



Nebraska Public Power District

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April 3, 1985

Mr. H. L. Thompson, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Revision 1 to the Man-Rem Estimate
Radiation Protection Program
Recirculation Piping Replacement

Dear Mr. Thompson:

- Reference: 1) Generic Letter 84-07 "Procedural Guidance for
Piping Replacement in BWR's" dated March 14, 1984.
- 2) Letter from J. M. Pilant to D. G. Eisenhut
dated August 15, 1984 (NLS8400232) "Recirculation
Piping Replacement Radiation Protection Program".

Reference 2 was submitted by the District in response to your request in Reference 1. As stipulated in Reference 2, a revised man-rem estimate is to be submitted if actual dose-rates or manpower requirements significantly changed the projected calculations. This submittal addresses that stipulation. Should further developments in the recirculation piping replacement program necessitate additional revisions to the man-rem estimate, the District will submit them to the Staff.

Should you have any questions, please contact me.

Sincerely,

Jay M. Pilant
Manager, Technical Staff
Nuclear Power Group

JMP:LRB:cmk

Enclosure (5)

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REVISION TO THE IGSCC PROJECT MAN-REM ESTIMATE

I. Introduction

In conformance with Cooper Nuclear Station's Radiation Protection Plan and the Contractor's ALARA program, an estimate was developed by the contractor (Chicago Bridge and Iron Co.) prior to work beginning on replacing the recirculation piping and other piping susceptible to the IGSCC phenomena at Cooper Nuclear Station

This initial estimate was based mainly on projected dose rates and expected manpower levels. Although considered a best estimate at the time, it was stipulated in the Radiation Protection Plan that if actual dose rates or manpower requirements rendered this estimate obsolete, then a new revised estimate would be developed.

As the IGSCC project progressed, it became apparent that the initial estimate had become outdated and needed revising. Because of this, the ALARA committee asked the contractor to generate a revision of the initial estimate based on the latest available information. The contractor assembled all the relevant data including actual dose rates, current manpower trends and scheduling adjustments to develop the first revision to the Man-Rem Estimate. The specific reasons for these changes are addressed in Section III of this report.

In accordance with Section II(c), part 3 of the CNS Radiation Protection Plan for the recirculation piping replacement program, any revised estimate along with the reasons for the estimate changes would be submitted to the Nuclear Regulatory Commission. This report is intended to meet this requirement of the Radiation Protection Plan.

II. Revision 1 of the IGSCC Project Man-Rem Estimate

The man-rem estimate presented here totals 1,435.686 Man-Rem. This is a 1.4% increase over the initial estimate of 1415.700. In addition, the new man-hour totals in the revised Man-Rem Estimate is now 96,295 man hours. This is a 43.6% increase over the initial estimate of 67,043 manhours.

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
A-1	Start Verification of Walkdown	491	21.086
A-2	Insulation Removal - Pre-Decon	238	12.957
A-3	Install Power and Lights	105	4.266
A-4	Temporary Shielding for Decon	130	8.303
5	CNS Drywell Support	5,280	63.360
A-6	As-Builts of Lines - Pre-Decon	18	.932
A-7	Temporary Support of Valves and Pumps	862	34.129
A-8	Protect Systems - During Decon	418	16.204
A-9	Install Rigging - Pre and During Decon	626	12.443
A-10	General Area Decon - Pre and During Decon	260	9.424
A-11	Isolate and Tap Recirculation System for Decon	1241	64.280
12	Cancelled		
13	CNS-1001' Level Work	2942	34.489
14	Removal of Pipe Supports - During Decon	950	31.350
15	CNS Work - April Outage	46	2.123
A-16	Disconnect Chillers 1B and 1D, Assoc. Motors and Valves - During Decon	381	3.983
A-17	Decon of Systems	883	14.199
18	Install Audio-Visual In Drywell	60	3.000
A-19	Temp. Support Riser and Header Loop A and B	748	12.212
A-20	Supervision for Work - Pre and During Decon	1870	32.803
A-21	Fire Watch - Pre and During Decon	444	10.781
A-22	Install Scaffolding Pre-Decon	1438	51.924

