable requirements of ANSI N14.6 (Reference 14). The stress design safety factors are based on the combined maximum static and dynamic loads that could be imparted to the handling device, based on the characteristics of the crane. Special lifting devices used for the handling of critical loads are listed in Table 9.1.5-2.

Lifting Devices Not Specially Designed
Slings or other lifting devices not specially designed are selected in accordance with ANSI B30.9 (Reference 15), except that the load rating is based on the combined maximum static and dynamic loads that could be imparted to the sling.

For the handling of critical loads, dual or redundant slings are used, or a sling having a load rating twice that required for a non-critical load is used.

Load Lift Points
The design stress safety factors for heavy load lift points, such as lifting lugs or cask trunnions, are consistent with the safety factors used for special lifting devices. The design of lift points for critical loads is in accordance with NUREG-0612, Paragraph 5.1.6.(3).

9.1.5.2.2.3 Instrumentation Applications
Limit switches are used to initiate protective responses to:

- **Hoist overtravel.**
- **Hoist overspeed.**
- **Hoist overload or unbalance load.**
- **Improper winding of hoist rope on the drum.**
- **Bridge or trolley overspeed.**
- **Bridge or trolley overtravel.**

Redundant limit switches are used with the main hoist and the auxiliary hoists to limit the extent of travel in both the hoisting and lowering directions. The primary protection for each hoist in each direction is a limit switch which interrupts power to the hoist motor via the

control circuitry. Interruption of power to the hoist motor causes the hoist brakes to set. The hoist may be operated in the safe direction to back out of the overtravel condition.

The secondary protection for each hoist in the raising direction is a block-actuated limit switch, which is mechanically and electrically independent of the primary limit switch and interrupts power to the hoist motor and the hoist brakes, causing the brakes to set. The secondary protection for each hoist in the lowering direction is a limit switch, which is mechanically and electrically independent of the primary switch, but also interrupts power to the hoist motor via the control circuitry. Actuation of the secondary limit switches prevents further hoisting or lowering until specific corrective action is taken.

A centrifugal-type limit switch, located on the drum shaft, provides overspeed protection for each hoist. Hoist speeds in excess of 115 percent of the rated lowering speed for a critical load causes the hoist motor to stop and the holding brakes to set.

A load-sensing system is used to detect overloading of the hoists. Hoisting motion is stopped when the overload setpoint is exceeded. Similarly, an unbalanced load is detected by a system that stops the hoist motion when there is excessive movement of the equalizer mechanism.
A level wind limit switch is provided to detect improper threading of the hoist rope in the drum grooves. This switch stops crane drive motors and sets the brakes. Further hoisting or lowering is prevented until specific corrective action is taken.

End-of-travel limit switches are provided for the trolley. These switches are set to trip just before the trolley comes into contact with the bumper. This provides confidence that the kinetic energy of the trolley is within the energy-absorbing capacity of the bumpers.

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise 9.1.5.3 as follows:

9.1.5.3 Safety Evaluation

The design and arrangement of heavy load handling systems promotes the safe handling of heavy loads by one of the following means:

- A single-failure-proof system is provided so that a load drop is unlikely.
- The arrangement of the system in relationship to safety-related plant components is such that the consequences of a load drop are acceptable per NUREG 0612. Postulated load drops are evaluated in the heavy loads analysis.

The polar crane**, cask handling crane,** ~~and~~ the **containment** equipment hatch **and maintenance hatch** hoists ~~systems~~ are single failure proof. These systems stop and hold a critical load following the credible failure of a single component. Redundancy is provided for load bearing components such as the hoisting ropes, sheaves, equalizer assembly, hooks, and holding brakes. These systems are designed to support a critical load during and after a safe shutdown earthquake. The seismic Category I equipment and maintenance hatch hoist systems are designed to remain operational following a safe shutdown earthquake. The polar crane is designed to withstand rapid pressurization of the containment during a design basis loss of coolant accident or main steam line break, without collapsing.

