UFSAR Revision History

Revision Number	Submittal Date	Submittal Description
0	July 1982	Original UFSAR
1	July 1983	1983 Update
2	July 1984	1984 Update
3	July 1985	1985 Update
4	July 1986	1986 Update
5	July 1987	1987 Update
6	July 1988	1988 Update
7	July 1989	1989 Update
8	July 1990	1990 Update
9	July 1991	1991 Update
10	July 1992	1992 Update
11	July 1993	1993 Update
12	July 1994	1994 Update
13	July 1995	1995 Update
14	July 1996	1996 Update
15	July 1997	1997 Update
16.0	July 1999	1999 Update
16.1	10/20/1999	Minor Version Update
16.2	11/24/1999	Minor Version Update
16.3	06/23/2000	Minor Version Update
16.4	08/21/2000	Minor Version Update
16.5	10/20/2000	Minor Version Update

UFSAR Revision History

Revision Number	Submittal Date	Submittal Description
16.6	02/09/2001	Minor Version Update
17.0	06/14/2001	**Major Revision**
17.1	10/31/2001	Minor Version Update
17.2	04/16/2002	Minor Version Update
17.3	09/09/2002	Minor Version Update
18.0	12/07/2002	**Major Revision**
18.1	07/31/2003	Minor Version Update
18.2	03/02/2004	Minor Version Update
19.0	06/18/2004	**Major Revision**
19.1	09/29/2004	Minor Version Update
19.2	12/15/2004	Minor Version Update
19.3	03/24/2005	Minor Version Update
20.0	08/19/2005	**Major Revision**
20.1	11/30/2005	Minor Version Update
20.2	06/01/2006	Minor Version Update
21.0	04/05/2007	**Major Revision**
21.1	08/28/2007	Minor Version Update
21.2	04/02/2008	Minor Version Update
22.0	09/12/2008	**Major Revision**
22.1	08/14/2009	Minor Version Update
23.0	09/10/2010	**Major Revision**
24.0	03/17/2012	**Major Revision**

UFSAR Revision History		
Revision Number	**Submittal Date**	**Submittal Description**
25.0	09/092013	**Major Revision**
26.0	03/03/2015	**Major Revision**
27.0	07/20/2016	**Major Revision**
28.0	05/25/2018	**Major Revision**
29.0	10/24/2019	**Major Revision**

Comparison Of Design Parameters**

** This table is retained for historical purpose only. It compares original Cook Plant parameters to other similar nuclear plants

Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
1	Total Primary Heat Output, MWt	3250	3250	2758	1518.5	2200
2	Total Core Heat Output, Btu/hr	$11{,}090 \times 10^6$	$11{,}090 \times 10^6$	9413×10^6	5181×10^6	7479×10^6
3	Heat Generated in Fuel, %	97.4	97.4	97.4	97.4	97.4
4	Maximum thermal Overpower	12%	12%	12%	12%	12%
5	System Pressure, Nominal, psia	2250	2250	2250	2250	2250
6	System Pressure, Minimum Steady State, psia	2220	2220	2220	2220	2220
	Hot Channel Factors					
7	Heat Flux, F_q	2.79	2.79	3.23	2.80	3.23
8	Enthalphy Rise, $F_{\Delta H}$	1.60	1.60	1.77	1.60	1.77

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9	DNB Ratio at Nominal Operating Conditions	1.97	2.02	2.00	2.11	1.81
10	Minimum DNBR for Design Transients	1.30	1.30	1.30	1.30	1.30
	Coolant Flow					
11	Total Flow Rate, lb/hr	135.6×10^6	133.0×10^6	136.3×10^6	66.7×10^6	101.5×10^6
12	Effective Flow Rate for Heat Transfer, lb/hr	129.5×10^6	128.9×10^6	130×10^6	63.6×10^6	97.0×10^6
13	Effective Flow Area for Heat Transfer, ft^2	51.4×10^3	51.4×10^3	51.4×10^3	51.4×10^3	51.4×10^3
14	Average Velocity Along Fuel Rods, ft/sec	15.5	15.3	15.4	15.0	14.3
15	Average Mass Velocity, lb/hr-ft^2	2.53×10^6	2.52×10^6	2.53×10^6	2.37×10^6	2.32×10^6
16	Coolant Temperature, °F Design Nominal Inlet	536.3	530.2	543	552.5	546.2

