Consumers Power Company

General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • Area Code 517 788-0550

August 3, 1979

Director, Nuclear Reactor Regulation
Att Mr Dennis L Ziemann, Chief
Operating Reactors Branch No 2
US Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-255 - LICENSE DPR-20 -
PALISADES PLANT - STEAM GENERATOR
REPAIR REPORT - REVISION 3 JULY 1979

Attached is Revision 3 dated July 1979 of the "Palisades Plant Steam Generator Repair Report." This Revision 3 contains responses to requests for additional information transmitted by letter dated May 16, 1979.

David A Bixel
Nuclear Licensing Administrator

CC JGKeppler, USNRC

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CONSUMERS POWER COMPANY

PALISADES PLANT

STEAM GENERATOR REPAIR REPORT

Docket 50-255
License DPR-20

At the request of the Commission and pursuant to the Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974, as amended, and the Commission's Rules and Regulations thereunder, Consumers Power Company submits the "Palisades Plant Steam Generator Repair Report," Revision 3, July 1979, which describes the potential repair program based on complete replacement of the existing steam generators if major repairs become necessary.

CONSUMERS POWER COMPANY

By R. C. Youngdahl
R C Youngdahl, Executive Vice President

Sworn and subscribed to before me this 3rd day of August 1979.

Dorothy H. Bartkus
Dorothy H Bartkus, Notary Public
Jackson County, Michigan
My commission expires March 26, 1983.

7908070

RELIABILITY CORRESPONDENCE

CONSUMERS POWER COMPANY

PALISADES PLANT

STEAM GENERATOR REPAIR REPORT

Docket 50-255
License DPR-20

At the request of the Commission and pursuant to the Atomic Energy Act of 1954 and the Energy Reorganization Act of 1974, as amended, and the Commission's Rules and Regulations thereunder, Consumers Power Company submits the "Palisades Plant Steam Generator Repair Report," Revision 3, July 1979, which describes the potential repair program based on complete replacement of the existing steam generators if major repairs become necessary.

CONSUMERS POWER COMPANY

By R C Youngdahl (Signed)
R C Youngdahl, Executive Vice President

Sworn and subscribed to before me this 3rd day of August 1979.

Dorothy H Bartkus (Signed)
Dorothy H Bartkus, Notary Public
Jackson County, Michigan
My commission expires March 26, 1983.

Accession
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PALISADES PLANT SGRR

REMOVE		INSERT	
vi	Rev 2	vi	Rev 3
vii	Rev 2	vii	Rev 3
viii	Rev 1	viii	Rev 3
x	Rev 2	x	Rev 3
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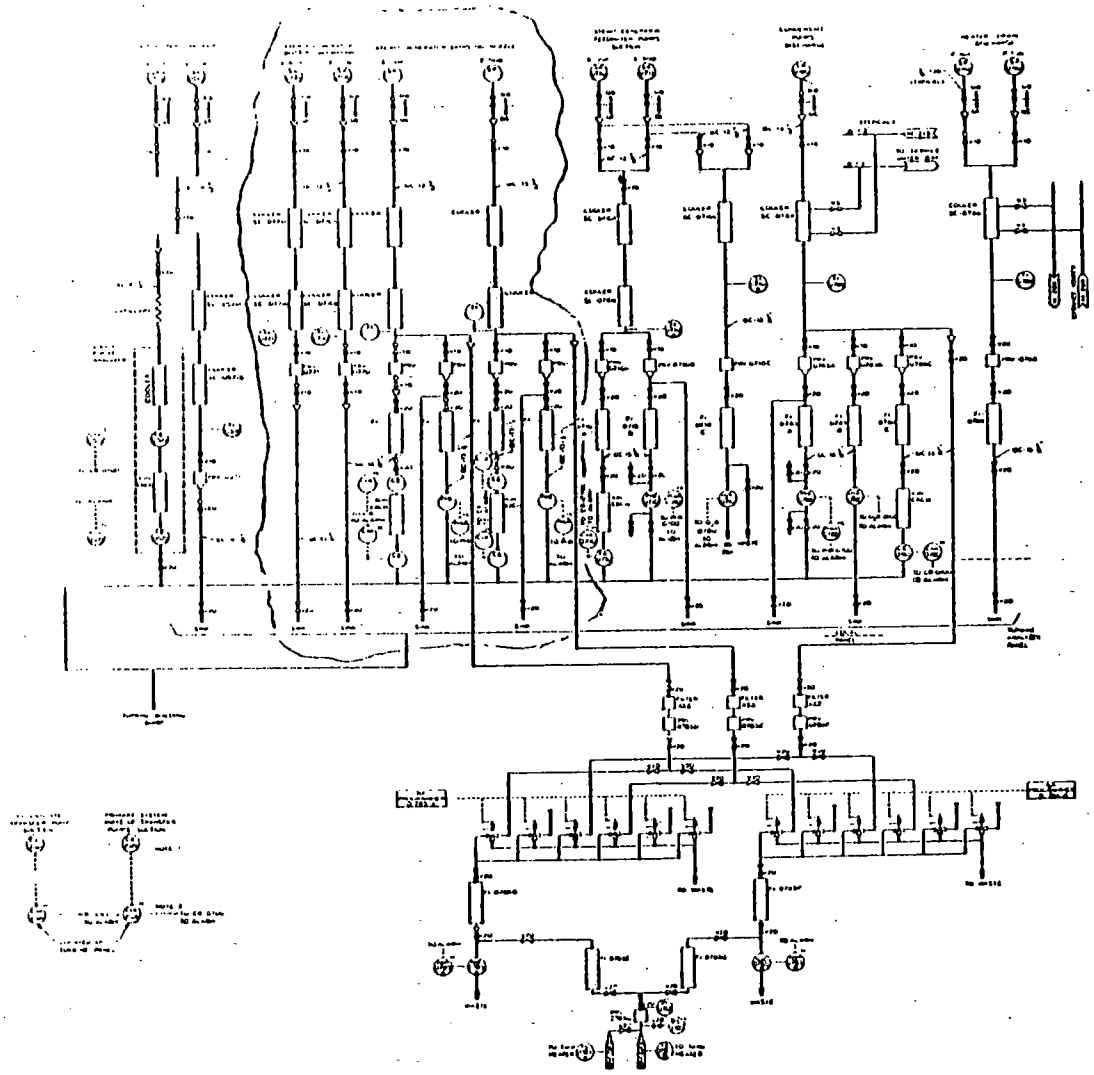


PALISADES PLANT
STEAM GENERATOR REPAIR REPORT

MODIFIED TURBINE ANALYZER PANEL FOR SAMPLING SYSTEM
Figure 3.3-2

Revision 3
July 1979

PALISADES PLANT SGRR

TABLE 4.3.2

(SHEET 1)

MAN-REM ASSESSMENT FOR REPLACEMENT

(The manhour and man-rem estimates have been revised refer to Table C-1-1 to C-1-5.)

Work Area	Estimated (1) Manhours in Radiation Field	Average Radiation Field (rem/hr)	Area (1) Man-Rem Dose (Man-Rem) Unshielded	Reduction Factor (Shielding and/or Decontamination)	Area Man-Rem Dose (Man-Rem)
1. Outside of power plant building but within security fence	213,300	$.5x10^{-6}$	1.06	1.0	1.06
2. Checking in and out through security and health pysics, as well as time spent suiting up, cleaning up, and moving to and from work area for personnel working in radioactive areas	55,300	.0025	138.25	1.0	138.25
3. Inside containment near new construction opening	3,550	0.001	3.55	1.0	3.55
4. Within 6 feet of outside of reactor coolant pipe or bottom of steam generator before removal of steam generators	5,050	0.03	151.5	1.0	151.5
5. Within 6 feet of outside of reactor coolant pipe after steam generator's removal	19,100 23,400 A1	0.01	191.0 234.0 A1	1.0	191.0 234.0 A1
6. Within 6 feet of outside of reactor coolant pipe or bottom of steam generators with partial exposure to inside of reactor coolant pipe before steam generator's removal	750	1.0	750.0	0.05	37.5
7. Within 6 feet of outside of reactor coolant pipe with partial exposure to inside of reactor coolant pipe after steam generator's removal	4,400	1.0	4,400	0.05	220.0
8. Inside reactor coolant pipe	4,500 200 A1 300 A2	9.0	40,500 1,800 A1 2,700 A2	0.1	4070.0 180.0 A1 270.0 A2
9. Low radiation area within containment	41,250 4,200 A2	0.001 .005 A2	41.25 21.0 A2	1.0	41.25 21.0 A2

PALISADES PLANT SGRR

TABLE 4.3.2

(SHEET 2)

MAN-REM ASSESSMENT FOR REPLACEMENT

(The manhour and man-rem estimates have been changed refer to Table C-1-1 to C-1-5.)

Work Area	Estimated (1) Manhours in Radiation Field	Average Radiation Field (rem/hr)	Area (1) Man-Rem Dose (Man-Rem) Unshielded	Reduction Factor (Shielding and/or Decontamination)	Area Man-Rem Dose (Man-Rem)
10. Within 6 feet of top half of original steam generators	1,100	0.005	5.5	1.0	5.5
11. Within 6 feet of top half of new steam generators	8,050	0.001	8.05	1.0	8.05
12. Operating floor of containment	15,800	0.005	79.0	0.2	15.8
13. Inside containment, above polar crane	1,150	0.001	1.15	1.0	1.15
14. Auxiliary building near clean resin tank and cooling water tank	750	0.001	0.75	1.0	0.75
15. Auxiliary building near blowdown tank	6,700	0.001	6.7	1.0	6.7
16. Spent fuel pool floor	2,750	0.005	13.75	1.0	13.75
17. Within 6 feet of the bottom half of new steam generators	3,700	0.010	37.0	1.0	37.0
18. Within 6 feet of the outside of the reactor vessel	50	1.0	50.0	1.0	50.0
19. Next to the existing steam generators outside of the containment	1,000	0.02	20.0	1.0	20.0
				Total	4,993
				A1	1,666
				A2	1,193

Note:

(1) The three man-rem estimates given for work area 8 (inside of reactor coolant pipe) are presented because of three welding techniques under consideration. The ALARA considerations will be the factor determining which technique is eventually used. The total time estimated for cutting, welding, and inspecting inside the reactor coolant pipes is 4,500 manhours. One alternative (A1) is a technique, presently being investigated for feasibility, utilizing manual welding from the outside of the piping. Using this method, only 200 manhours out of a total of 4,500 would be required inside primary coolant piping. The remaining 4,300 manhours would be spent within 6 feet of the reactor coolant pipe (work area 5). The second alternative (A2) is an automatic welding technique for the cladding from inside the piping utilizing remote viewing. This method required 300 manhours inside the piping, and the remaining 4,200 manhours would be spent in a low radiation area in the containment (work area 9).