The ~~spent fuel shipping~~ cask ~~storage~~ **loading** pit is separated from the spent fuel pool. The spent fuel shipping cask crane cannot move over the spent fuel pool because the crane rails do not extend over the pool. Mechanical stops prevent the ~~spent fuel shipping~~ cask **handling** crane from going beyond the ends of the rails.

A heavy loads analysis is performed to evaluate postulated load drops from heavy load handling systems located in safety-related areas of the plant, specifically the nuclear island. No evaluations are required for critical loads handled by the containment polar crane, **the cask handling crane,** ~~or~~ the **containment** equipment hatch hoists**, and the containment maintenance hatch hoist** since a load drop is unlikely.

The heavy loads analysis is to confirm that a postulated load drop does not cause unacceptable damage to reactor fuel elements, or loss of safe shutdown or decay heat removal capability.

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise Table 9.1-5 as follows:

Table 9.1-5

NUCLEAR ISLAND HEAVY LOAD HANDLING SYSTEMS(1)

Name	Crane/Hoist Type	Location (Building)	Maximum Load Rating (tons)
Containment Polar Crane	Overhead bridge	Containment	~~275~~300(2)
Equipment Hatch Hoist	Fixed hoist	Containment	10
Maintenance Hatch Hoist	Fixed hoist	Containment	10
Spent Fuel Shipping Cask Crane	Overhead bridge	Auxiliary	150
MSIV Monorails Hoist A	Monorail hoists	Auxiliary	2
MSIV Monorails Hoist B	Monorail hoists	Auxiliary	2

Notes:
1. Nuclear island elevators are discussed in the heavy loads analysis.
2. Trolley maximum load rating for a critical load.

Revise Table 9.1.5-2 as follows:

Table 9.1.5-2

SPECIAL LIFTING DEVICES USED FOR THE HANDLING OF CRITICAL LOADS

Polar Crane Special Lifting Devices	Description
Integrated head package (IHP)	The IHP combines several separate components into an integral unit. It incorporates the lifting device that provides the interface between the polar crane and the reactor vessel head.
Reactor internals lifting rig	The reactor internals lifting rig is a three-legged carbon steel and stainless steel structure that is attached to the main hook for handling of the upper and lower reactor internals packages.
Reactor coolant pump (RCP)	The RCP handling machine is used for removal of the RCP motor and hydraulic elements from the pump casing. The pump/motor shell includes lifting lugs which are attached to a lifting device to allow the RCP motor and hydraulic elements to be handled by the polar crane ~~auxillary~~ **main** hook.

Document Number: APP-GW-GLN-106 **Revision Number:** 0

Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise Table 9.1.5-3 as follows:

Table 9.1.5-3

POLAR CRANE COMPONENT DATA

Bridge	
Bridge span	See Figure 1.2-12
Travel speed	See Note 1
Braking systems (type)	Service, parking and emergency
Trolley	
Travel speed	See Note 1
Braking systems (type)	Service, parking and emergency
Main Hoist	
Approximate capacity	See Table 9.1-5
Hook speed	See Note 1
Approximate hook travel (elevation)	To reactor vessel internals
Load brakes (type and number)	Electric (one)
Holding brakes (type and number)	Friction (two)
Auxiliary Hoist	
Approximate capacity	~~75~~ **25** tons
Hook speed	See Note 1
Approximate hook travel (elevation)	To reactor coolant pump
Load brakes (type and number)	Electric (one)
Holding brakes (type and number)	Friction (two)

Note:

1. Bridge, trolley and hoist speeds are within the recommended ranges of ASME NOG-1.

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

Revise Table 12.4-11 as follows:

Table 12.4-11

DESIGN IMPROVEMENTS THAT REDUCE REFUELING DOSES

Improved Design/Method	Reference Design/Method
Integrated RV Head Package	Conventional RV head package
RV Head Insulation with Suitcase-Type Fasteners and Permanent ID Markings	Insulation fastened with screws (no markings)
Combination Thermocouples and Flux Detectors	Top-mounted thermocouples and bottom-mounted flux detectors
Quick-Opening Fuel Transfer Tube Closure System	Bolted cover
Quick-Acting Stud Tensioner	Threaded-on stud tensioner
Pass and One-Half Stud Tensioning Procedure	Three-pass stud tensioning procedure
Electrical-Driven Stud Spin-Out Tool	Air-driven, spin-out tool
Permanent Reactor Cavity Seal Ring	Bolted or inflatable seal ring
Expandable Stud Hole Plugs	Threaded stud hole plugs
~~RV O-Ring Spring Clips~~	~~Tab and screw O-ring retaining system~~
Shielded RV Head Storage Stand	Nonshielded stand
Smooth-Finish Reactor Cavity Liner (#1 Finish)	Rough-finish reactor cavity liner