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17	Maximum Inlet Due to Instrumentation Error and Deadband, °F	540.3	534.2	547	556.5	550.2
18	Average Rise in Vessel, °F	63.0	64.1	53.0	57.6	55.9
19	Average Rise in Core	65.7	66.8	55.5	60.0	58.3
20	Average in Core	570.3	564.8	571.0	582.5	575.4
21	Average in Vessel	567.8	563.2	569.5	581.3	574.2
22	Nominal Outlet of Hot Channel	667.5	631.7	633.5	642.9	642
23	Average Film Coefficient, Btu/hr-ft^2-F	5850	5800	5790	5600	5400
24	Average Film Temperature Difference, °F	35.4	35.6	30.3	31.0	31.8

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Heat Transfer at 100% Power					
25	Active Heat Transfer Surface Area, ft^2	52,200	52,200	52,200	28,715	42,460
26	Average Heat Flux, Btu/hr-ft^2	207,900	207,900	175,600	175,800	171,600
27	Maximum Heat Flux, Btu/hr-ft^2	579,600	579,600	567,300	491,000	554,200
28	Average Thermal Output, kw/ft	6.7	6.7	5.7	5.7	5.5
29	Maximum Thermal Output, kw/ft	18.8	18.8	18.4	16.0	17.0
30	Maximum Clad Surface Temp at Nominal Pressure, °F	657	657	657	657	657

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	Fuel Central Temperature, °F					
31	Maximum at 100% Power	4250	4250	4090	3750	4030
32	Maximum at Overpower	4500	4500	4380	4000	4300
33	Thermal Output, kw/ft at Maximum Overpower	21.1	21.1	20.6	17.9	20.0
	Core Mechanical Design Parameters					
	Fuel Assemblies					
34	Design	RCC Canless 15x15	RCC Canless 15x15	RCC Canless 15x15	RCC Canless 14x14	RCC Canless 15x15
35	Rod Pitch, in.	0.563	0.563	0.563	0.556	0.563
36	Overall Dimensions, In.	8.426 x 8.426	8.426 x 8.426	8.426 x 8.426	7.763 x 7.763	8.426 x 8.426
37	Fuel Weight (as UO_2), pounds	216, 600	216, 600	216, 000	120, 130	176, 200

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38	Total Weight, pounds	276, 000	276, 000	276, 000	154, 519	226, 200
39	Number of Grids per Assembly	7	7	9	7	7
	Fuel Rods					
40	Number	39,372	39,372	39,372	21,659	32,028
41	Outside Diameter, in.	0.422	0.422	0.422	0.422	0.422
42	Diametral Gap, in. (Region 1, 2)	0.0075	0.0075	0.0065	0.0065	0.0065
	(Region 3)	0.0085	0.0085			
43	Clad Thickness, in	0.0243	0.0243	0.0243	0.0243	0.0243
44	Clad Material	Zircaloy	Zircaloy	Zircaloy	Zircaloy	Zircaloy

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Fuel Pellets					
45	Material	UO_2Sintered	UO_2Sintered	UO_2Sintered	UO_2Sintered	UO_2Sintered
46	Density (% of Theoretical)	94-93-92	94-93-92	94-92-91	94-92-91	94-92-91
47	Diameter Gap, in. (Region 1, 2)	0.3659	0.3659	0.3669	0.3669	0.3669
	(Region 3)	0.3649	0.3649			
48	Length, in.	0.6000	0.6000	0.6000	0.6000	0.6000
	Rod Cluster Control Assemblies					
49	Neutron Absorber	5% Cd-15% In-80%Ag	5% Cd-15% In-80%Ag	5% Cd-15% In-80%Ag	5% Cd-15% In-80%Ag	5% Cd-15% In-80%Ag
50	Cladding Material	Type 304 SS-Cold Worked	Type 304 SS-Cold Worked	Type 304 SS-Cold Worked	Type 304 SS-Cold Worked	Type 304 SS-Cold Worked