PALISADES PLANT SGRR

C-1 Provide the following additional information regarding ALARA considerations (Sections 1.1.5 and 4.3.5):

(1) Duration of exposure associated with anticipated replacement/repair tasks

(2) Repetition rate of the tasks

(3) Numbers of work force exposed during each task

(4) Occupational exposures associated with anticipated replacement/repair activities

RESPONSE:

Tables (C-1-1 through C-1-5) provide the requested additional information. The manhour and corresponding man-rem estimates have changed from the original presented in Table 4.3.2. The changes are based on modifications to the welding techniques, described as Alternative (A_1) and Alternative (A_2), and further development of work packages.

The new exposure estimates are as follows: 1,547 to 2,808 man-rem (A_1), based on manual welding the reactor coolant pipe carbon steel portion and machine welding the cladding (with remote viewing), and 1,537 to 2,663 man-rem (A_2) based on machine welding (with remote viewing) both the carbon steel and cladding. The man-rem range reflects two analyses, for 140 and 42 days after shut down for the commencement of primary system pipe cutting. These estimates do not include a contingency.

It should be noted that Work Area 8, which represents manhours spent inside the reactor coolant pipe, has been expanded to appropriately differentiate radiation field levels before and after local decontamination.

TABLE C-1-1
(Sheet 1)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
1	Scaffold, cut, and remove construction opening liner plate.	180	6	1	1	1,080	
		83	6	2	1	498	
2	Install new liner plate for construction opening, including fitup, scaffolding welding, etc.	233	6	3	1	1,398	
		100	6	2	1	600	
3	Cover and uncover spent fuel pool (protective cover).	270	7	16	0	1,890	
		116	7	2	0	812	
		240	7	1	0	1,680	
4	Cut reactor coolant pipe.	15	2	4	12	360	Inside radiation control envelope
		15	2	6	12	360	
		17	2	2	12	408	
		12	2	9	12	288	
5	Machine weld preparation on ends of reactor coolant pipes.	58	2	7	18	2,088	12 weld preps would be on decontaminated pipe and 6 on pipe attached to reactor.
		35	2	2	18	1,260	
		23	2	9	18	828	
6	Rig, fitup, line up, and tack in place reactor coolant pipe closure spools.	28	5	7	12	1,680	
		17	5	2	12	1,020	
		11	5	9	12	660	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 2)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
7	Weld hot leg reactor coolant pipe (carbon steel).	131	4	5	4	2,096	Manual welding 8C level
		2	1	8C	4	8	
		131	4	9	4	2,104	
		113	4	2	4	1,800	
8	Clad hot leg reactor coolant pipe (stainless steel)	2	1	8C	4	8	Utilizing machine welding with remote welding
		50	2	9	4	400	
		30	2	2	4	240	
9	Weld cold leg reactor coolant pipe (carbon steel).	89	4	5	8	2,864	Manual welding
		2	1	8C	8	16	Manual welding
		91	4	9	8	2,896	
		77	4	2	8	2,448	
10	Clad cold leg reactor coolant pipe (stainless steel)	2	1	8C	8	16	Machine welding with remote viewing
		45	2	9	8	720	
		28	2	2	8	448	
11	Stress relieve reactor coolant pipe.	22	4	5	12	1,056	
		2	1	8C	12	24	
		22	4	9	12	1,056	
		20	4	2	12	960	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 3)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
12	X-Ray and NDT reactor coolant pipe.	1/2	1	8	48	24	Leave pill guide in place 8C when possible in order to reduce exposure.
		4	2	5	120	1,960	
		3	2	2	120	720	
		1	2	9	120	240	
13	Install cleanliness plugs in reactor coolant pipe prior to cutting pipe.	1/2	1	8A	6	3	
		1	2	4	6	12	
14	Clean inside of reactor coolant pipe after welding.	1	1	8C	12	8	
15	Cover steam generator reactor coolant nozzles	1	4	8B	6	24	
		1	4	1	6	24	
		1	4	9	6	24	
		4	2	7	6	48	(Seal weld only)
16	Cover ends of reactor coolant pipe spools (temporary).	1	4	8B	18	72	
		2	4	7	18	144	
		1/2	4	1	18	36	
		1	4	2	18	72	
17	Rig reactor coolant pipes to decontamination area.	3	4	5	6	72	
		1	4	2	6	24	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 4)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
18	Measure reactor coolant pipe closure spools.	4	3	5	12	144	
		1	3	2	12	36	
19	Remove insulation from steam generators.	38	4	2	2	304	
		32	4	4	2	256	
		25	4	9	2	200	
		32	4	10	2	256	
20	Reinsulate new steam generator.	180	4	2	2	1,440	
		120	4	9	2	960	
		150	4	11	2	1,200	
		150	4	17	2	1,200	
21	Remove and replace reactor coolant pipe insulation.	5	2	2	12	120	
		3	2	4	12	72	
		5	2	5	12	120	
		3	2	9	12	72	
22	Cut, remove, bevel, erect, weld, stress relieve, and insulate main steam lines at top of steam generator.	260	3	2	2	1,560	
		277	3	9	2	1,662	
		40	3	10	2	240	
		148	3	11	2	888	
		148	3	12	2	888	
23	X-Ray and NDT main steam line.	40	2	2	2	160	(6 weld)
		25	2	9	2	100	
		65	2	11	2	260	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 5)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
24	Cut, bevel, erect, weld, stress reileve, and insulate feedwater line.	162	2	2	2	648	
		107	2	9	2	428	
		25	2	10	2	100	
		245	2	11	2	980	
25	X-Ray and NDT feedwater line.	20	2	2	2	80	(4 welds)
		45	2	11	2	180	
26	Remove and replace miscellaneous small pipe near steam generators.	60	4	2	1	240	
		50	4	4	1	200	
		40	4	9	1	160	
		50	4	17	1	200	
27	Move component cooling water tank and clean resin tank out of way and reinstall.	75	4	2	1	300	
		50	4	9	1	200	
		125	4	14	1	500	
28	Install blowdown, tank, pump, and insulation.	40	3	2	1	120	
		20	3	9	1	60	
		67	3	15	1	201	
29	Install new blowdown piping inside containment.	122	6	2	1	732	
		13	6	4	1	78	
		92	6	5	1	552	
		177	6	9	1	1,062	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 6)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
30	Install new blowdown piping outside containment.	193	6	2	1	1,158	
		128	6	9	1	768	
		322	6	15	1	1,932	
31	Remove electrical inside containment so steam generator can be removed.	37	4	2	1	148	
		63	4	4	1	252	
		25	4	9	1	150	
32	Reinstall electrical inside containment.	90	8	2	1	720	
		60	8	9	1	480	
		75	8	11	1	600	
		75	8	17	1	600	
33	Install electrical for new blowdown system.	92	4	2	1	368	
		12	4	9	1	48	
		173	4	15	1	692	
		32	4	17	1	128	
34	Install and remove equipment required to monitor position of reactor and steam generators during weldup of reactor coolant pipe.	30	2	2	1	60	
		-	-	10	-	-	
		130	1	9	1	130	
		20	2	17	1	40	
		20	2	18	1	40	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 7)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
35	Mobilize, install cages. Remove dome and buttress facia, relax tendons, remove tendons, chip concrete, cut rebar and tendon sheathing for containment construction opening.	1,075	20	1	1	21,500	
36	Replace opening on containment, including the following: Replace tendon sheathing, rebar, concrete and tendons, stress tendons and replace dome and buttress facia, demobilize.	1,275	15	1	1	19,125	
37	Construct and remove barge slip.	829	14	1	1	11,606	
38	Foundations for rigging equipment, including sheetpiling, earthwork, concrete foundations and removal of foundations (at containment building).	692	12	1	1	8,304	
39	Mobile heavy lift rigger.	100	15	1	1	1,500	
40	Assemble 4 crawlers.	150	10	1	1	1,500	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 8)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
41	Assemble jacking frame at barge.	62	12	1	1	744	
42	Assemble jacking frame at containment.	78	12	1	1	936	
43	Preassemble equipment for inside containment.	78	12	1	1	936	
44	Install lifting equipment inside containment.	112	15	2	1	1,680	
		158	15	12	1	2,370	
		105	15	13	1	1,575	
45	Remove existing steam generators from containment (rigging).	23	15	1	2	690	
		26	15	2	2	780	
		44	15	4	2	1,320	
		19	15	19	2	570	
46	Transport and store existing steam generators.	31	10	19	2	620	
47	Receive and ballast barge.	20	5	1	1	100	
48	Offload, store, load, and transport new steam generators.	158	10	1	2	3,160	
49	Rerig as required to install.	16	15	1	2	480	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 9)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
50	Install new steam generators.	19	15	1	2	570	
		21	15	2	2	630	
		37	15	12	2	1,110	
		12	15	17	2	360	
51	Remove all external rigging equipment from site.	225	15	1	1	3,375	
52	Remove all rigging equipment from containment.	75	15	2	1	1,125	
		105	15	12	1	1,575	
		70	15	13	1	1,050	
53	Remove internal rigging equipment from site.	63	15	1	1	945	
54	Miscellaneous rigging	150	5	1	1	750	
55	Steam generator storage building.	406	10	1	1	4,060	
56	Cut and remove top support of steam generator.	8	5	10	1	40	
		5	5	2	1	25	
		3	5	9	1	15	
57	Remove shims other steam generator top support.	6	4	10	1	24	
		4	4	2	1	16	
		2	4	9	1	8	

