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April 10, 2014
Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Attention: Mr. Jeffrey Ciocco
Division of New Reactor Licensing

Project No.0782
MKD/NW-14-0007L

Subject: Submittal of KHNP Responses to Request for Additional Information 1-7425

Reference: 1) NRC Request for Additional Information 1-7425, dated Mar 10, 2014 (NRC Project 0782)
2) KHNP Topical Report: Realistic Evaluation Methodology for Large-Break LOCA of the APR1400, Revision 0, Dec 2012 (APR1400-F-A-TR-12004 (R0))

KHNP is hereby submitting responses to the Request for Additional Information (RAI) 1-7425, dated March 10, 2014. The RAI and responses are related to KHNP's Topical Report, APR1400-F-A-TR-12004(R0).

Enclosure 1 contains one copy of the associated affidavit. Enclosure 2 provides "KHNP Responses to Request for Additional Information No. 1-7425" (Proprietary), and Enclosure 3 provides "KHNP Responses to Request for Additional Information No. 1-7425" (Non-proprietary).

If additional information or clarification is required, please contact Yun-ho Kim, Director of KHNP Washington DC Center at yunhokim@khnp.co.kr or 703-388-0592.

Sincerely,

M. K. Kim

Myung-Ki Kim
Project Manager
Advanced Reactors Development Laboratory
Korea Hydro and Nuclear Power Co., Ltd

Enclosure:
1. Affidavit KAW-14-0007
2. KHNP Responses to Request for Additional Information No. 1-7425 (Proprietary)
3. KHNP Responses to Request for Additional Information No. 1-7425 (Non-Proprietary)

Cc: Mr. Samuel S. Lee

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ENCLOSURE 1

Affidavit KAW-14-0007

I, Jae-yong Lee, state the following:

1. I am the Director of Korea Hydro & Nuclear Power Co., Ltd. (KHNP), and as such I am authorized to request withholding the information transmitted with this letter from public disclosure and to execute this affidavit.

2. I am familiar with the criteria applied by KHNP to determine whether certain information is proprietary, and with the policies established by KHNP to ensure the proper application of these criteria.

3. The information, KHNP Responses to Request for Additional Information No. 1-7425 (Proprietary) and drawings provided as hard copies and PDF format files, transmitted with this letter have been classified by KHNP as proprietary in accordance with the policies for the control and protection of proprietary and confidential information. The information regarded as proprietary is identified and marked consistent with the requirements of 10 CFR 2.390, § (b)(1)(i). Accordingly, the proprietary information is enclosed within brackets and the right-hand bracket carries a notation of "TS" to indicate that the trade secret nature of the information claimed to be proprietary is the basis for proposing that the information so identified be withheld from public disclosure.

4. Pursuant to the considerations set forth in 10 CFR Section 2.390(a), KHNP considers the information classified as proprietary to be "trade secret" information since it is design, analysis, or test information that would be difficult for a competitor to reproduce and hence provides an economic and competitive advantage to KHNP.

5. The need for designating the information as proprietary has been raised within KHNP. The information is being treated proprietary and confidential and has not been disclosed by KHNP to the public.

6. Nondisclosure of the proprietary information transmitted with this letter is vital to the competitiveness held by KHNP and, hence, disclosure of the proprietary information transmitted in with this letter would have negative commercial impacts on the competitive position of KHNP in the U.S. nuclear market.

7. In accordance with KHNP policy, proprietary information contained in this document may be, or may have been, made available on a limited basis to regulatory bodies, customers, potential customers, and their agents, suppliers, and licensees, and others

under suitable agreements providing for nondisclosure and limited use of the information.

I declare that the foregoing statements are true and correct to the best of my knowledge, information and belief.

Executed on April 10, 2014.

Jae-yong Lee
Director
APR1400 Licensing Team
Korea Hydro & Nuclear Power Co., Ltd.