Revise paragraph in Subsection 19.34.2.1 as follows:

19.34.2.1 In-Vessel Retention of Molten Core Debris

Chapter 39 of the AP1000 PRA presents an AP1000-specific evaluation to determine the likelihood that sufficient heat can be removed from the outside surface of the submerged reactor pressure vessel lower head to prevent reactor vessel failure and relocation of debris to containment. The methodology used to quantify the margin to vessel failure in Reference 19.34-2 for the AP600 was adapted to the AP1000. For the AP1000 the methodology assumes that:

- The RCS is depressurized.
- The reactor vessel is submerged above the 98-ft elevation in the containment.
- The reflective insulation promotes the two-phase natural circulation in the reactor vessel cooling annulus.
- The **reactor vessel** external surface ~~treatment promotes wetability of the reactor vessel~~ **is bare metal**.

Revise Subsection 19.39.10.3 as follows:

19.39.10.3 Reactor Vessel External Surface Treatment

Based on the reactor vessel system design specification **the surface is not coated and remains as bare metal.**~~, only treatment of the external surface of the reactor vessel is a protective paint applied by the manufacturer prior to shipping. The paint protects the vessel carbon steel surface. Testing of the paint in ULPU-2000 configuration III concluded that the aged painted surface did not inhibit the wetability of the lower head (Reference 19.39-1).~~

Revise Appendix 19B as follows:

APPENDIX 19B EX-VESSEL SEVERE ACCIDENT PHENOMENA

The AP1000 design includes features to enhance the likelihood of retaining the core within the reactor vessel for severe accident sequences. These features include:

- Depressurization of the reactor coolant system (RCS) in the event of an accident by either automatic or manual actuation of the highly reliable automatic depressurization system (ADS)
- A containment layout wherein the water relieved from the reactor coolant system (either from the ADS discharge or a break in the RCS) accumulates in the reactor cavity region
- The capability to manually initiate flooding of the reactor cavity by gravity draining the in-containment refueling water storage tank (IRWST) into the reactor cavity
- The absence of in-core penetrations in the reactor vessel bottom head eliminates a possible reactor vessel failure mode
- The reactor cavity layout provides for rapid flooding of the reactor vessel to the reactor coolant loop nozzle elevation
- The reactor vessel insulation design promotes the two-phase natural circulation in the vessel cooling annulus
- The external reactor vessel surface treatment ~~promotes wetability of the vessel~~ **is bare metal.**

IV. REGULATORY IMPACT

A. FSER Impact

2.a Design Change 049, Stainless Steel Surfaces for CA Modules:

To be consistent with the changes to DCD Tier 2 regarding the type of stainless steel used in CA modules, the following sections of the FSER will need to be revised: Section 3.8.3.6.

This design change does not affect the conclusion in the FSER that the Tolerances for fabrication, assembly and erection of the structural modules conform to the requirements of Section 4 of ACI-117, Sections 3.3 and 3.4 of AWS D1.1, and Sections Q1.23 and Q1.25 of AISC-N690.

2.b Design Change 050, Cask Handling Crane Upgrade:

To be consistent with the changes to DCD Tier 2 regarding the description of the cask handling crane, the following sections of the FSER will need to be revised: Section 9.1.5. This design change does not affect the conclusion in the FSER that the AP1000 cask handling crane complies with the requirements of:

- GDC 2 (adherence to the guidance of Regulatory Positions C.1 and C.6 of RG 1.13, as well as Regulatory Positions C.1 and C.2 of RG 1.29),
- GDC 4 (adherence to the guidance of Regulatory Positions C.3 and C.5 of RG 1.13)
- GDC 61, (as it relates to the facility design for fuel storage)
- NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," July 1980.