TABLE C-1-1
(Sheet 10)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
58	Remove hydraulic snubbers.	4	5	10	8	160	
		3	5	2	8	120	
		1	5	9	8	40	
59	Unbolt existing steam generator.	4	3	4	2	24	
		3	3	2	2	18	
		1	3	9	2	6	
60	Remove shims at steam generator base.	15	3	4	2	90	
		9	3	2	2	54	
		6	3	9	2	36	
61	Bolt down steam generators.	10	3	5	2	60	
		6	3	2	2	36	
		4	3	9	2	24	
62	Reshim bottom steam generator (sliding base).	50	3	5	2	300	
		30	3	2	2	180	
		20	3	9	2	120	
63	Replace top steam generator support.	120	3	11	2	720	
		72	3	2	2	432	
		48	3	9	2	288	
64	Reshim top steam generator supports.	40	3	11	2	240	
		24	3	2	2	144	
		16	3	9	2	96	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 11)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
65	Reinstall steam generator hydraulic snubbers.	30	4	11	8	960	
		18	4	2	8	576	
		12	4	9	8	384	
66	Miscellaneous pipe operations (welders tests, material hangling, scaffolding, training, hangers and supports, line testing, cleanup, tents).			1		25,088	Welders tests, training, material handling and fabrication of tents are in Location 1. Remainder of manhours were allocated on the basis of piping manhours in each location.
				2		7,030	
				4		952	
				5		3,699	
				8		20	
				9		6,982	
				10		552	
				11		1,088	
				12		413	
				15		914	
				17		87	
67	Distributables (startup, cleanup, scaffolding, welders tests other than pipe fitters, miscellaneous).			1		11,436	Welders tests and miscellaneous in Area 1. Remainder of manhours allocated on the basis of direct manhours excluding Area 1.
				2		13,298	
				3		1,003	
				4		1,526	
				5		4,883	
				6		131	
				7		1,613	
				8		51	
				9		9,766	
				10		567	
				11		2,921	

*Refer to Table C-1-5

TABLE C-1-1
(Sheet 12)

MANUAL WELDING OF RC PIPE WITH MACHINE CLADDING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
67	(Continued)			12		2,616	
				13		1,090	
				14		218	
				15		1,526	
				16		785	
				17		1,090	
				19		480	
68	Nonmanual			1		99,160	Office personnel and 50% of engineers and supervision's man-hours are in Location #1. Remainder of man-hours by discipline were allocated to the proper location based on direct manhours expended in that location by discipline. For example: The man-hours for electrical engineers and supts were allocated based on the electrical direct hours expended on each task at each location.
				2		6,511	
				3		53	
				4		1,110	
				5		2,872	
				6		16	
				7		85	
				8		14	
				9		5,770	
				10		426	
				11		1,176	
				12		895	
				13		149	
				14		11	
				15		1,143	
				16		141	
				17		401	
				19		67	

*Refer to Table C-1-5

TABLE C-1-2
(Sheet 1)

SUMMARY OF MANHOURS FOR ALL TASKS BY LOCATION

MANUAL WELDING OF REACTOR COOLANT C.S. PIPE WITH
MACHINE CLADDING AND REMOTE VIEWING

TASK NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1		498	1,000																
2		600	1,398																
3	1,680	812														1,890			
4		408		360		360			288										
5		1,260					2,088		828										
6		1,020					1,680		660										
7		1,800			2,096			8	2,104										
8		240						8	400										
9		2,448			2,864			16	2,896										
10		448						16	720										
11		960			1,056			24	1,056										
12		720			960			24	240										
13				12				3											
14								8											
15	24						48	24	24										
16	16	72					144	72											
17		24			72														
18		36			144														
19		304		256					200	256									
20		1,440							960		1,200						1,200		
21		120		72	120				72										
22		1,560							1,662	240	888	888							
23		160							100		260								
24		648							428	100	980								
25		80									180								
26		240		200					160								200		
27		300							200					500					

TABLE C-1-2
(Sheet 2)

SUMMARY OF MANHOURS FOR ALL TASKS BY LOCATION

MANUAL WELDING OF REACTOR COOLANT C.S. PIPE WITH
MACHINE CLADDING AND REMOTE VIEWING

TASK NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
28		120							60						201				
29		732		78	552				1,062										
30		1,158							768						1,932				
31		148		252					150										
32		720							480		680						600		
33		368							48						692		128		
34		60							130								40	40	
35	21,500																		
36	19,125																		
37	11,606																		
38	8,304																		
39	1,500																		
40	1,500																		
41	744																		
42	936																		
43	936																		
44		1,680																	
45	690	780		1,320								2,370	1,575						570
46																			620
47	100																		
48	3,160																		
49	480																		
50	570	630										1,110					360		
51	1,375																		
52		1,125										1,575	1,050						
53	945																		

TABLE C-1-2
(Sheet 3)

SUMMARY OF MANHOURS FOR ALL TASKS BY LOCATION

MANUAL WELDING OF REACTOR COOLANT C.S. PIPE WITH
MACHINE CLADDING AND REMOTE VIEWING

TASK NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
54	750																		
55	4,060																		
56		25							15	40									
57									8	24						16			
58		120							40	160									
59		18		24					6										
60		54		90					36										
61		36			60				24										
62		180			300				120										
63		432							288		720								
64		144							96		240								
65		576							384		960								
66	25,088	7,030		952	3,699			20	6,982	552	1,088	413			914		87		
Total Directs	107,061	32,334	2,478	3,640	11,923	360	3,960	223	23,662	1,372	7,116	6,356	2,625	500	3,739	1,906	2,615	40	1,190
67	11,436	13,298	1,003	1,526	4,883	131	1,613	51	9,766	567	2,921	2,616	1,090	218	1,526	785	1,090	-	480
68	99,160	6,511	53	1,110	2,872	16	85	14	5,770	426	1,176	895	149	11	1,143	141	401	-	67
Total	217,657	52,143	3,534	6,276	19,678	507	5,658	288	39,198	2,365	11,213	9,867	3,864	729	6,408	2,832	4,106	40	1,737

TABLE C-1-3
(Sheet 1)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
1	Scaffold, cut, and remove construction opening liner plate.	180	6	3	3	1,080	
		83	6	2	1	498	
2	Install new liner plate for construction opening, including fitup, scaffolding, welding, etc.	233	6	3	1	1,398	
		100	6	2	1	600	
3	Cover and uncover spent fuel pool (protective cover).	270	7	16	0	1,890	
		116	7	2	0	812	
		240	7	1	0	1,680	
4	Cut reactor coolant pipe.	15	2	4	12	360	Inside radiation control envelope
		15	2	6	12	360	
		17	2	2	12	408	
		12	2	9	12	288	
5	Machine weld prep on ends of reactor coolant pipes.	58	2	7	18	2,088	12 weld preps would be on decontaminated pipe and 6 on pipe attached to reactor.
		35	2	2	18	1,260	
		23	2	9	18	828	
6	Rig, fitup, lineup and tack in place reactor coolant pipe closure spools.	28	5	7	12	1,680	
		17	5	2	12	1,020	
		11	5	9	12	660	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 2)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
7	Weld hot leg reactor coolant pipe (carbon steel).	4	2	7	4	32	Utilizing machine welding with remote viewing.
		3	1	8C	4	12	
		234	1	5	4	935	
		146	3	2	4	1,753	
		273	3	9	4	3,276	
8	Clad hot leg reactor coolant pipe (stainless steel)	2	1	8C	4	8	Utilizing machine welding with remote viewing.
		50	2	9	4	400	
		30	2	2	4	240	
9	Weld cold leg reactor coolant pipe (carbon steel).	4	2	7	8	64	
		2	1	8	8	16	
		160	1	5	8	1,280	
		100	3	2	8	2,400	
		186	3	9	8	4,464	
10	Clad cold leg reactor coolant pipe (stainless steel).	2	1	8C	8	16	Machine welding with remote viewing.
		45	2	9	8	720	
		28	2	2	8	448	
11	Stress relieve reactor coolant pipe.	22	4	5	12	1,056	
		2	1	8C	12	24	
		22	4	9	12	1,056	
		20	4	2	12	960	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 3)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
12	X-Ray and NDT reactor coolant pipe.	1/2	1	8C	48	24	Leave pill guide in place 8C when possible in order to reduce exposure.
		4	2	5	120	1,960	
		3	2	2	120	720	
		1	2	9	120	240	
13	Install cleanliness plugs in reactor coolant pipe prior to cutting pipe.	1/2	1	8A	6	3	
		1	2	4	6	12	
14	Clean inside of reactor coolant pipe after welding.	1	1	8C	12	8	
15	Cover steam generator reactor coolant nozzles.	1	4	8B	6	24	
		1	4	1	6	24	
		1	4	9	6	24	
		4	2	7	6	48	(Seal weld only)
16	Cover ends of reactor coolant pipe spools (temporary).	1	4	8B	18	72	
		1	4	7	18	144	
		1/2	4	1	18	36	
		1	4	2	18	72	
17	Rig reactor coolant pipes to decontamination area.	3	4	5	6	72	
		1	4	2	6	24	