KHNP
KOREA HYDRO & NUCLEAR POWER CO., LTD

ENCLOSURE 3

" KHNP Responses to Request for Additional Information No. 1-7425" (Non-Proprietary)

April 2014

KHNP Responses to Request for Additional Information No. 1-7425

Question TR Realistic Evaluation Methodology for LBLOCA of the APR1400-1

Provide a complete set of RELAP5 Mod 3.3 code manuals, including the theory manual, the input (user) manual, and the code qualification (benchmarking) manual. If these manuals are identical to published NUREG reports issued by the NRC, provide a list of these NUREG reports.

Response

RELAP5/MOD3.3 code manuals are identical to published NUREG reports issued by the NRC. The following is a list of these NUREG reports.

Volume Number	*Title*	*Report Number*	*Issued Date*
I	*RELAP5/MOD3.3 Code Manual Volume I: Code Structure, System Models, and Solution Methods*	*NUREG/CR-5535/Rev P3-Vol I*	*March, 2003*
II	*User's Guide and Input Requirements*	*NUREG/CR-5535/Rev P3-Vol II*	*March, 2006*
	Appendix A Input Requirements	*NUREG/CR-5535/Rev P3-Vol II App A*	*March, 2006*
III	*Developmental Assessment Problems*	*NUREG/CR-5535/Rev P3-Vol III*	*March, 2006*
VI	*Models and Correlations*	*NUREG/CR-5535/Rev P3-Vol IV*	*March, 2006*
V	*User's Guidelines*	*NUREG/CR-5535/Rev P3-Vol V*	*March, 2006*
VI	*Validation of Numerical Techniques in RELAP5/MOD3.0*	*NUREG/CR-5535/Rev P3-Vol VI*	*March, 2006*
VII	*Summaries and Reviews of Independent Code Assessment Reports*	*NUREG/CR-5535/Rev P3-Vol VII*	*March, 2006*
VIII	*Programmers Manual*	*NUREG/CR-5535/Rev P3-Vol VIII*	*March, 2006*

In addition to the inputs specified in RELAP5/MOD3.3 input manual, additional inputs are required for following calculations.

- *Quantification of uncertainty parameters*
  - *Uncertainty multiplier input cards are needed for 124 simple random sampling (SRS) calculations*
- *Calculation with CONTEMPT4/MOD5*
  - *Input cards are needed in order to activate and run CONTEMPT4/MOD5*
- *Evaluation of scale bias*
  - *Input cards are needed in order to activate scale bias calculations*

RELAP5/MOD3.3 was modified to accept additional inputs required for the above calculations.

The input requirements for the above calculations are as follow.

Input Data for Code Uncertainty Parameter Multiplier

The CAREM, realistic evaluation methodology for LBLOCA of the APR1400, selected total 30 uncertainty parameters. The uncertainty multipliers for [ ]^{TS}, can be input using RELAP5/MOD3.3 input cards specified in the input manual. But, the uncertainty multipliers for [ ]^{TS}, cannot be input using RELAP5/MOD3.3 input cards. Thus, additional input structures for code uncertainty parameters are needed. Table 1 shows [ ]^{TS} that need additional input data. The input cards for code uncertainty parameter multipliers are described below.

Table 1. Code Uncertainty Parameters

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Input Data for Coupled Run with CONTEMPT4/MOD5

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Input Data for Bias Calculation

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Question TR Realistic Evaluation Methodology for LBLOCA of the APR1400-2

Provide a Compact Disk (CD) containing: (1) the complete RELAP5/MOD3.3/K source code subroutine listings; (2) the complied executable file(s); (3) the code input deck(s) developed for Shin-Kori (SKN), Unit 3 and Unit 4; (4) the model (node) diagram corresponding to the SKN input deck(s); and (5) the Parallel Virtual Machine (PCM) package used to link the CONTEMPT4/MOD5 with RELAP-5 code.

Response

A compact disk is provided separately.

(1) Most subroutines of RELAP5/MOD3.3/K are identical to those of released RELAP5/MOD3.3 (patch 03) by NRC. Total 51 subroutines were modified or added during the CAREM developmental phase. [

]^{TS} The subroutine list of the released RELAP5/MOD3.3 (patch 03) is presented in the code manual volume 8, Programmers Manual.