2.c Design Change 170, Polar Crane Design:

The design changes described for the polar crane require no changes to the FSER. These design changes do not affect the position in the FSER that the AP1000 polar crane will comply with the requirements of:

- GDC 2 (adherence to the guidance of Regulatory Positions C.1 and C.6 of RG 1.13, as well as Regulatory Positions C.1 and C.2 of RG 1.29),
- GDC 4 (adherence to the guidance of Regulatory Positions C.3 and C.5 of RG 1.13)
- NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," July 1980.

2.d Design Change 185, IHP Design:

The Integrated Head Package is described in subsection 3.9.4 of the NRC Final Safety Evaluation Report (FSER). The changes detailed in this document do not impact the FSER.

2.e Design Change 205, Correction of Dose Reduction features of O-Ring:

This design change requires no changes to the FSER. The change in the O-ring design feature does not impact conclusions made in the FSER relating to radiation protection.

2.f Design Change 206, New Fuel Storage Pit Fuel Assembly Drop:

This design change requires no changes to the FSER. This design change will not impact the staff's position of acceptence of the new fuel storage facility contingent on compliance with the following requirements:

- GDC 2, "Design Bases for Protection Against Natural Phenomena," as it relates to the ability of the facility and the structures housing it to withstand the effects of natural phenomena, such as earthquakes
- GDC 5, "Sharing of Structures, Systems, and Components," as it relates to whether shared structures, systems, and components (SSCs) important to safety are capable of performing required safety functions
- GDC 61, "Fuel Storage and Handling and Radioactivity Control," as it relates to the facility design for fuel storage
- GDC 62, "Prevention of Criticality in Fuel Storage and Handling," as it relates to the prevention of criticality

2.g Design Change 221, Crane Capacity for New Fuel Handling Crane:

To be consistent with the changes to DCD Tier 2 regarding the description of fuel handling crance, the following sections of the FSER will need to be revised: Section 9.1.4. This design change does not affect the conclusion in the FSER that the AP1000 fuel handling crane complies with the requirements of GDC 2.

2.h Design Change 230, CRDM Material/ Manufacturing changes:

The applicatoin of CRDM materials is described in the NRC Final Safety Evaluation Report (FSER). To be consistent with the changes to DCD Tier 2 regarding the description of CRDM materials, the following sections of the FSER will need to be revised:

- Section 4.5.1.1

The design changes outlined in this report will not impact the conclusion drawn in the FSER. Based on the description of the CRDMs and information provided in the DCD and this report, the design of the CRDM structural materials still meets the requirements of GDC 1, 14, and 26, as well as 10 CFR 50.55a.

2.i Design Change 241, Cask Handling Crane Design:

To be consistent with the changes to DCD Tier 2 regarding the description of the cask handling crane, the following sections of the FSER will need to be revised: Section 9.1.5. This design change does not affect the conclusion in the FSER that the AP1000 cask handling crane complies with the requirements of:

- GDC 2 (adherence to the guidance of Regulatory Positions C.1 and C.6 of RG 1.13, as well as Regulatory Positions C.1 and C.2 of RG 1.29),
- GDC 4 (adherence to the guidance of Regulatory Positions C.3 and C.5 of RG 1.13)
- GDC 61, (as it relates to the facility design for fuel storage)
- NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," July 1980.

2.j Design Change 245, RCP Flywheel Material Changes:

This design change requires no changes to the FSER. This design change does not change the conclusion drawn in APP-GW-GLN-016, Rev. 0, AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump.

This design change will not impact the conclusion that the integrity of the reactor coolant pump pressure boundary will be maintained in the event of a postulated reactor coolant pump flywheel missile and that the measures taken to ensure the integrity of the RCP flywheels are acceptable and meet the safety requirements of GDC 1 and 4 and 10 CFR 50.55a(a)(1).