*Refer to Table C-1-5

PALISADES PLANT SGRR

TABLE C-1-3
(Sheet 4)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
18	Measure reactor coolant pipe closure spools.	4	3	5	12	144	
		1	3	2	12	36	
19	Remove insulation from steam generators.	38	4	2	2	304	
		32	4	4	2	256	
		25	4	9	2	200	
		32	4	10	2	256	
20	Reinsulate new steam generator.	180	4	2	2	1,440	
		120	4	9	2	960	
		150	4	11	2	1,200	
		150	4	17	2	1,200	
21	Remove and replace reactor coolant pipe insulation.	5	2	2	12	120	
		3	2	4	12	72	
		5	2	5	12	120	
		3	2	9	12	72	
22	Cut, remove, bevel, erect, weld, stress relieve, and insulate main steam lines at top of steam generator.	260	3	2	2	1,560	
		277	3	9	2	1,662	
		40	3	10	2	240	
		148	3	11	2	888	
		148	3	12	2	888	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 5)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
23	X-Ray and NDT main steam line.	40	2	2	2	160	(6 welds)
		25	2	9	2	100	
		65	2	11	2	260	
24	Cut, bevel, erect, weld, stress relieve, and insulate feedwater line.	162	2	2	2	648	
		107	2	9	2	428	
		25	2	10	2	100	
		245	2	11	2	980	
25	X-Ray and NDT feedwater line.	20	2	2	2	80	(4 welds)
		45	2	11	2	180	
26	Remove and replace miscellaneous small pipe near steam generators.	60	4	2	1	240	
		50	4	4	1	200	
		40	4	9	1	160	
		50	4	17	1	200	
27	Move component cooling water tank and clean resin tank out of way and reinstall.	75	4	2	1	300	
		50	4	9	1	200	
		125	4	14	1	500	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 6)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
28	Install blowdown, tank, pump, and insulation.	40	3	2	1	120	
		20	3	9	1	60	
		67	3	15	1	201	
29	Install new blowdown piping inside containment.	122	6	2	1	732	
		13	6	4	1	78	
		92	6	5	1	552	
		177	6	9	1	1,062	
30	Install new blowdown piping outside containment.	193	6	2	1	1,158	
		128	6	9	1	768	
		322	6	15	1	1,932	
31	Remove electrical inside containment so steam generator can be removed.	37	4	2	1	148	
		63	4	4	1	252	
		25	4	9	1	150	
32	Reinstall electrical inside containment.	90	8	2	1	720	
		60	8	9	1	480	
		75	8	11	1	600	
		75	8	17	1	600	
33	Install electrical for new blowdown system.	92	4	2	1	368	
		12	4	9	1	48	
		173	4	15	1	692	
		32	4	17	1	128	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 7)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
34	Install and remove equipment required to monitor position of reactor and steam generators during weldup of reactor coolant pipe.	30	2	2	1	60	
		–	–	10	–	–	
		130	1	9	1	130	
		20	2	17	1	40	
		20	2	18	1	40	
35	Mobilize, install cages. Remove dome and buttress facia, relax tendons, remove tendons, chip concrete, cut rebar and tendon sheathing for containment construction opening.	1,075	20	1	1	21,500	
36	Replace opening on containment, including the following: Replace tendon sheathing, rebar, concrete and tendons, stress tendons and replace dome and buttress facia, demobilize.	1,275	15	1	1	19,125	
37	Construct and remove barge slip.	829	14	1	1	11,606	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 8)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
38	Foundations for rigging equipment, including sheet-piling, earthwork, concrete foundations, and removal of foundations (at containment building).	692	12	1	1	8,304	
39	Mobile heavy lift rigger	100	15	1	1	1,500	
40	Assemble 4 crawlers.	150	10	1	1	1,500	
41	Assemble jacking frame at barge.	62	12	1	1	744	
42	Assemble jacking frame at containment.	78	12	1	1	936	
43	Preassemble equipment for inside containment.	78	12	1	1	936	
44	Install lifting equipment inside containment.	112	15	2	1	1,680	
		158	15	12	1	2,370	
		105	15	13	1	1,575	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 9)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
45	Remove existnig steam generators from containment (rigging).	23	15	1	2	690	
		26	15	2	2	780	
		44	15	4	2	1,320	
		19	15	19	2	570	
46	Transport and store existing steam generators.	31	10	19	2	620	
47	Receive and ballast barge.	20	5	1	1	100	
48	Offload, store, load, and transport new steam generators.	158	10	1	2	3,160	
49	Rerig as required to install.	16	15	1	2	480	
50	Install new steam generators.	19	15	1	2	570	
		21	15	2	2	630	
		37	15	12	2	1,110	
		12	15	17	2	360	
51	Remove all external rigging equipment from site.	225	15	1	1	3,375	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 10)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
52	Remove all rigging equipment from containment.	75	15	2	1	1,125	
		105	15	12	1	1,575	
		70	15	13	1	1,050	
53	Remove internal rigging equipment from site.	63	15	1	1	945	
54	Miscellaneous rigging.	150	5	1	1	750	
55	Steam generator storage building.	406	10	1	1	4,060	
56	Cut and remove top support of steam generator.	8	5	10	1	40	
		5	5	2	1	25	
		3	5	9	1	15	
57	Remove shims other steam generator top support.	6	4	10	1	24	
		4	4	2	1	16	
		2	4	9	1	8	
58	Remove hydraulic snubbers.	4	5	10	8	160	
		3	5	2	8	120	
		1	5	9	8	40	
59	Unbolt existing steam generator.	4	3	4	2	24	
		3	3	2	2	18	
		1	3	9	2	6	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 11)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
60	Remove shims at steam generator base.	15	3	4	2	90	
		9	3	2	2	54	
		6	3	9	2	36	
61	Bolt down steam generators	10	3	5	2	60	
		6	3	2	2	36	
		4	3	9	2	24	
62	Reshim bottom steam generator (sliding base).	50	3	5	2	300	
		30	3	2	2	180	
		20	3	9	2	120	
63	Replace top steam generator support.	120	3	11	2	720	
		72	3	2	2	432	
		48	3	9	2	288	
64	Reshim top steam generator supports.	40	3	11	2	240	
		24	3	2	2	144	
		16	3	9	2	96	
65	Reinstall steam generator hydraulic snubbers.	30	4	11	8	960	
		18	4	2	8	576	
		12	4	9	8	384	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 12)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
66	Miscellaneous pipe operations (welders tests, material handling, scaffolding, training, hangers and supports, line testing, cleanup, tests).				1	25,058	Welders tests, training, material handling and fabrication of tents are in Location 1. Remainder of manhours were allocated on the basis of piping manhours in each location.
					2	6,993	
					4	1,064	
					5	1,954	
					7	217	
					8	20	
					9	8,358	
					10	543	
					11	1,107	
					12	434	
					15	933	
					17	87	
67	Distributables (startup, cleanup, scaffolding, welders tests other than pipe fitters, miscellaneous).				1	11,400	
					2	13,385	
					3	1,003	
					4	1,526	
					5	3,052	
					6	131	
					7	1,744	
					8	---	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 13)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
67	(Continued)				9	11,466	
					10	567	
					11	2,921	
					12	2,616	
					13	1,090	
					14	218	
					15	1,526	
					16	785	
					17	1,090	
					19	480	
68	Nonmanual				1	99,160	Office personnel +50%
					2	6,431	of engineers and
					3	53	supervision manhours
					4	1,191	are in Location 1.
					5	1,648	Remainder of manhours
					6	16	by discipline were
					7	238	allocated to the
					8	61	proper location based
					9	6,753	on direct manhours
					10	420	expended in that
					11	1,191	location by discipline.
					12	911	

*Refer to Table C-1-5

TABLE C-1-3
(Sheet 14)

MACHINE WELDING OF R.C. PIPE WITH REMOTE VIEWING

TASK NUMBER	DESCRIPTION	DURATION (HOURS)	AVERAGE NUMBER OF PERSONNEL	*LOCATION	NUMBER OF TIMES TASK PERFORMED	MANHOURS	COMMENTS
68	(Continued)				13	149	For example: The manhours for electrical engineers and supts were allocated based on the electrical direct hours expended on each task at each location.
					14	11	
					15	1,158	
					16	141	
					17	401	
					18	---	
					19	67	

*Refer to Table C-1-5

TABLE C-1-4
(Sheet 1)

SUMMARY OF MANHOURS FOR ALL TASKS BY LOCATION

WELDING OF REACTOR COOLANT PIPE BY
MACHINE WITH REMOTE VIEWING

TASK NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1		498	1,080																
2		600	1,398																
3	1,680	812														1,890			
4		408		360		360			288										
5		1,260					2,088		828										
6		1,020					1,680		660										
7		1,753			935		32	12	3,276										
8		240						8	400										
9		2,400			1,280		64	16	4,464										
10		448						16	720										
11		960			1,056			24	1,056										
12		720			960			24	240										
13				12				3											
14								8											
15	24						48	24	24										
16	36	72					144	72											
17		24			72														
18		36			144														
19		304		256					200	256									
20		1,440							960		1,200						1,200		
21		120		72	120				72										
22		1,560							1,662	240	888	888							
23		160							100		260								
24		648							428	100	980								
25		80									180								

TABLE C-1-4
(Sheet 1)

SUMMARY OF MANHOURS FOR ALL TASKS BY LOCATION

WELDING OF REACTOR COOLANT PIPE BY
MACHINE WITH REMOTE VIEWING

TASK NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
26		240		200					160								200		
27		300							200					500					
28		120							60						201				
29		732		78	552				1,062										
30		1,158							768						1,932				
31		148		252					150										
32		720							480		600						600		
33		368							48						692		128		
34		60							130								40	40	
35	21,500																		
36	19,125																		
37	11,606																		
38	8,304																		
39	1,500																		
40	1,500																		
41	744																		
42	936																		
43	936																		
44		1,680																	
45	690	780		1,320								2,370	1,575						570
46																			620
47	100																		
48	3,160																		
49	480																		
50	570	630										1,110					360		
51	3,375																		
52		1,125										1,575	1,050						
53	945																		

TABLE C-1-4
(Sheet 3)