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
24	Cancelled		
25	Cancelled		
A-26	Chiller Interference's - Remove	377	4.71
A-27	Install Equipment Hatch Ramps	240	1.764
A-28	Remove Chillers	307	3.516
A-29	Remove Loop "A" Recirculation Pump Motor	222	1.95
A-30	Remove Loop "B" Recirculation Motor Pump	165	1.702
31	Permanent Shielding After Decon Includes NOzzle Shield Plugs	275	6.05
A-32	Temporary Shielding (RHR Piping, Main Steam, Feed Water, etc.)	20	.521
A-33	Move machining equipment into drywell	44	.857
A-34	Remove "A" Suction to Pump and RHR	715	14.417
A-35	Remove "A" Loop Discharge	216	4.08
A-36	Remove "A" Loop Cross and Header	580	13.307
A-37	Remove "A" Loop 12" Ø Riser from Header to Safe End	860	13.845
38	Remove and Install N1 Safe End Loop A	275	9.9
39	N2 Safe End and Thermal Liner Removal and Reinstallation (Nozzles F, G, H, J, K)	3450	85.0
A-40	Remove "A" Loop Valves Outside Containment	309	6.988
A-41	Remove "B" Loop Suction (From N1 Nozzle to Pump)	306	4.988
A-42	Remove "B" Loop to Cross (From Pump to Header)	184	3.256

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
A-43	Remove "B" Loop Cross and Header	265	6.457
A-44	Remove "B" Loop 12" Risers (5 Risers)	587	9.965
45	Remove and Install N1 Safe End "B" Loop	275	9.9
46	N2 Safe End and Thermal Liner Removal and reinstall Loop "B" (Nozzles A, B, C, D, E)	3450	85.0
A-47	Remove "B" Loop Valves to Outside of Drywell	264	4.91
A-48	Remove Core Spray Lines Loop A & B from Safe End to Valve	507	7.349
49	Remove and Install Core Spray Safe Ends Loop A & B	676	22.4
50	Remove RWCU Line (Complete to Outside Drywell)	480	10.1
51	Remove and Reinstall Delta P Safe End and Piping	131	7.98
52	Remove and Install Jet Pump Inst. Safe Ends Loop A & B	692	24.28
53	General Decon During Removal of Pipe	2160	26.1
54	Cancelled		
A-55	Fire Watch During Pipe Removal	1080	13.0
56	Machine Preps on RHR Valves	208	4.848
57	Machine Preps on Pumps - Loops "A" & "B"	600	21.0
58	Machine Preps on Core Spray Valves	94	1.9
A-59	Supervision for Removal	8383	66.6
A-60	Removal of Structural Interferences After Decon But Before Recirc. System Removal	590	7.6
A-61	Complete Removal of Duct Work	425	3.464

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
A-62	Complete Major Rigging	56	.639
63	Removal of Electric Interferences After Decon	350	4.2
64	Pipe Cut-Up/Packing Into LSA Containers	89	1.3
65	Machine Prep Recir. Valves "A" & "B"	540	5.28
66	Machine Prep on RWCU Valves	40	1.6
A-67	Removal of Whip Restraints	132	2.14
68	Move Welding Equipment into Drywell	125	1.5
69	Removal Pipe Supports Loop "A & B" After Decon	495	8.4
A-70	Removal of Small Line Interferences Loop "A" & "B"	268	4.846
A-71	Insulation Removal (Post-Decon)	180	2.574
A-72	Chillers 1A and 1C, Assoc. Motors and Valves	131	1.736
A-73	Disconnect A and B Loop Suct., Discharge and Bypass Valves	95	1.756
74			
75	Install Scaffold Pipe Removal	833	11.287
76	General Decon During Pipe Installation	1620	19.4
77	Fire Watch During Pipe Installation	1620	19.4
78	Maintain Lighting and Equipment During Installation	80	.8
79	Supervision for Installation (Recirc. Piping)	4500	36.0
80	Moving (Temporary) Shielding Materials	150	1.8

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
81	Install Loop "A" Suction Line	1183	16.871
82	Install RHR Connection to Suction Line	438	7.068
83	Install "A" Loop Discharge Line	1018	12.331
84	Install "A" Loop Cross and Header	684	5.472
85	Install "A" Loop Risers (From Header to Safe End)	950	12.846
86	Cancelled		
87	Cancelled		
88	Install (Transporting) "A" Loop Recirc. Valves to Location	26	.3
89	Install "B" Loop Suction Line and Valve	1009	10.988
90	Install "B" Loop Discharge Line & Valve	861	14.13
91	Install "B" Loop Header	546	4.368
92	Install Loop "B" Risers (From Header to Safe End)	950	12.846
93	Cancelled		
94	Cancelled		
95	Cancelled		
96	Install Core Spray Lines A & B (From Safe Ends to Valves)	890	11.37
97	Cancelled		
98	Install RWCU Line to Valve Outside of Drywell	658	12.6
99	Replace Chillers	1176	9.408
100	Install Pump Motors Loop A & B	400	9.6