2.k Design Change 256, Maintenance Hatch Hoist Design:

To be consistent with the changes to DCD Tier 2 regarding the description of the cask handling crane, the following sections of the FSER will need to be revised: Section 9.1.5. This design change does not affect the conclusion in the FSER that the AP1000 cask handling crane complies with the requirements of:

- GDC 2 (adherence to the guidance of Regulatory Positions C.1 and C.6 of RG 1.13, as well as Regulatory Positions C.1 and C.2 of RG 1.29),
- GDC 4 (adherence to the guidance of Regulatory Positions C.3 and C.5 of RG 1.13)

2.l Design Change 257, RV Coating before Shipping:

This design change requires no changes to the FSER. The change in the reactor vessel coating for shipment does not impact conclusions made in the FSER relating to the safety of the reactor vessel and pressure boundary integrity.

2.m Design Change 259, Revision of Load Follow Design Transient:

The review of the AP1000 design transients is documented in Chapter 3 of the NRC Final Safety Evaluation Report (FSER). The changes to the reactor coolant system design transients do not alter the conclusions in the FSER.

2.n Design Change 262, Non Safety Related Classification for AP1000 Fuel Handling Equipment:

To be consistent with the changes to DCD Tier 2 regarding the description of fuel handling machine and spent fuel handling tool, the following sections of the FSER will need to be revised: Section 9.1.4. This design change does not affect the conclusion in the FSER that the AP1000 fuel handling machine and spent fuel handling tool complies with the requirements of :

- GDC 2, as it relates to the ability of SSC to withstand the effects of earthquakes
- GDC 5, as it relates to whether shared SSCs important to safety are capable of performing required safety functions
- GDC 61, as it relates to a radioactivity release resulting form fuel damage and the avoidance of excessive personnel radiation exposure.
- GDC 62, as it relates to the prevention of criticality accidents.

2.o Design Change 270, Polar Crane and Cask Handling Crane Design References:

The design changes described for the Polar crane and Cask handling crane require no changes to the FSER. These design changes do not affect the position in the FSER that the AP1000 polar crane and cask handling cranes (respectively) will comply with the requirements of:

- GDC 2 (adherence to the guidance of Regulatory Positions C.1 and C.6 of RG 1.13, as well as Regulatory Positions C.1 and C.2 of RG 1.29),
- GDC 4 (adherence to the guidance of Regulatory Positions C.3 and C.5 of RG 1.13)
- NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants," July 1980.
- GDC 61, (as it relates to the facility design for fuel storage)

2.p Fuel Handling Machine, Generic Description:

This description change requires no changes to the FSER. This change to description of the Fuel Handling Machine does not impact conclusions made in the FSER relating to the safety of the Fuel Handling System.

B. SCREENING QUESTIONS (Check correct response and provide justification for that determination under each response)

1. Does the proposed change involve a change to an SSC that adversely affects a DCD described design function? ☐ YES ☒ NO

   The design changes presented in this report do not involve changes to an SSC that adversely affects a DCD described design function.

2. Does the proposed change involve a change to a procedure that adversely affects how DCD described SSC design functions are performed or controlled? ☐ YES ☒ NO

   The design changes presented in this report do not involve changes to a procedure that adversely affects how DCD described SSC design functions are performed or controlled.

3. Does the proposed activity involve revising or replacing a DCD described evaluation methodology that is used in establishing the design bases or used in the safety analyses? ☐ YES ☒ NO

   The design changes presented in this report do not involve revising or replacing a DCD described evaluation methodology that is used in establishing the design bases or used in the safety analyses.

4. Does the proposed activity involve a test or experiment not described in the DCD, where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the DCD? ☐ YES ☒ NO

   The design changes presented in this report do not involve tests or experiments not described in the DCD, where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the DCD.

C. **Evaluation of Departure from Tier 2 Information** (Check correct response and provide justification for that determination under each response)

10 CFR Part 52, Appendix D, Section VIII. B.5.a. provides that an applicant for a combined licensee 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.b. The questions below address the criteria of B.5.b.

1. Does the proposed departure result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   No design changes presented in this technical report impact the conclusions made in the FSER and there are no new accident initiators and no effect on the frequency of evaluated accidents.

