2.20 B-OTSG REPAIRS

A. Pre-Outage Planning Milestones

The pre-outage planning effort for the B-OTSG Repairs was initiated in September 1978 with a B&W/FPC meeting to discuss repair goals. The results of this meeting were that B&W was directed to continue the development of remote repair equipment assuming that a full repair would be done at the next refueling outage. In addition, B&W was asked to develop a surveillance program. In parallel, FPC would evaluate its final decision on the extent of repairs.

On January 15, 1979, W. P. Stewart gave the following direction to B&W confirming FPC's official position on repairs:

(1) Perform a limited video inspection of selected tubes
(2) Open the 120 lane tubes
(3) Open/deburr 1000 random tubes for future eddy current testing
(4) Implement a surveillance program
(5) Video inspect all worked tubes
(6) Complete development of all remote tooling

Planning for the refueling outage progressed along this direction. In parallel, remote tooling development had continued and a demonstration was held on January 23, 1979 for FPC. This showed that the development effort was progressing, but needed further work for the equipment to be fully accepted for use in the OTSG. After more efforts at tooling development and refinement, another demonstration was held on March 26, 1979. This resulted in a basic acceptance of the remote equipment for use, with the exception of the main welding unit. Suggested improvements were then made on the main welding unit and this too became acceptable.

Site preparation efforts began in earnest the first week of April 1979 with the arrival of the tooling equipment and B&W personnel. Boilermakers were hired starting April 9, 1979, in order to start a two week mock-up training effort. In addition, set up of support facilities (e.g., power supplies, control center, etc.) was conducted at this time.

All work to be done on the B-OTSG was covered by Work Requests for each major task. The work package (Work Request, RWPs, clearances, etc.) were prepared in advance and submitted to planning by late March 1979. Pre-outage planning, based upon inputs from B&W and estimates by the site activity coordinator, showed the B-OTSG repair effort would run from April 25, 1979 to May 22, 1979, for

a total of twenty-eight (28) days (see Attachment 2.20-A). The effort was originally planned to be off-critical path. However, the last pre-outage schedule resulted in the B-OTSG effort as critical path by a slight margin. The schedule for this effort was reduced from a thirty-seven (37) day schedule initially submitted by B&W.

B. Summary of Work Accomplished

Attachment 2.20-B summarizes the as-built schedule for the B-OTSG repair effort. The following is a brief narrative of repair efforts performed during the outage:

1. Equipment for the effort was staged to the RB equipment hatch on 4/25/79 in preparation for RB access.

2. The motor home control center was set up on 4/26/79.

3. The lower primary manway removal commenced on 4/28/79 and was completed on 4/29/79. The J-leg and drain hole screens were then installed. The temporary lower manway cover installation was completed on 4/30 - 5/1/79.

4. The upper primary manway was removed on 5/3/79. A demineralized water flush was conducted but had no affect on general area radiation levels (~8R/hr general area).

5. The eddy current sky hook and camera for general scan was installed on 5/1/79. The eddy current manipulator was then installed with a camera to perform freeze frame shots of the lane tubes. This was completed on 5/3/79.

6. The freepath equipment was mounted on the eddy current manipulator and the freepath commenced on 5/4/79. As of 5/7/79, a total of 1,017 tubes had been checked, but only 178 would accept the 0.500" gauge. Because of the high rejection rate, freepathing was halted in favor of using the milling machine.

7. Ring girder installation commenced late on 5/7/79, but ran into delays due to improper fitting of the marking template and inadequate ID of the tubes being used for the holddown cam locks. Modifications were made and the ring girder installation completed on 5/9/79. After corrections to problems with the milling machine air connections and setup of the vacuum, spotfacing of the lane tubes commenced on 5/10/79. The first 18 tubes were

spotfaced with a non-radiused type cutter. A radiused cutted was installed and spotfacing continued through 5/11/79. At this time, the crossbar brace was removed to gain more outer peripheral access. On 5/12/79, the right angle milling head was installed and lane tube spotfacing completed.