RELAP5/MOD3.3/K code was compiled in following environment.

- *OS: Windows NT server, 32bit*
- *Compiler: Compaq Visual Fortran 6.6B*

The folder structure of the compact disk containing RELAP5/MOD3.3/K source code files is as follows;

Folder Name	*Description*
Source code/Cenvrl	*Environment source files*
Source code/contempt/conta	*Released CONTEMPT4/MOD5 source files*
Source code/contempt/contl	*Modified or added source files for the CAREM*
Source code/contempt/ct4_exe	*Main function file of released CONTEMPT4/MOD5*
Source code/contempt/envrl	*Released CONTEMPT4/MOD5 environment source files*
Source code/relap5/envrl	*Released RELAP5/MOD3.3 environment source files*
Source code/relap5/kREM	*Modified or added source files for the CAREM*
Source code/relap5/selap	*Released RELAP5/MOD3.3 source files*

Table 2. List of RELAP5/MOD3.3/K Source Code Subroutines

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Table 2. List of RELAP5/MOD3.3/K Source Code Subroutines (Continued)

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(2) List of compiled RELAP5/MOD3.3/K code and libraries. These files are contained in "(2) Compiled files" folder.

Code	*File Name*	*Description*
RELAP5/MDO3.3/K	*Relap5m33p3k_dvi_compaq.exe*	*RELAP5 code execution file*
CONTEMPT4/MOD5	*contl.dll*	*CONTEMPT code DLL file*
Property Table for RELAP5/MOD3.3/K	*tpfh2onew*	*Water property file for RELAP*
Property Table for CONTEMPT4/MOD5	*tpfh2o*	*Water property file for CONTEMPT*
CONTEMPT4/MOD4 Input File	*inputc*	*CONTEMPT code input file*

(3) SKN34 input decks for the CAREM are contained in folder "(3) SKN34 inputs". In this folder, base and nominal input decks are provided in sub-folder "Base" and "Nominal", respectively. The base input decks do not consider any code uncertainty parameter and the code calculated values are used in RELAP5 calculations. [

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(4) Figure 1 showed model diagram of SKN34, and graph file was contained in "(4) Model diagram" folder.