2. Does the proposed departure result in more than a minimal increase in the likelihood of occurrence of a malfunction of a structure, system, or component (SSC) important to safety and previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   Design changes presented in this report will not cause and increase in the likelihood of malfunctions related to plant safety. Design changes presented in this report present no new effect on malfunctions of structures, systems or components.

3. Does the proposed departure Result in more than a minimal increase in the consequences of an accident previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   The design changes presented in this report have no effect on the operation, performance, and pressure boundary integrity of the AP1000 design. Therefore, there is no increase in the calculated release of radioactive material during postulated accident conditions.

4. Does the proposed departure result in more than a minimal increase in the consequences of a malfunction of an SSC important to safety previously evaluated in the plant-specific DCD? ☐ YES ☒ NO

   The design changes presented in this report have no effect on the design functions or reliability of safety related components. Therefore there is no increase in the calculated release of radioactive material due to a malfunction of an SSC.

5. Does the proposed departure create a possibility for an accident of a different type than any evaluated previously in the plant-specific DCD? ☐ YES ☒ NO

   The design changes presented in this report have no effect on the operation, performance and pressure boundary integrity of the AP1000. The changes do not introduce any additional failure modes to plant components and systems. Therefore, there is no possibility of an accident of a different type than any evaluated previously in the plant-specific DCD.

6. Does the proposed departure create a possibility for a malfunction of an SSC important to safety with a different result than any evaluated previously in the plant-specific DCD? ☐ YES ☒ NO

The changes have no effect on the design functions of AP1000 components and systems. Therefore, there are no additional failure modes or the possibility for a malfunction of an SSC important to safety with a different result than evaluated previously.

7. Does the proposed departure result in a design basis limit for a fission product barrier as described in the plant-specific DCD being exceeded or altered? ☐ YES ☒ NO

There is no change to the design function of AP1000 components and systems. Therefore, the proposed departure result does not result in a design basis limit for a fission product barrier as described in the plant-specific DCD being exceeded or altered

8. Does the proposed departure result in a departure from a method of evaluation described in the plant-specific DCD used in establishing the design bases or in the safety analyses? ☐ YES ☒ NO

The methods of evaluation described in the plant-specific DCD, for the systems and components associated with the design changes presented in this report, are not altered by the proposed departure.

☒ The answers to the evaluation questions above are "NO" and the proposed departure from Tier 2 does not require prior NRC review to be included in plant specific FSARs as provided in 10 CFR Part 52, Appendix D, Section VIII. B.5.b

☐ One or more of the answers to the evaluation questions above are "YES" and the proposed change requires NRC review.

Document Number: APP-GW-GLN-106 **Revision Number:** 0
Title: AP1000 Licensing Design Change Document for Generic Reactor Coolant Pump

D. 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 licensee 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 questions below address the criteria of B.5.c.

1. Does the proposed activity result in an impact to features that mitigate severe accidents. If the answer is Yes answer Questions 2 and 3 below. ☐ YES ☒ NO

2. Is there is a substantial increase in the probability of a severe accident such that a particular severe accident previously reviewed and determined to be not credible could become credible? ☐ YES ☐ NO ☒ N/A

   Based on the design changes presented in this report there is no change in the probability of a severe accident.

3. Is there is a substantial increase in the consequences to the public of a particular severe accident previously reviewed? ☐ YES ☐ NO ☒ N/A

   Based on the design changes presented in this report there is no change in the probability of a severe accident.

☒ The answers to the evaluation questions above are "NO" or are not applicable and the proposed departure from Tier 2 does not require prior NRC review to be included in plant specific FSARs as provided in 10 CFR Part 52, Appendix D, Section VIII. B.5.c

☐ One or more of the answers to the evaluation questions above are "YES" and the proposed change requires NRC review.

E. Security Assessment

1. Does the proposed change have an adverse impact on the security assessment of the AP1000. ☐ YES ☒ NO

The design changes presented in this report will not alter barriers or alarms that control access to protected areas of the plant. The changes presented in this report will not alter requirements for security personnel.