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
51	Clad Thickness, In.	0.019	0.019	0.019	0.019	0.019
52	Number of Cluster	53	53	53	37	53
53	Number of Control Rods per Cluster	20	20	20	16	20
	Core Structure					
54	Core Barrel I.D./O.D., in.	148.0/15215	148.0/152.5	148.0/152.5	109.0/112.5	133.875/ 137.875
55	Thermal Shield I.D./O.D., in.	158.5/164.0	158.5/164.0	158.5/164	115.3/122.5	
	Final Nuclear Design Data					
	Structural Characteristics					
56	Fuel Weight (As UO_2), lbs	216,600	216,600	216,000	120,130	176,200
57	Clad Weight, lbs	44,547	44,547	44,600	24,260	36,300

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
58	Core Diameter, in (Equivalent)	132.7	132.7	132.5	96.5	119.5
59	Core Height, in. (Active Fuel)	144	143.4	144	144	144
	Reflector Thickness and Composition					
60	Top - Water plus Steel, in.	10	10	10	10	10
61	Bottom - Water plus Steel, in.	10	10	10	10	10
62	Side - Water plus Steel, in.	15	15	15	15	15
63	H_2O/U, (Cold volume Ratio)	4.09	4.09	4.18	4.20	4.18
64	Number of Fuel Assemblies	193	193	193	121	157
65	UO_2 Rods per Assembly	204	204	204	179	204

Comparison Of Design Parameters**

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Performance Characteristics					
66	Loading Technique	3 region, non-uniform	3 region, non-uniform	3 region, non-uniform	3 region, non-uniform	3 region, non-uniform
	Fuel Discharge Burnup, MWD/MTU					
67	Average First Cycle	14,000	14,000	14,200	15,100	14,500
68	Equilibrium Core Average	21,800	21,800	24,700	33,000	33,000
	Feed Enrichments, weight %					
69	Region 1	2.25	2.25	2.2	2.27	1.85
70	Region 2	2.80	2.80	2.7	3.03	2.55
71	Region 3	3.30	3.30	3.2	3.40	3.10
	Equilibrium	3.2	3.2	-	3.40	3.10

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Control Characteristics					
	Effective Multiplication (Beginning of Life)					
72	Cold, No Power, Clean	1.183	1.183	1.257	1.211	1.180
73	Hot, No Power, Clean	1.154	1.154	1.999	1.167	1.38
74	Hot, Full Power, Xe and Sm Equilibrium	1.092	1.092	1.152	1.113	1.077
	Rod Cluster Control Assemblies					
75	Material	5% Cd-15% In-80% Ag	5% Cd-15% In-80% Ag	5% Cd-15% In-80% Ag	5% Cd-15% In-80% Ag	5% Cd-15% In-80% Ag
76	Number of RCC Assemblies	53	53	53	53	53
77	Number of Absorber Rods per RCC Assembly	20	20	20	20	20

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
78	Total Rod Worth	See Table 3.2.1-3	See Table 3.2.1-3	See Table 3.2.1-3	See Table 3.2.1-3	See Table 3.2.1-3
	Boron Concentration					
79	To shut reactor down with no rods inserted, Clean (k_{eff} = .99) Cold/Hot, ppm/ppm	1408/1265	1408/1265	1480/1370	1598/1676	1250/1210
80	To control at power with no rods inserted,	1168/850	1168/850	1200/780	1465/1007	1000/920
	clean/equilibrium xenon and samarium, ppm/ppm					
81	Boron worth, Hot	1% Δk/k/ 85 ppm	1% Δk/k/ 85 ppm	1% Δk/k/ 89 ppm	1% Δk/k/ 130 ppm	7.3 Δk/k
82	Boron worth, Cold	1% Δk/k/ 70 ppm	1% Δk/k/ 70 ppm	1% Δk/k/ 72 ppm	1% Δk/k/ 98 ppm	5.6 Δk/k