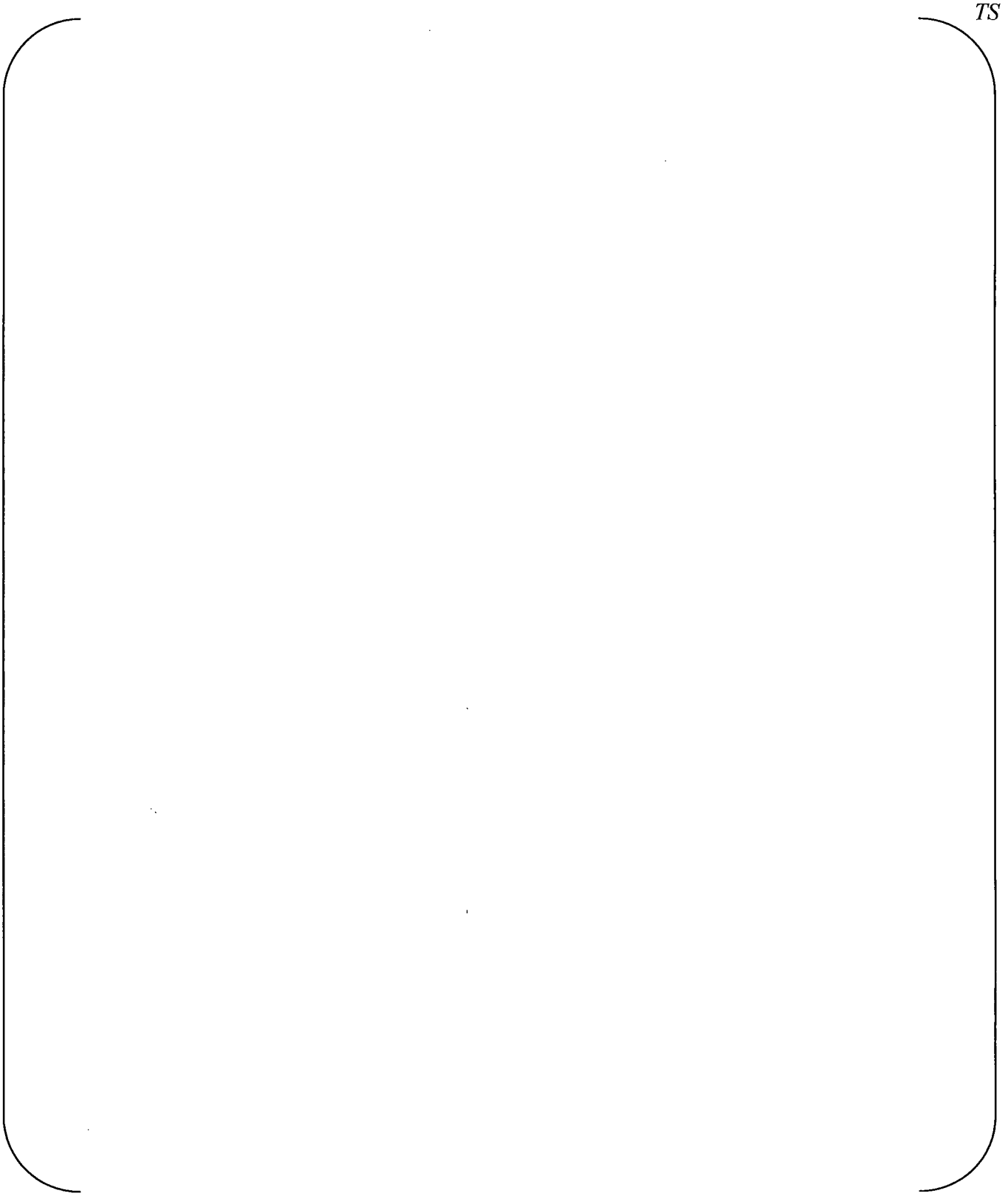

Figure 1 Model Diagram of SKN34

(5) CONTEMPT4/MOD5 is liked to RELAP5/MOD3.3/K using dynamic link library in Windows system. General information on the coupling of RELAP5/MOD3.3/K and CONTEMPT4/MOD5 are described in Appendix I of the CAREM topical report.

For the coupling code runs (RELAP5/MOD3.3/K and CONTEMPT4/MOD5), CONTEMPT DLL file (contl.dll) should be in the same folder with RELAP5/MOD3.3/K execution file. Two water property files (tpfh2o for CONTEMPT4/MOD5, tpfh2onew for RELAP5/MOD3.3) and input deck for CONTEMPT4/MOD5 (inputc) also should be in the same folder.

Question TR Realistic Evaluation Methodology for LBLOCA of the APR1400-3

Provide full size hard copies and PDF format files for a complete set of drawings of the reactor primary system, including the reactor pressure vessel, reactor core, cold leg and hot leg piping, steam generator, pressurizer, and the accumulator, as well as a diagram of the emergency core cooling system piping.

Response

Hard copies and PDF format files of the requested drawings are provided separately. Table 3 shows the list of drawings provided as hard copies and PDF format files.