SUMMARY OF MANHOURS FOR ALL TASKS BY LOCATION

WELDING OF REACTOR COOLANT PIPE BY
MACHINE WITH REMOTE VIEWING

TASK NO.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
54	750																		
55	4,060																		
56		25							15	40									
57									8	24						16			
58		120							40	160									
59		18		24					6										
60		54		90					36										
61		36			60				24										
62		180			300				120										
63		432							288		720								
64		144							96		240								
65		576							384		960								
Subtotal	82,021	25,209	2,478	2,664	5,479	360	4,056	207	19,453	820	6,028	5,943	2,625	500	2,825	1,906	2,528	40	1,190
66	25,058	6,993	-	1,064	1,954	-	217	20	8,358	543	1,107	434			933		87		
Total Directs	107,079	32,202	2,478	3,728	7,433	360	4,273	227	27,811	1,363	7,135	6,377	2,625	500	3,758	1,906	2,615	40	1,190
67	11,400	13,385	1,003	1,526	3,052	131	1,744	-	11,466	567	2,921	2,616	1,090	218	1,526	785	1,090	-	480
68	99,160	6,431	53	1,191	1,648	16	238	61	6,753	420	1,191	911	149	11	1,158	141	401	-	67
Total	217,639	52,018	3,534	6,445	12,133	507	6,255	288	46,030	2,350	11,247	9,904	3,864	729	6,422	2,832	4,106	40	1,737

PALISADES PLANT SGRR
TABLE C-1-5
(SHEET 1)
MAN-REM ESTIMATE

Work Area (Location)	(1) Average Radiation Field (rem/hr)	Estimated Manhours in Radiation Field (Manual Welding) A_1	(Machine Welding) A_2	(2) Area Man-Rem Dose (Man-Rem) (Manual Welding)	(Machine Welding)
1. Outside of power plant building but within security fence.	$.5 \times 10^{-5}$	217659	217639	1.1	1.1
2. Checking in and out through security and health physics as well as time spent suiting up, cleaning up and moving to and from work areas for personnel working in radioactive areas.	.0025	52143	52018	130.3	130
3. Inside containment near new construction opening.	.001	3534	3534	3.5	3.5
4. Within 6' of outside of reactor coolant pipe or bottom of steam generator prior to removal of steam generators.	.030 - .050	6276	6445	188.3 - 313.8	193.3 - 322.3
5. Within 6' outside of reactor coolant pipe after steam generator's removal.	.010 - .030	19678	12133	196.8 - 590.3	121.3 - 364.0
6. Within 6' of outside of reactor coolant pipe or bottom of steam generators with partial exposure to inside of reactor coolant pipe prior to steam generator's removal.	.050 - 0.100	507	507	25.4 - 50.7	25.4 - 50.7
7. Within 6' of outside of reactor coolant pipe with partial exposure to inside of reactor coolant pipe after steam generator's removal.	.050 - .100	5658	6255	283 - 454.8	312.8 - 625.5

PALISADES PLANT SGRR
TABLE C-1-5
(SHEET 2)
MAN-REM ESTIMATE

Work Area (Location)	(1) Average Radiation Field (rem/hr)	Estimated Manhours in Radiation Field (Manual Welding) A_1	Estimated Manhours in Radiation Field (Machine Welding) A_2	(2) Area Man-Rem Dose (Man-Rem) (Manual Welding)	(2) Area Man-Rem Dose (Man-Rem) (Machine Welding)
8. a) Inside of reactor coolant pipe before decontamination.	9.0 - 12.0	4.3	4.2	38.7 - 51.6	37.8 - 50.4
b) Outside of pipe w/partial exposure inside before decontamination.	1.0 - 2.0	136	134	136 - 272.0	134 - 268.0
c) Inside of reactor coolant pipe after decontamination.	.035	148	150	5.2	5.3
9. Low radiation area within containment	.005	39198	46030	196	230.2
10. Within 6' of top half of original steam generators (installed in place).	.005	2365	2350	11.8	11.8
11. Within 6' of top half of new steam generators (installed in place).	.001	11213	11247	11.2	11.3
12. Operating floor or containment.	.005 - .010	9867	9904	49.3 - 98.7	49.5 - 99.0
13. Inside containment, at polar crane elevation.	.001	3867	3864	3.9	3.9
14. Auxiliary building near clean resin tank and cooling water tank.	.001	729	729	0.7	0.7
15. Auxiliary building near blowdown tank.	.001	6408	6442	6.4	6.4
16. Spent fuel pool floor.	.005	2832	2832	14.2	14.2
17. Within 6' of the bottom half of new steam generators (in place).	.010 - .030	4106	4106	41.1 - 123.2	41.1 - 123.2

PALISADES PLANT SGRR
TABLE C-1-5
(SHEET 3)
MAN-REM ESTIMATE

Work Area (Location)	(1) Average Radiation Field (rem/hr)	Estimated Manhours in Radiation Field (Manual Welding) A_1	(Machine Welding) A_2	(2) Area Man-Rem Dose (Man-Rem) (Manual Welding)	(Machine Welding)
18. Within 6' of the outside of the reactor vessel.	.100	40	40	4.0	4.0
19. Next to the existing steam generators outside of the containment	.020 - .030	1737	1737	34.7 - 52.1	34.7 - 52.1
20. Installation of shielding and local decontamination.	(3)	(3)	(3)	165.7 - 300.8	164.7 - 285.3
				1547 - 2807.6	1537 - 2662.9

NOTE:

(1) Reduction factors attributed to shielding and/or decontamination have been incorporated into these field estimates and will not be presented here as a separate column.

(2) Further reduction in area man-rem dose could occur as work packages and ALARA studies continue. The estimates are based on conservative assumptions.

(3) The manhour estimates for placement of shielding and local decontamination are tentative due to the continuation of ALARA analysis and work package development. The numbers presented here are an estimate and represent a percentage of the total man-rem.

PALISADES PLANT SGRR

C-2 Describe the designated contamination control envelopes and your plan to maintain occupational exposure within these envelopes "ALARA." Include also dose rates, exposure times, and numbers of workers involved in the tasks (Section 4.3.3).

RESPONSE:

The contamination control envelopes will be used for the cutting of reactor coolant piping (Task 4). Although the design of the envelopes has not been finalized, the envelopes will include a high efficiency filtration system. The flow of air within the envelopes will preclude the escape of contaminants through the tent openings used for entering and exiting the area.

Each of the 12 cuts on primary coolant piping will require two workers approximately 15 manhours. It is estimated that 720 man-hours will be spent within the control envelopes, with an average radiation field of 30-50 mr/hr. This results in an estimated 21-36 man-rem of occupational exposure.

As described in the Repair Report, Section 4.3-1, personnel involved in work within areas with a high level of contamination will wear two sets of protective clothing. Respiratory protection will be required in accordance with Palisades health physics procedures. Sheet lead, lead wool blanket, or other shielding will be used where possible in accordance with ALARA guidelines.

PALISADES PLANT SGRR

C-3 Provide a diagram showing the radiation surveys around the steam generator replacement/repair activities. Include similar radiation surveys for Figures 4.2-4 through 4.2-7. Include a table showing the whole body dose received during the inspection and plugging of the degraded steam generator tubes for 1976, 1977, and 1978.

RESPONSE:

1. Figures 4.3-3, 4.3-4, and 4.3-5, which are included in the Steam Generator Repair Report, show radiation surveys around the steam generators at various times after shutdown. The fields specified are representative of those expected for the replacement repair activities. It should be noted that the fields specified in Figure 4.3-5 are expected to decrease significantly at the time that pipe cutting begins, considered to be 42-140 days post-shutdown for study purposes. The decrease will follow the general radiation field near the steam generator piping shown in Figure 4.3-7. Figures 4.2-4 through 4.2-7 have been modified to include general field information in areas where replacement/repair activities will occur and are now designated as Figures C-3-1 through C-3-4.

2. As requested, Tables C-3-1 and C-3-2 show the whole body dose received for inspection and plugging steam generator tubes during 1976 and 1978, respectively.

TABLE C-3-1
PALISADES PLANT - RADIATION DOSE SUMMARY
STEAM GENERATOR WORK 1976

	Activity		1976 Exposure
1.	ECT Personnel		
	Inside steam generator (without shielding)	16.5R	
	Outside steam generator	19.3R	
	Total (received over a period of 21 days)		35.8R
2.	Insert and remove shielding		
	Inside steam generator	17.8R	
	Outside steam generator	2.0R	
	Total		19.8R
3.	Insert templates		
	Inside steam generator	25.3R	
	Outside steam generator	2.8R	
	total		28.1R
4.	Brushing and rolling		
	Inside steam generator	37.6R	
	Outside steam generator	4.3R	
	Total		41.9R

PALISADES PLANT SGRR

Activity		1976 Exposure
5.	Insert plugs	
	Inside steam generator	28.8R
	Outside steam generator	2.9R
	Total	31.7R
6.	Weld plugs	
	Inside steam generator	54.4R
	Outside steam generator	15.3R
	Total	69.7R
7.	QC inspection of above operation	
	Inside steam generator	23.6R
	Outside steam generator	1.6R
	Total	25.2R
8.	Engineers support of above operations	10.7R
	Exposure accumulated inside steam generator	204.0R
	Exposure accumulated outside steam generator	48.2R
	TOTAL ACCUMULATED EXPOSURE	262.9R

NOTE: The exposure designated inside and outside steam generator are only estimates (although the total for each operation is accurate), since inside steam generator data is extracted from high radiation dose summary sheets which also include some outside steam generator work. The net result is that the inside steam generator data reads slightly higher and the outside steam generator data reads slightly lower than actually occurred. Radiation exposure to engineers is not included in this breakdown.