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	Kinetic Characteristics					
83	Moderator Temperature, Coefficient, Δk/k/°F	-0.3×10^{-4} to -3.2×10^{-4}	-0.3×10^{-4} to -3.2×10^{-4}	-0.3×10^{-4} to -3.0×10^{-4}	$+0.3 \times 10^{-4}$ to -3.5×10^{-4}	$+0.3 \times 10^{-4}$ to -3.5×10^{-4}
84	Moderator Pressure Coefficient, Δk/k/psi	$+0.3 \times 10^{-6}$ to $+4.0 \times 10^{-6}$	$+0.3 \times 10^{-6}$ to $+4.0 \times 10^{-6}$	-0.3×10^{-6} to $+3.0 \times 10^{-6}$	-0.3×10^{-6} to 3.5×10^{-6}	-0.3×10^{-6} to 3.5×10^{-6}
85	Moderator Density Coefficient Δk/k/g/cm^3	-0.1×10^{-5} to -0.8×10^{-5}	-0.1×10^{-5} to -0.8×10^{-5}	+0.03 to -0.30	-0.10 to -0.30	$+0.5 \times 10^{-3}$ to -2.5×10^{-3}
86	Doppler Coefficient, Δk/k/°F	-1.0×10^{-5} to -1.7×10^{-5}	-1.0×10^{-5} to -1.7×10^{-5}	$-1\ 1 \times 10^{-5}$ to $-1\ 8 \times 10^{-5}$	-1×10^{-5} to -1.6×10^{-5}	-1×10^{-5} to -1.6×10^{-5}
	Reactor Coolant System Code Requirements					
	Component					
87	Reactor Vessel	ASME III Class A	ASME III Class A	ASME III Class A	ASME III Class A	ASME III Class A
	Steam Generator					

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88	Tube Side	ASME III Class A	ASME III Class A	ASME III Class A	ASME III Class A	ASME III Class A
89	Shell Side	ASME III Class C*	ASME III Class C*	ASME III Class C*	ASME III Class C*	ASME III Class C*
90	Pressurizer	ASME III Class A	ASME III Class A	ASME III Class A	ASME III Class A	ASME III Class A
91	Pressurizer Relief Tank	ASME III Class C	ASME III Class C	ASME III Class C	ASME Class C	ASME Class C
92	Pressurizer Safety Valves	ASME III	ASME III	ASME III	ASME III	
93	Reactor Coolant Piping	USAS B31.1	USAS B31.1	USAS B31.1	USAS B31.1	USAS B31.1

* The shell side of the steam generator conforms to the requirements for Class A vessels and is so stamped as permitted under the rules of Section III.

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Principal Design Parameters Of The Reactor Coolant System					
94	Reactor Primary Heat Output, MWt	3250	3250	2758	1518.5	2200
95	Reactor Primary Heat Output, Btu/hr	$11{,}090 \times 10^6$	$11{,}090 \times 10^6$	9413×10^6	5181×10^6	7508×10^6
96	Operating Pressure, psig	2235	2235	2235	2235	2235
97	Reactor Inlet Temperature	536.3	530.2	543	552.5	546.2
98	Reactor Outlet Temperature	599.3	594.3	596.0	610.0	602.1
99	Number of Loops	4	4	4	2	3
100	Design Pressure, psig	2485	2485	2485	2485	
101	Design Temperature, °F	650	650	650	650	650
102	Hydrostatic Test Pressure (Cold), psig	3107	3107	3110	3110	3110

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
103	Coolant Volume, including pressurizer, cu. Ft.	12,612	12,710	12,600	6450	9088
104	Total Reactor Flow, gpm	350,000	350,000	178,000	268,500	
104A	Total Reactor Flow lb/sec	37,765	31,765			
	Principal Design Parameters Of The Reactor Vessel					
105	Material	Same as others See Table 4.2-1	Same as others See Table 4.2-1	SA-302 Grade B, low alloy steel, internally clad with austenitic stainless steel	SA-302 Grade B, low alloy steel, internally clad with austenitic stainless steel	SA-302 Grade B, low alloy steel, internally clad with austenitic stainless steel
106	Design Pressure, psig	2485	2485	2485	2485	2485
107	Design Temperature, °F	650	650	650	650	650