8. Tube end opening for the eddy current sample was commenced on 5/12/79. This effort went extremely slow due to lack of good maneuverability of the equipment. The tube end opening was halted on 5/15/79 in order to get on with welding the lane tubes. At this point, only 146 tubes were opened, but a return to tube end opening was planned, if the schedule permit, at a later date. Prior to milling head removal, the original 18 spotfaced tubes were respotfaced with a radiused cutter.

9. Setup for lane tube welding commenced on 5/16/79 with the deburring of all spotfaced tubes. The heaters were then installed and the open lane area was heated to 300-350°F and maintained for 3 hours 15 minutes. After cooling down, the heaters were removed and the roll expander installed early on 5/17/79. All but five (5) tubes were roll expanded at the upper 1/8" and these five were accepted as is.

10. The NED welder head was installed late on 5/17/79. However, the welding effort immediately ran into problems and delays due to such things as test block holder inadequacy, pilot assembly alignment, camera and cable problems, and lack of good argon cover gas. By 5/21/79, the NED welder head was removed and replaced with the Copley, backup welder head. This unit also ran into problems with argon and a control problem. These were solved by securing the ventilation to minimize cross flow and discovering a grounding problem on the control unit. A satisfactory test block weld was finally made on 5/23/79. Tube to tube heat welding commenced on 5/24/79.

11. On 5/23/79, filling of the FTC for fuel shuffle was started and a gasket leak on the temporary lower manway cover was discovered. Draindown and removal of the cover was required. The cover was removed on 5/24/79, at which time welding was halted to eliminate the possibility of the "chimney affect" causing argon cover gas problems. A new gasket was installed and the temporary cover replaced late on 5/24/79.

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12. Tube to tube sheet welding was reinitiated early on 5/25/79. Additional problems were encountered with the filler wire fusing in the wire guide tube and several other items. Welding was again started early on 5/26/79 and all but five (5) tubes which were inaccessible, were completed on 5/27/79.

13. Setup for manual welding was then initated and the manual welds on the five (5) inaccessible tubes completed on 5/28/79. However, there was some concern by one of the welders about adequate fusion. The liquid penetrant rig and cameras were installed on 5/29/79 to initiate the PT effort and perform a visual inspection. The visual examination was conducted on 5/29/79 and resulted in sixteen (16) tubes requiring repairs. Four (4) of these tubes had the weld deposited outside the tube and had no contact with the tube itself (Tubes 77-14, 75-13, 75-14 and 75-15). In addition, it appeared that these four tubes were recessed below the newly spotfaced area of the tubesheet. Weld repairs started on 5/30/79 by manual grinding and rewelding. The decision on the four (4) tubes mentioned above was to respotface the tubesheet flush to the top of the tube and reweld. This was completed on 5/31/79.

14. The final visual inspection and video taping of the 92 reworked lane tubes was conducted on 6/1/79. The PT examination was then started and completed with some delays on 6/2/79. Three (3) tubes were required to be repaired as a result of PT examination.

    Based upon equipment performance and schedule considerations, it was decided to halt further OTSG repair work at this time.

15. The ring girder removal was started on 6/2/79 and was completed on 6/3/79. All pieces were wiped down, bagged and marked, and placed by the RB equipment hatch laydown area.

16. The upper tubesheet was vacuumed and cleaned on 6/3/79. Tubes for the surveillance program equipment were opened and the surveillance program initiated. The surveillance program was completed on 6/6/79 with no major problems. A final video scan of the upper tubesheet was made after removal of all equipment.

17. The recirculation flush system was set up on 6/5/79, and flushing was initiated on 6/6/79. However, leaks in the recirculation flush system finally forced abandoning this approach. A demineralized

water flush was initiated on 6/7/79 and ran for 6 hours. final QC inspection and Chem/Rad Cl^- leach test found the upper head acceptable.

18. The lower head of B-OTSG was drained on 6/7/79 and the temporary manway cover removed on 6/8/79. The J-leg and drain hole screens were removed and the lower head was vacuumed. However, a few loose chips remained and in the process of trying to remove them, muslin cloths were inadvertently used instead of lint-free rags. Since the muslin was only used in limited areas, it was decided that solvent cleaning of the lower head could not be justified due to the high radiation exposure. The B-OTSG was turned over to FPC mechanics for closeup on 6/8/79.