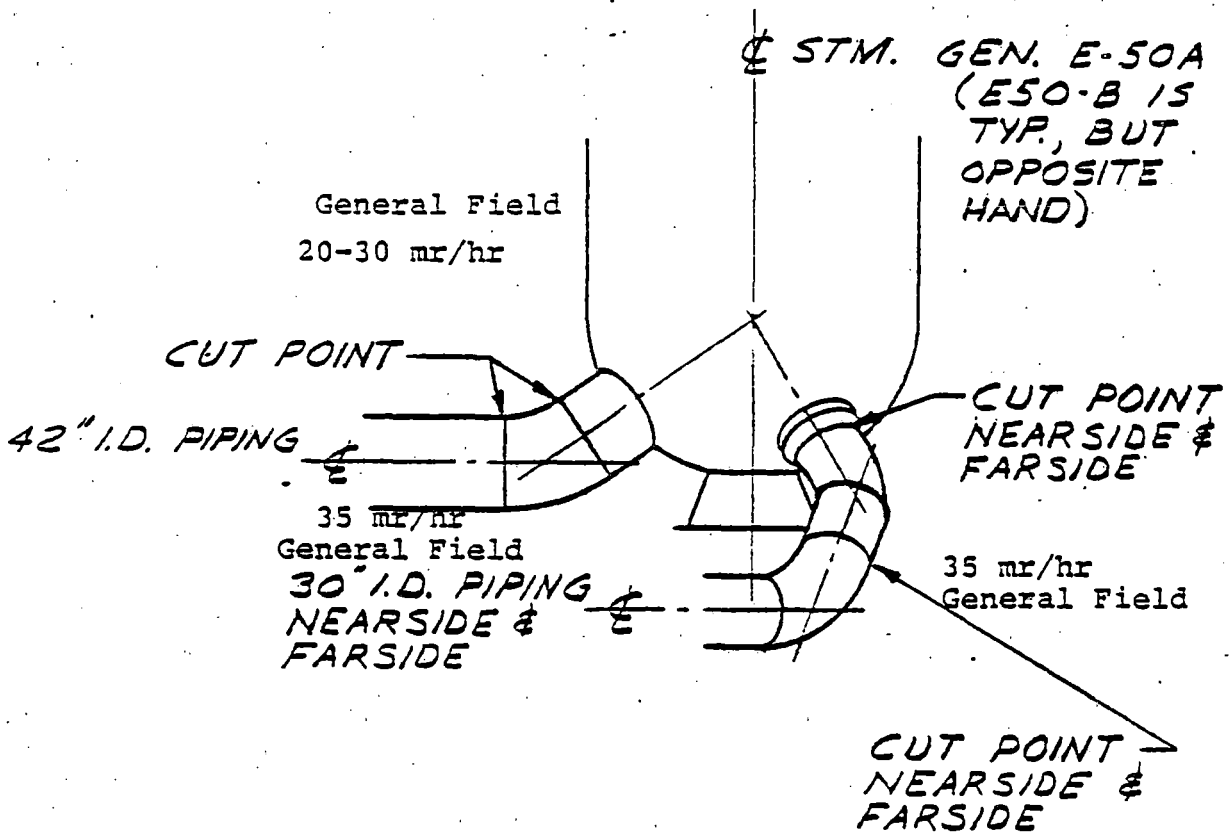
TABLE C-3-2
PALISADES PLANT - RADIATION DOSE SUMMARY
STEAM GENERATOR WORK 1978

Organization/Activity		*1978 Exposure (Level 9 R/hr 3.5 R/hr)
1.	Consumers Power Company Repairmen	
a.	Manway cover removal/vacuuming	5.6
b.	Dam installation	45.0
c.	Surge line shielding + miscellaneous	5.5
d.	Flooring/RSS hot legs	8.5
e.	Flooring, struts, tracks, bridge	
	A cold leg	14.3
	B cold leg	22.5

PALISADES PLANT SGRR

Activity		*1978 Exposure
f. Tracks, bridge		
	A hot leg	6.1
	B hot leg	6.3
g. General maintenance		1.9
h. Tube plugging		
	A cold leg	3.1
	A hot leg	1.6
	B cold leg	3.9
	B hot leg	1.8
i. Equipment removal/leg cleanup		6.8
j. Dam removal		4.6
k. Manway cover replacement		4.9
l. Cont. cleanup		2.6
		145.0
2. HP coverage		6.0
3. NDT lab/contractors		44.3
4. CE - Setup		2.4
Deplugging	A cold leg	7.4
	A hot leg	4.3
Sleeving		14.9
		29.0
	Total exposure	*224.3 Man-rem

NOTE: *These exposures are based on dosimeters and TLDs. Source is containment entry logs. These numbers should only be considered close approximations.



ELEVATION

PALISADES PLANT STEAM GENERATOR REPAIR REPORT
PRIMARY COOLANT PIPING CUT POINTS Figure C-3-1

Revision 3
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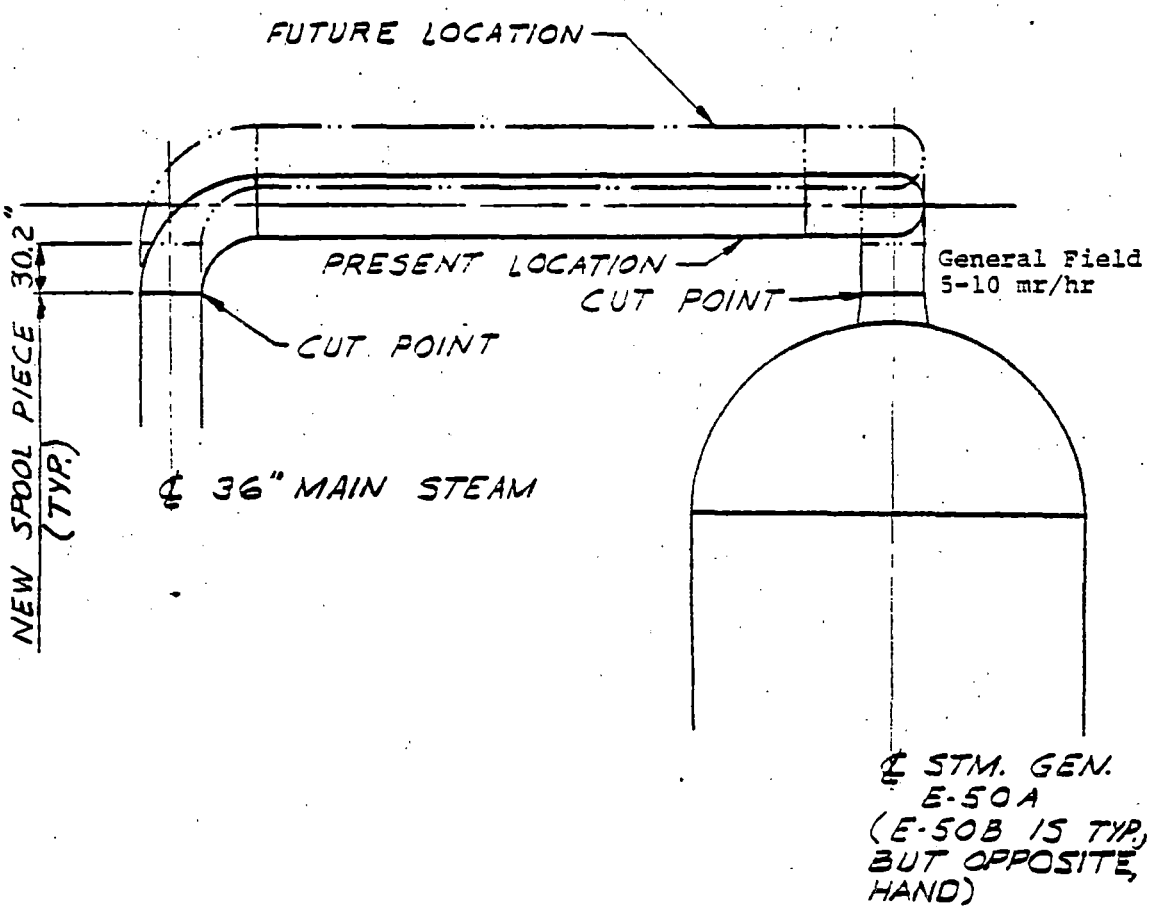