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108	Operating Pressure, psig	2235	2235	2235	2235	2235
109	Inside Diameter of Shell, in.	173	173	173	132.0	155.5
110	Outside Diameter Across Nozzles, in.	262-7/16	262-7/16	262-7/16	244-1/16	236
111	Minimum Clad Thickness, in.	43-9-11/16	43-9-23/32 (Unit 1) 43-9 15/16 (Unit 2)	43-9-11/16	39-0	41-6
112	Overall Height of Vessel & Enclosure Head, ft-in.	5/32	5/32	5/32	5/32	5/32

Comparison Of Design Parameters**

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Principal Design Parameters Of The Steam Generators					
113	Number of Units	4	4	4	2	3
114	Type	Vertical U-Tube with integral-moisture separator	Vertical U-Tube with integral-moisture separator	Vertical U-Tube with integral-moisture separator	Vertical U-Tube with integral-moisture separator	Vertical U-Tube with integral-moisture separator
115	Tube Material	Inconel	Inconel	Inconel	Inconel	Inconel
116	Shell Material	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel	Carbon Steel
117	Tube Side Design Pressure, psig	2485	2485	2485	2485	2485
118	Tube Side Design Temperature, °F	650	650	650	650	650
119	Tube Side Design Flow, lb/hr	33.9×10^6	33.8×10^6	34.1×10^6	33.4×10^6	33.9×10^6

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120	Shell Side Design Pressure, psig	1085	1085 (design)	1085	1085	1085
121	Shell Side Design Temperature, °F	600	1/4	556	556	556
122	Operating Pressure, Tube Side, Nominal psig	2235	3107	2235	2235	2235
123	Operating Pressure, Shell Side, Max, psig	1085 (design)	1085 (design)	1105.3	1020	1020
124	Maximum Moisture at Outlet at Full Load, %	1/4	1/4	1/4	1/4	¼
125	Hydrostatic Test Pressure, Tube Side (cold), psig	3107	3107	3110	3110	3110

Comparison Of Design Parameters**

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Principal Design Parameters Of The Reactor Coolant Pumps					
126	Number of Units	4	4	4	4	4
127	Type	Vertical, single stage radial flow with bottom suction and horizontal discharge	Vertical, single stage radial flow with bottom suction and horizontal discharge	Vertical, single stage radial flow with bottom suction and horizontal discharge	Vertical, single stage radial flow with bottom suction and horizontal discharge	Vertical, single stage radial flow with bottom suction and horizontal discharge
128	Design Pressure, psig	2485	2485	2485	2485	2485
129	Design Temperature, °F	650	650	650	650	650
130	Operating Pressure, Nominal, psig	2235	2235	2235	2235	2235
131	Suction Temperature, °F	539	539	556	551.5	546.5

Comparison Of Design Parameters**

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Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
132	Design Capacity, gpm	88,500	87,500	80,000	80,000	88,500
133	Design Head, ft.	277	277	252	259	261
134	Hydrostatic Test Pressure (cold), psig	3107	3107	3110	3110	3110
135	Motor Type	AC Induction single speed	AC Induction single speed air cooled	AC Induction single speed	AC Induction single speed air cooled	AC Induction single speed air cooled
136	Motor Rating (nameplate)	6000 HP	6000 HP	6000 HP	6000 HP	6000 HP

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**** This table is retained for historical purpose only. It compares original Cook Plant parameters to other similar nuclear plants**

Reference Line No.	Thermal And Hydraulic Design Parameters	Donald C. Cook Nuclear Plant Units 1 & 2 Final Report	Zion Station Units 1 & 2 Final Report	Indian Point #2 Final Report	Point Beach Units 1 & 2 Final Report	H. B. Robinson #2 Final Report
	Principal Design Parameters Of The Reactor Coolant Piping					
137	Material	See Table 4.2-1	See Table 4.2-1	Austenitic SS	Austenitic SS	Austenitic SS
138	Hot Leg - I.D., in.	29	29	29	29	29
139	Cold Leg - I.D., in.	27-1/2	27-1/2	27-1/2	27-1/2	27-1/2
140	Between Pump and Steam generator - I.D., in.	31	31	31	31	31
137	Design Pressure, psig	2485	2485	2485	2485	2485

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