Table 3. List of Drawings

Component	***PDF File Name***	***Project Drawing No.***	***Title***
Reactor Pressure Vessel	*MRDFD-140001M_1*	*9-431-Z-S-172-20*	*Reactor Vessel Arrangement & Installation*
	MRDFD-140001M_2	*9-431-Z-S-170-30*	*Reactor Vessel Closure Head Requirements*
	MRDFD-140001M_3	*9-732-Z-S-171-10*	*In-core Instrument Assembly*
	N11023-110CD-0101	*1-110-H-175-001C*	*Closure Head Ass'y for R/V*
	N11023-110CD-0102	*1-110-H-175-002C*	*Closure Head Machining for R/V*
	N11023-110CD-0103	*1-110-H-175-003C*	*Closure Head for R/V*
	N11023-110CD-0601	*1-110-H-175-004C*	*Closure Head Nozzles for R/V*
	N11023-110CD-0901	*1-110-H-175-005C*	*Closure Parts for R/V*
	N11023-110CD-1001	*1-110-H-175-006C*	*Closure Studs for R/V*
	N11023-110CD-1101	*1-110-H-175-007C*	*Closure Nuts & Washers for R/V*
	N11023-110CD-2101	*1-110-H-175-008C*	*Vessel Flange for R/V*
	N11023-110CD-2501	*1-110-H-175-009C*	*Inlet Nozzle for R/V*
	N11023-110CD-2601	*1-110-H-175-010C*	*Outlet Nozzle for R/V*
	N11023-110CD-2701	*1-110-H-175-011C*	*DVI Nozzle for R/V*
	N11023-110CD-2901	*1-110-H-175-012C*	*Monitor Tube for R/V*
	N11023-110CD-3101	*1-110-H-175-013C*	*Vessel Attachments for R/V*
	N11023-110CD-3201	*1-110-H-175-014C*	*Core Stabilizing Lugs for R/V*
	N11023-110CD-4101	*1-110-H-175-015C*	*Bottom Head for R/V*
	N11023-110CD-4201	*1-110-H-175-016C*	*Bottom Head Nozzles for R/V*
	N11023-110CD-6101	*1-110-H-170-001C*	*General Arrangement-Elevation*
	N11023-110CD-6102	*1-110-H-170-002C*	*General Arrangement-Sections*
	N11023-110CD-6201	*1-110-H-184-001C*	*External Interfaces*
	N11023-110CD-6202	*1-110-H-184-002C*	*External Interfaces*
	N11023-110CD-6203	*1-110-H-184-003C*	*External Interfaces*
	N11023-110CD-6204	*1-110-H-184-004C*	*Internal Interfaces*
	N11023-110CD-6205	*1-110-H-184-005C*	*Internal Interfaces*
	N11023-110CD-6501	*1-110-H-175-017C*	*Flow Baffle*
	N11023-110CD-6601	*1-110-H-175-018C*	*Surveillance Holders*
Steam Generators	*MRDFD-140001M_4*	*9-431-Z-S-172-11*	*Steam Generator Sliding Base Arrangement & Installation*
	MRDFD-140001M_5	*9-431-Z-S-172-12*	*Steam Generator Upper Supports Arrangement & Installation*
	N11023-160CD-0801	*1-160-H-175-001C*	*Steam Outlet Nozzle*
	N11023-160CD-0901	*1-160-H-175-002C*	*Dryer Supports*
	N11023-160CD-2801	*1-160-H-175-003C*	*Secondary Nozzles*
	N11023-160CD-2901	*1-160-H-175-004C*	*Vessel Supports*
	N11023-160CD-4101	*1-160-H-175-005C*	*Tubesheet Drilling*

Table 3. List of Drawings (Continued)