ELEVATION

PALISADES PLANT STEAM GENERATOR REPAIR REPORT
MAIN STEAM PIPING CUT POINTS
Figure C-3-2

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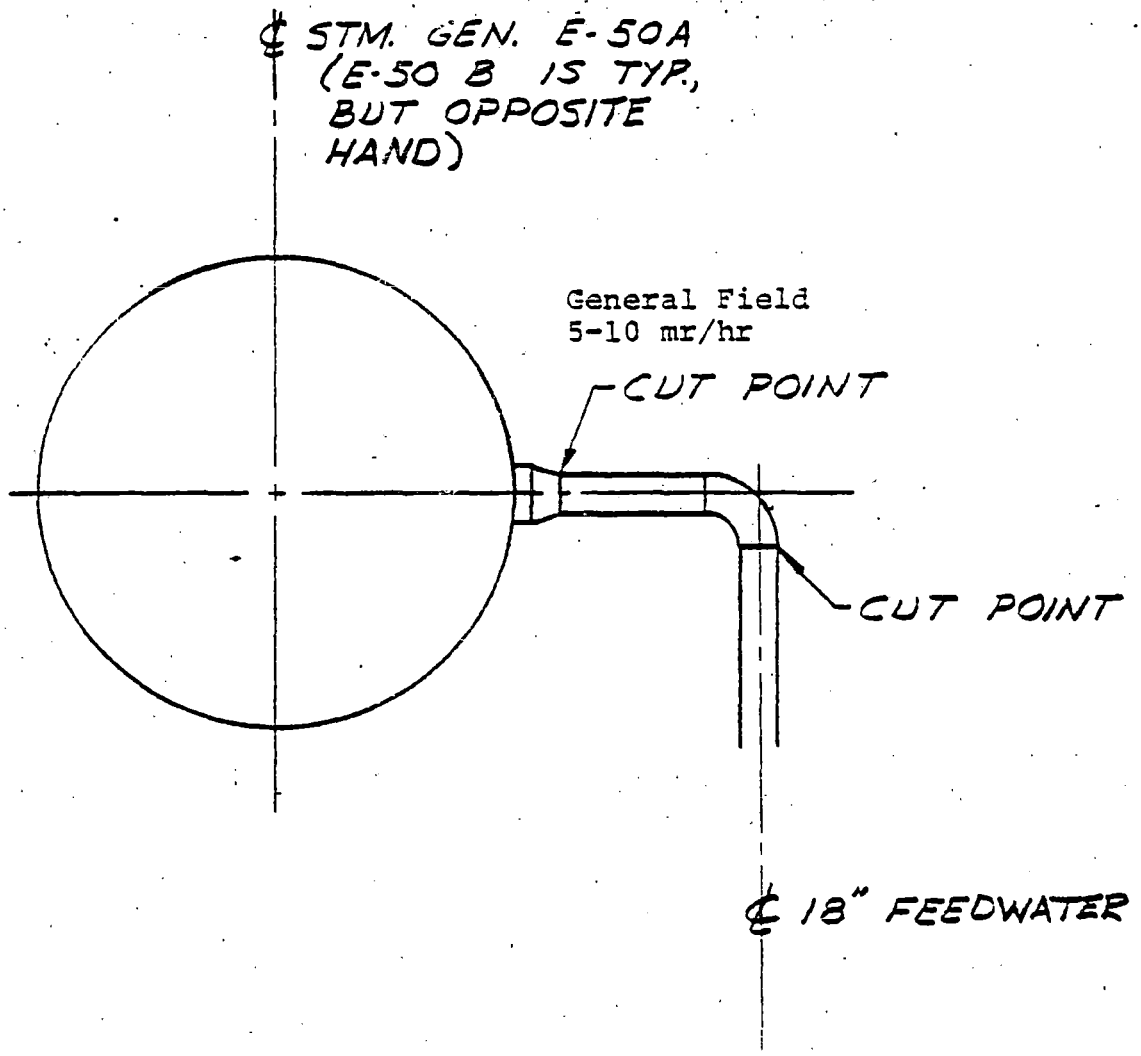
July 1979



PLAN

PALISADES PLANT STEAM GENERATOR REPAIR REPORT
FEEDWATER PIPING CUT POINTS Figure C-3-3

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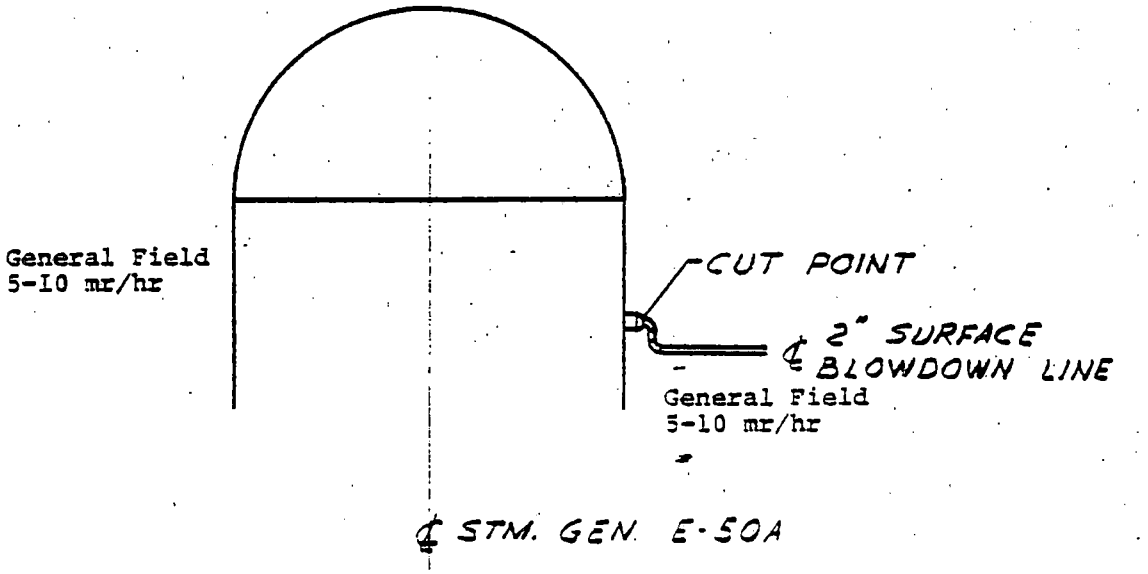
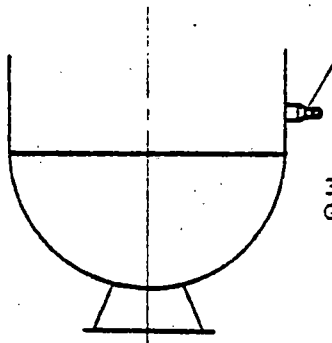


ELEVATION

STM. GEN. E-50B IS TYP., BUT OPPOSITE HAND



35 mr/hr
General Field with Manways Covered

ELEVATION
ROTATED 90° CLOCKWISE

PALISADES PLANT
STEAM GENERATOR REPAIR REPORT

BLOWDOWN PIPING
CUT POINTS

Figure C-3-4

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PALISADES PLANT SGRR

C-4 Discuss briefly how you would avoid imbalance of the permanent ventilation systems due to the additional construction -related ventilation equipment (portable fans, hoods and filters, etc).

RESPONSE:

Additional construction - related ventilation equipment will be used to supplement the permanent ventilation system and will remove fumes associated with welding and cutting operation as well as ventilating temporary enclosures. Significant imbalance of the permanent ventilation system is not expected since the construction related ventilation equipment will exhaust inside the containment after filtration, and/or have relatively low flowrate. However, should imbalance of the permanent ventilation system occur, balance can be restored by controlling the dampers on the permanent ventilation system.

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C-5 Your description of compliance with Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Exposure at Nuclear Power Stations Will Be As Low As Reasonably Achievable", Revision 3, June 1978, states that the following considerations were not implemented:

1. Radiation zones in the containment work areas, identifying the exposure levels in each work zone. C.2.(a)

2. Streaming or scattering of radiation from installed shielding, such as plugs in open ended pipe lines following cutting. C.2.b.(4)

3. Outleakage of airborne contamination from the containment due to steam generator replacement/repair activities when the equipment hatch is open.

4. Operating experiences should be recorded, evaluated, and reflected in the selection of replacement instrumentation. C.2.(c)(3)

5. Provision to be implemented to minimize exposure of station personnel in performing code inspection, such as removable insulation, smooth welds, etc. (C.2.(i)(11)

6. An adequate emergency lighting system can reduce potential exposures of station personnel by permitting prompt egress from high radiation areas if the station lighting system fails.

7. A staff member who is a specialist in radiation protection assigned the responsibility for contributing to and coordinating ALARA efforts in support of operation that could result in substantial individual and collective dose levels.

8. ...Station work areas to limit the average concentration of radioactive material in air to levels below... in Appendix B, Table 1, Column of 10 CFR Part 20. C.2.d

Provide justification for not implementing these provisions of Regulatory Guide 8.8, and demonstrate that alternative precautions you have taken will provide comparable levels of protection.

PALISADES PLANT SGRR

RESPONSE:

The philosophy of the radiation protection group is to maintain the occupational dose to all personnel as low as is reasonably achievable (ALARA). This has been stated as a policy in the Palisades Plant Radiation Protection Manual. In order to ensure that the various provisions of Regulatory Guide 8.8 are evaluated adequately, a third party ALARA review of the repair effort has been utilized. The reviewers' responsibilities are to develop ALARA "checklists" to be used in conjunction with the work package descriptions for each of the repair tasks. The "checklists" will evaluate and recommend any measure found appropriate to maintaining the personnel exposure ALARA as defined in Regulatory Guide 8.8 (Revision 3).

Although the detailed work packages are presently in the development stage, each of the following specific provisions will necessarily be given complete consideration for use during any replacement/repair activity:

1. The identification of exposure levels in any work zone is presently implemented per Palisades Plant health physics procedures. The Repair Report Section 4.3.5.4 describes the low background radiation waiting areas that will be used near each containment work area. As specified, special signs, tape, or rope-off areas will be utilized to designate these zones. Intermediate zones could be utilized, if found ALARA, as individual work packages are developed.

2. The effective streaming or scattering of radiation from installed shielding, such as plugs in open ended pipe lines, can be minimized through the use of local decontaminating of pipe stubs, use of temporary shielding, or exposure control by controlling ingress or egress to work areas. (See Repair Report Sections 4.3.5.2 and 4.3.5.3). All of these ALARA techniques are being evaluated for use with the individual work packages per third party ALARA review described above.

PALISADES PLANT SGRR

3. In addition to the temporary enclosure on the construction opening, airborne radioactivity inside containment during the steam generator repair effort will be controlled, monitored, and ultimately released via the plant vent stack. The air will be drawn through the hatches and construction opening and exhausted by the purge system via the plant ventilation stack, thus precluding airborne radioactive particles or gases from leaving containment openings utilized for construction activities. (See Repair Report Section 4.3.3).

4. Continuous air monitors, area radiation monitors, and portable survey instruments will be used in accordance with Palisades Plant health physics procedures. Daily and weekly operational checks, calibration, and response settings will be implemented and recorded as required per Palisades Plant health physics procedures.

5. Appropriate provisions will be implemented to minimize exposure of station personnel in performing code inspection, such as removable insulation, smooth welds, etc. Design features to improve maintenance and inspection are discussed in the Repair Report Section 2.2.2.

6. An emergency lighting system will be available for the steam generator replacement activities.

7. A staff member who is a specialist in radiation protection will be assigned to the responsibility for coordinating ALARA efforts.

8. Special measures will be implemented to minimize and control the average concentration of radioactive material in air to below those specified in Appendix B, Table 1, Column 1 of 10 CFR Part 29. In addition to temporary enclosures in areas where cutting will occur, containment air will be conditioned for the removal of airborne radioactivity by use of filters.