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
101	Cancelled		
102	Cancelled		
103	Pipe Support Installation and Modification Loop "A & B"	936	9.42
104	Elect. RWCU Valves	80	.96
105	Install Scaffold Pipe Reinstallation	480	3.8
106	Elect. Sump Pumps	500	8.0
107	Elect. Interferences (Pre/Post Decon)	190	5.19
108			
109			
110			
111	Reinstall Structural Interferences	1800	14.54
112	Reinstall and Reconnect Small Bore and Piping Interferences	2700	24.85
113	Reinstall Ductwork	2000	16.0
114	Reinstall Electrical Interferences	1068	8.5
115	Remove Rigging	300	2.4
116	Reconnect Elect. Chillers, Pumps and Valves	1816	14.5
117	Remove Permanent Shielding	513	14.846
118	Remove Temporary Shielding	200	2.2
119	Remove Temporary Supports	248	1.984
120	Install (New) Insulation	800	6.4
121	Reinstall Whip Restraints	1200	9.6
122	Remove Protective Equipment	496	3.968
123	Remove Scaffolding and Tools	900	7.2

A - Actual for Jobs Complete

JOB NO.	DESCRIPTION	MAN HOURS	MAN REM
124			
125	Remove Power and Lighting	100	.8
126	Decon Tools and Equipment	600	4.8
127	Remove Welding and Machining Equipment	290	2.32
128	Q.A. Walkdown	400	3.2
129	Supervision for Restoration	3000	24.0
130	Fire Watch During Restoration (3 Levels)	540	4.3
131	General Decon During Restoration	720	5.8
132			
133			
134			
A-135	April Walkdown Exposure (TLD)	482	14.3
136			
137			
138			
139			
140			
141			
142			
143			
144	Pre-Operational Testing	3000	3.000

TOTAL M/HOURS: 96,295

TOTAL MAN-REM: 1,435.686

III. Reasons for Changes in the Man-Rem Estimate

The two major reasons for revising the Man-Rem Estimate were, underestimation of the manhours required to accomplish the work and overestimating working area dose rates. Below are some specific examples of these two general categories.

A. Increase in Estimated Man-Hours

The amount of manhours required to complete the pipe removal portion was underestimated by the contractor. Nineteen (19) out of the forty-eight (48) completed jobs, (40%) work scope completion, had manhour overruns over their initial estimate of greater than 25%.

Overall, the actual manhours expended were 65.4% above the estimate at the time the first revision was initiated.

Reasons for the manhour estimate overruns include:

1. Underestimating manpower requirements

The initial man-rem estimate supplied by the contractor underestimated manpower needs. Many jobs exceeded their estimate by significant amounts although no major problems or inefficiencies were apparent during the work's progress.

2. Unexpected Problems with Work Scope

Some jobs took longer than expected because of unanticipated problems. For example, many pipe cuts were over the original estimate because of machine alignment problems, extensive cutting machine repairs not anticipated in the original estimate, and the material hardness had apparently changed.

3. Unanticipated Interference Removal

As the initial pipe removal sequence of the outage progressed, it was soon realized that many more interferences needed to be removed than was planned in the original job scope. Additional manhours were added to the revised man-rem estimate to reflect the increased scope of work.

B. Change in Expected Dose Rates

As discussed previously, the initial estimate was based on expected dose rates that would be encountered during the course of the outage. Fortunately, in many cases, the estimated dose rates were much higher than was actually measured. Below are three major examples of situations where the dose rate estimated was much higher than actually occurred.

1. Decon Effectiveness

The original estimate had assumed an average decontamination factor of approximately 25. Although the actual decontamination factor was about 40, this was not uniform throughout the recirculation system. Poor decontamination at one suction safe end and at both ring headers contributed to higher than estimated dose rates in some work areas. However, most work areas around the recirculation piping had lower dose rates than were predicted by the original Man-Rem Estimate.

2. Effectiveness of Temporary Shielding

At the submittal of the original estimate, the amount of shielding and the resultant dose rates could only be approximated. In addition, at the time of the original estimate, not all shielding designs and locations were finalized. The original estimate did not give enough credit to dose reductions caused by temporary shielding installations. The revised estimate has incorporated the actual post-shielding dose rates.

3. Shielding Effectiveness of Water in Reactor and Piping

At the time of the estimate, both the reactor and recirculation piping were full of water. The original estimate over compensated for the expected increase in dose rates. The estimate has been revised utilizing the most recent radiation surveys taken after the reactor water level was dropped and recirculation piping drained.

IV. Summary

Although the difference between the original Man-Rem Estimate and the first revision are, in some cases, considerable, the significant difference in expected dose rates and observed dose rates permitted the increase in overall man-rem for the IGSCC outage to be minimal (1.4%), despite the large increase (43.6%) in manhours.