Component	*PDF File Name*	*Project Drawing No.*	*Title*
Steam Generators	*N11023-160CD-4102*	*1-160-H-175-006C*	*Lower Vessel Assembly*
	N11023-160CD-4103	*1-160-H-175-007C*	*Lower Vessel Assembly*
	N11023-160CD-4104	*1-160-H-175-008C*	*Handhole Access*
	N11023-160CD-4105	*1-160-H-175-009C*	*Feedwater Box*
	N11023-160CD-4106	*1-160-H-175-010C*	*Flow Distribution Plate*
	N11023-160CD-4601	*1-160-H-175-011C*	*Tubesheet*
	N11023-160CD-4701	*1-160-H-175-012C*	*Secondary Nozzles*
	N11023-160CD-5401	*1-160-H-175-013C*	*Primary Head*
	N11023-160CD-5701	*1-160-H-175-014C*	*Primary Divider Plates & Bars*
	N11023-160CD-5801	*1-160-H-175-015C*	*Primary Nozzles*
	N11023-160CD-5802	*1-160-H-175-016C*	*Primary Nozzles*
	N11023-160CD-6201	*1-160-H-170-001C*	*General Arrangement - Elevation*
	N11023-160CD-6202	*1-160-H-170-002C*	*General Arrangement - Sections*
	N11023-160CD-6203	*1-160-H-184-001C*	*Interfaces*
	N11023-160CD-6204	*1-160-H-184-002C*	*Interfaces*
	N11023-160CD-6205	*1-160-H-175-017C*	*Drawing Plan List*
	N11023-160CD-7101	*1-160-H-175-018C*	*Assembly of Tube Bundle*
	N11023-160CD-7102	*1-160-H-175-019C*	*External Attachements*
	N11023-160CD-7301	*1-160-H-175-020C*	*Steam Separators*
	N11023-160CD-7302	*1-160-H-175-021C*	*Steam Dryer Drains*
	N11023-160CD-7601	*1-160-H-175-022C*	*Primary Closure Parts*
	N11023-160CD-7602	*1-160-H-175-023C*	*Secondary Clolsure Parts*
	N11023-160CD-8501	*1-160-H-175-024C*	*Separator Support Plate*
	N11023-160CD-8601	*1-160-H-175-025C*	*Downcomer Feedwater Piping*
	N11023-160CD-8602	*1-160-H-175-026C*	*Recirculation Piping*
	N11023-160CD-8701	*1-160-H-175-027C*	*Shroud*
	N11023-160CD-8801	*1-160-H-175-028C*	*Tube Bundle Supports*
	N11023-160CD-8901	*1-160-H-175-029C*	*Upper Tube Supports*
	N11023-160CD-8902	*1-160-H-175-030C*	*Upper Tube Supports Details*
	N11023-160CD-9101	*1-160-H-175-031C*	*Tube Details*
	N11023-160CD-9401	*1-160-H-175-032C*	*Full Eggcrates*
	N11023-160CD-9402	*1-160-H-175-033C*	*Half Eggcrates*
	N11023-160CD-9403	*1-160-H-175-034C*	*Partial Eggcrates*
Pressurizer	*MRDFD-140001M_6*	*9-431-Z-S-172-40*	*Pressurizer Arrangement & Installation*
	N11023-170CD-0101	*1-170-H-175-001C*	*Top Head*
	N11023-170CD-0801	*1-170-H-175-002C*	*Spray Nozzle*
	N11023-170CD-0802	*1-170-H-175-003C*	*Manway*

Table 3. List of Drawings (Continued)