PALISADES PLANT SGRR

C-6 Explain what steps you plan to take to help maintain doses ALARA in this project. Indicate what use will be made of contaminations tents, lead wool blankets, gloveboxes, remote cutting and welding equipment, temporary shielding and ventilation systems. Also indicate what equipment will be mocked-up for training purposes.

RESPONSE:

An independent ALARA review of the steam generator repair effort has been utilized to make recommendations for maintaining doses ALARA (see question C-5). The ALARA recommendations made will be incorporated into the various work packages. Each of the following items will be used where appropriate to maintaining doses ALARA.

1. Contamination Tents - The cutting of primary coolant piping will be contained within specially designed contamination control envelopes. The envelopes will be provided with high efficiency filtration.

2. Temporary shielding in the form of; lead wool blankets, lead shield plugs and sheet lead will be used where effective to maintaining doses ALARA. Experience has shown that lead wool blankets can effectively reduce streaming around shield plug and sheet lead fittings.

3. Gloveboxes - As yet, there are no repair/replacement activities described, which can effectively use glovebox enclosures for maintaining doses ALARA. As work procedures develop, glovebox techniques will remain a viable option.

4. Remote cutting and welding equipment - Automatic welding machines with remote viewing will be used for welding operations made to interior located stainless steel cladding. Measuring equipment for determining the location of reactor vessel and steam generator during weld-up and cutting operations will utilize remote indicators.

   Although the cutting techniques have not been finalized, the ALARA considerations will be one of the determining factors for final selection.

PALISAGES PLANT SGRR

5. Ventilation Systems - Local construction related ventilation equipment will be used to supplement the permanent ventilation system and will remove fumes associated with welding and cutting operation as well as controlling the airborne contamination existing in the temporary enclosures.

6. Mock-Ups of reactor coolant pipe, and the steam generator primary head as well as the actual cutting and welding equipment will be utilized for training and work planning.

PALISADES PLANT SGRR

C-7 Provide a table showing the occupational collective whole body dose estimates for the following phases of the steam generator replacement repair acitivities: (1) preparation, (2) removal, (3) installation and (4) storage.

Discuss briefly your procedure for calculating these doses, taking into account the dose reduction measures proposed to maintain doses as low as reasonably achievable (ALARA), including local decontamination, temporary lead shielding, pre-job planning, pre-job training and use of remote tools where practicable.

RESPONSE:

Table C-7-1 provides the requested information. The table groups the various tasks into preparation, removal, installation, and storage phases of the replacement/repair effort. The man-rem is the product of (man-hours) X (average radiation field) for each task. It should be noted that each task consists of man-hours accumulated in several locations, and each location has a corresponding radiation field. A description of locations and average radiation fields is presented in Table C-1-5, credit taken for decontamination and temporary shielding is incorporated into the radiation field estimates. Reduction factors for shielding and/or decontamination are presented in the repair report, Table 4.3.2.

PALISADES PLANT SGRR
TABLE C-7-1
MAN-REM ESTIMATE
(Preparation, Installation, Removal, and Storage)

Preparation			Removal			Installation			Storage		
Task No.	Hrs	Man-Rem	Task No.	Hrs	Man-Rem	Task No.	Hrs	Man-Rem	Task No.	Hrs	Man-Rem
1	1,578	2.32	1	1,416	31.26	2	1,993	2.90	46	620	12.4
3	4,382	11.58	13	15	27.36	5	4,176	111.69	55	4,060	0.02
34	140	2.60	15	120	26.52	6	3,360	89.85			
35	21,500	0.11	16	324	79.38	7	6,008	32.13			
37	11,606	0.06	19	1,016	10.72	8	648	2.88			
38	8,304	0.01	21	115	3.02	9	8,224	44.88			
39	1,500	0.01	22	476	.912	10	1,184	5.28			
40	1,500	0.01	24	577	1.91	11	3,096	19.08			
41	744	0.01	26	240	4.03	12	1,944	13.44			
42	936	0.01	27	300	1.00	14	12	.42			
43	936	0.01	31	550	8.68	17	96	.78			
44	5,625	17.62	45	3,360	52.95	18	180	1.53			
47	100	0.01	56	80	.34	20	4,800	9.60			
48	3,160	0.01	57	48	.24	21	269	1.00			
49	480	0.01	58	320	1.10	22	4,762	14.27			
			59	48	.79	23	520	1.16			
(1)	(1)	165.28	60	180	3.02	24	1,579	3.33			
						25	260	16.18			
						26	560	5.37			
						27	700	1.25			
						28	381	.80			
						29	2,424	15.00			
						30	3,858	8.67			
						32	2,400	10.8			
						33	1,236	3.13			
						34	130	2.6			
						36	19,125	0.09			
						50	2,670	10.72			
						51	3,375	.01			
						52	3,750	11.73			
						53	945	0.01			
						54	750	0.01			
						61	120	0.81			
						62	600	4.05			
						63	1,440	3.24			
						64	480	1.08			
						65	1,920	4.32			
Subtotal	62,491	199.66		9,185	251.41		89,980	454.09		4,680	12.42
66	25,058	75.82	66	1,584	4.67	66	20,126	60.94			
Total Directa											
	87,549	275.48		10,769	258.10		110,106	515.03		4,680	12.42
Distributables											
67	22,597	124		2,779	15.28		28,416	156.3		1,208	6.64
Nonmanual											
68	49,301	73.86		6,064	8.98		62,000	92.33		2,615	3.95
Total	159,447	473.34		19,612	282.36		200,522	763.66		8,523	23.01

(1) Decontamination/Shielding Installation

PALISADES PLANT SGRR

C-8 Discuss your cutting and welding operations and cleanup of surface contamination in respect to "ALARA" guidelines (Section 4.3.3).

RESPONSE:

We note that a definite schedule has not been set for the cutting and welding, that experience is being gained by way of similar operations at other plants, and that detailed work plans have not been completed. The final operations will reflect applicable experience, and ALARA considerations. The following is an outline of operations under consideration at this time.

1. Cutting of Reactor Coolant Pipe

   Since the Palisades reactor coolant pipe is carbon steel w/stainless steel cladding, a plan is to utilize a track mounted oxygen-acetylene torch to cut the pipe. Consideration is also being given to mechanically cutting the pipe in order to minimize the pipe lost during the cutting process and to facilitate the machining operation. The cutting operation will be accomplished in an enclosure to limit spread of contamination.

2. Handling of Pipe to Decontamination Area

   After the pipe has been cut, temporary shield plugs will be secured to each open end of the reactor coolant pipe and the short pieces of pipe moved to a decontamination area. The temporary shield plugs will be mechanically attached to the pipe in order to reduce the number of welding and cutting operations.

3. Field Machining of the RC Pipe Attached to Reactor and Reactor Coolant Pumps

   Temporary shield plugs will be inserted a short distance into the pipe. The pipe between the shield plug and the end of the pipe will then be decontaminated to the extent practical. The pipe weld preparations would then be field machined.

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4. Field Machining of the Short Pieces of Reactor Coolant Pipe

After the new steam generator has been placed, the dimensions between the existing reactor coolant pipe and the new steam generator nozzles will be transferred to the short pieces of reactor coolant pipe and the pipe weld preparations machined.

5. Welding of RC Pipe

After set-up of the reactor coolant pipe the joints may be welded by one of the following methods:

1. Manually weld the carbon steel portion of the reactor coolant pipe and utilize an automatic welding machine with remote viewing for welding the stainless steel interior cladding.

2. Utilize an automatic welding machine with remote viewing to weld both the carbon steel and stainless steel interior cladding.

6. Clean-up of Surface Contamination

Loose surface contamination will be removed manually from the outside of reactor coolant pipe pieces, prior to cutting operations and again, prior to removal from contamination control envelopes. Plastic or other impervious sheeting will be used to cover pipe pieces before relocating to decontamination area.

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C-9 Your estimated dose range of 1,200 to 5,000 man-rem for the steam generator replacement/ repair activities is too wide to assure that occupational exposure will be as low as reasonably practicable. Justify the high end of the range as being ALARA. Experiences with other designs indicate the feasibility of performing such work with substantially lower total doses than the high end of range you have predicted.

RESPONSE:

As presented in the task description (Question C-1), there are two welding techniques being considered for reactor coolant piping. One technique utilizes manual welding of reactor coolant carbon steel pipe with a machine weld-up of the stainless steel cladding. This technique would result in an estimated 1,547-2,808 man-rem for the repair. The second technique utilizes a machine weld-up of both carbon steel pipe and stainless steel cladding. This alternative results in an estimated 1,537-2,663 man-rem for the repair effort.

The high end of the range presented in Table 4.3.2, 5,000 man-rem, resulted from a manual weld-up of carbon steel pipe and cladding entirely from the inside. Due to the technical feasibility of the two welding techniques described above, this third alternative is no longer considered ALARA and has since been eliminated.

PALISADES PLANT SGRR

C-10 Provide a rough breakdown of the activities, person-hour occupancies, and projected dose rates which are used in deriving the estimated total of 40,250 man-rems per unit for retubing in place (Section 8.7).

RESPONSE:

Refer to Appendix A of the SGRR response to Question A-2, as transmitted to the USNRC by the Consumer Power Company letter dated June 11, 1979. That analysis is currently under reevaluation.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ADMINISTRATIVE LAW JUDGE

In the Matter of	)	
	)	
CONSUMERS POWER COMPANY	)	Docket No. 50-255
(Palisades Nuclear Power Facility)	)	(Civil Penalty)
	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of NRC STAFF'S SUPPLEMENTAL ANSWERS TO CONSUMERS POWER COMPANY'S SECOND ROUND OF INTERROGATORIES and NRC STAFF'S REQUESTS FOR ADMISSIONS BY CONSUMERS POWER COMPANY in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 7th day of November, 1980.

Hon. Ivan W. Smith*
Administrative Law Judge
Atomic Safety & Licensing Board
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

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