Component	PDF File Name	Project Drawing No.	Title
Pressurizer	N11023-170CD-2901	1-170-H-175-004C	Vessel Attachments
	N11023-170CD-5101	1-170-H-175-005C	Bottom Head
	N11023-170CD-5601	1-170-H-175-006C	Support Skirt
	N11023-170CD-5801	1-170-H-175-007C	Surge Nozzle
	N11023-170CD-6201	1-170-H-170-001C	General Arrangement
	N11023-170CD-6203	1-170-H-184-001C	Interfaces
	N11023-170CD-6204	1-170-H-184-002C	Interfaces
	N11023-170CD-6205	1-170-H-175-008C	Drawing Plan List
	N11023-170CD-7201	1-170-H-175-009C	Instrument Nozzles
	N11023-170CD-8401	1-170-H-175-010C	Heaters and Sleeves
	N11023-170CD-8601	1-170-H-175-011C	Heater Supports
Reactor Vessel Internals	N11023-120CD-0001	1-120-H-175-001C	Reactor Internals Dimensional Assembly
	N11023-120CD-0002	1-120-H-175-002C	Reactor Internals Assembly
	N11023-120CD-0101	1-120-H-175-003C	Core Support Barrel Assembly
	N11023-120CD-0201	1-120-H-175-004C	Core Shroud/Lower Structure Assembly
	N11023-120CD-0301	1-120-H-175-005C	Upper Guide Structure Assembly
	N11023-120CD-0401	1-120-H-175-006C	Alignment Keys
	N11023-120CD-0501	1-120-H-175-007C	Socket Head Cap Screw
	N11023-120CD-0601	1-120-H-175-008C	Bill of Material
	N11023-120CD-1001	1-120-H-175-009C	Core Support Barrel
	N11023-120CD-1401	1-120-H-175-010C	Lifting Bolt Insert
	N11023-120CD-2001	1-120-H-175-011C	Core Shroud Assembly
	N11023-120CD-2601	1-120-H-175-012C	Guide Lug Inserts/ Dowel Pin
	N11023-120CD-3001	1-120-H-175-013C	Lower Support Structure/ Instrument Nozzle Assembly
	N11023-120CD-3101	1-120-H-175-014C	Lower Support Structure Assembly
	N11023-120CD-3601	1-120-H-175-015C	Insert Pins
	N11023-120CD-3701	1-120-H-175-016C	Instrument Nozzle Support Plate
	N11023-120CD-3801	1-120-H-175-017C	Instrumentation Nozzles
	N11023-120CD-4001	1-120-H-175-018C	Inner Barrel Assembly
	N11023-120CD-4501	1-120-H-175-019C	HJTC Upper Tube Assembly
	N11023-120CD-4601	1-120-H-175-020C	HJTC Lower Tube Assembly
	N11023-120CD-5001	1-120-H-175-021C	Upper Guide Structure Support Barrel Assembly
	N11023-120CD-7001	1-120-H-175-022C	Holddown Ring

Table 3. List of Drawings (Continued)

Component	*PDF File Name*	*Project Drawing No.*	*Title*
Reactor Coolant Piping	*N11023-190CD-1102*	*1-190-H-175-001C*	*Closure Piping P-2,3,4,6,7,8,11,12,13,15,16,17*
	N11023-190CD-2801	*1-190-H-175-002C*	*Hot Leg Nozzles*
	N11023-190CD-2802	*1-190-H-175-003C*	*Cold Leg Nozzles*
	N11023-190CD-4101	*1-190-H-175-004C*	*Cold Leg Piping P-5*
	N11023-190CD-4102	*1-190-H-175-005C*	*Cold Leg Piping P-9*
	N11023-190CD-4103	*1-190-H-175-006C*	*Cold Leg Piping P-14*
	N11023-190CD-4104	*1-190-H-175-007C*	*Cold Leg Piping P-18*
	N11023-190CD-5801	*1-190-H-175-008C*	*Surge Line*
	N11023-190CD-6201	*1-190-H-184-001C*	*Interfaces*
	N11023-190CD-6202	*1-190-H-184-002C*	*Interfaces*
	N11023-190CD-6203	*1-190-H-184-003C*	*Interfaces*
	N11023-190CD-7101	*1-190-H-175-009C*	*Hot Leg Piping P-1*
	N11023-190CD-7102	*1-190-H-175-010C*	*Hot Leg Piping P-10*
	N11023-190CD-7201	*1-190-H-175-011C*	*Small Nozzles*
Safety Injection Tanks	*N11023-420CD-0010*	*1-420-H-175-001C*	*Outline Drawing for SIT*
ECCS Line	*MESFD-140001M*	*1-441-N-105-001*	*P&I Diagram Safety Injection/Shutdown Cooling System (1/4)*
	MESFD-140001M	*1-441-N-105-002*	*P&I Diagram Safety Injection/Shutdown Cooling System (2/4)*
	MESFD-140001M	*1-441-N-105-003*	*P&I Diagram Safety Injection/Shutdown Cooling System (3/4)*
	MESFD-140001M	*1-441-N-105-004*	*P&I Diagram Safety Injection/Shutdown Cooling System (4/4)*