19. The upper head was closed up on 6/9-10/79 and the lower head on 6/8-12/79. This ended that actual repair effort.

20. On 6/8/79, in preparation for removal of the repair equipment, a team entered the RB to verify appropriate markings on the pieces. At this time, the ring girder equipment was found missing. An intensive search was initated and on 6/9/79 some of the major pieces were located on a large wooden LSA shipping crate. On 6/13/79, authorization was given to inspect sealed waste drums and four consecutive drums were found to contain ring girder parts. However, the waste drums before and after these four were already shipped and were not reclaimable. On 6/27/79, two more major ring girder pieces were found in the contaminated storage trailer in incorrectly marked bags. All available pieces of the ring girder equipment have been cataloged and placed in storage as of 6/28/79 (refer to Attachments 2.20-F, G, and H).

C. Schedule

A comparison of Attachments 2.20-A and B will show that the actual duration of the repair efforts was 21 days longer than the original estimated schedule. Some of the more significant delay items encountered are explained below:

1. Shutdown delays (e.g., SPs on RCV-8, DHV-3 and 4 operation) in turn delayed start of the OTSG work. (~1.0 days)

2. Scaffolding and tent erection at the upper and lower manways due to coordination and manpower experience problems. (~1.0 days)

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3. Manway cover removal and replacement problems. Lower manway removal was hampered by sticking nuts and replacement by problems with the new stud tensioner. Upper manway and inspection cover replacement also ran into days. (~2.0 days)

4. Removal of OTSG insulation also took longer than scheduled for unknown reasons. (~0.5 days)

5. The temporary manway cover installation was delayed due to problems with initial fitup and then the leaking gasket requiring removal, replacement and reinstallation. (~1.5 days)

6. Setup of the eddy current manipulator due to equipment problems and some handling/installation problems. (~0.5 days)

7. Gauging of the 1000 random tubes due to some equipment problems and the fact that many of the primary identified tubes would not pass the 0.500" probe. This required additional time spent hunting for backup tubes. (~0.5 days)

8. Ring girder installation due to various problems with tube IDs required for holddown devices, camera functions, milling head operation, and vacuum operation (~1.5 days)

9. Spotfacing of lane tubes due to more time anticipated for operation, especially with milling head changeout and crossbar removal for access to outer periphery. (~1.0 days)

10. Tube end opening for eddy current sample due to problems noted in 9. above plus lack of hardware maneuverability and larger than anticipated number to be opened. (~3.0 days)

11. Welding of spotfaced tubes due to massive welding unit problems. (~8.0 days)

12. Manual repairs of reject welds due to larger number of rejects than expected. (~2.0 days)

13. Penetrant testing of welds mainly due to loss of penetrant and time to replace. (~0.75 days)

14. Ring girder removal due to excessive tangling of control cables and need to wipe down and bag these highly contaminated pieces. (~25 days)

15. Surveillance program due to minor setup problems and need for some retakes. (~0.5 days)

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16. Recirculation flush due to the leaky recirculation system. (~0.25 days)

The above totals ~24.25 days of delay time.

There were some items that were completed ahead of schedule and saved schedule time, such as:

1. J-leg screen installation. (~0.1 days)
2. Skyhook installation. (~.2 days)
3. Freeze frame inspection. (~1.5 days)
4. Heater installation and tubesheet heating. (~0.2 days)
5. Tube end deburring. (~0.4 days)
6. Wire brushing of welds. (~0.5 days)
7. Video inspection of weld reworks. (~0.2 days)
8. Upper tubesheet vacuuming. (~0.3 days)
9. Lower head cleaning. (~0.3 days)

These schedule savings total to ~3.7 days. The net result between delays and savings is the ~21 days delay in the overall repair effort. In looking at the delay items, the following breakdown should be noted:

- 78% to repair equipment problems
- 20% to miscellaneous problems and setup delays
- 2% to surveillance program problems

D. Personnel

This repair effort was performed mainly by a B&W crew using boilermaker craft labor. The basic organization and staffing is shown in Attachment 2.20-C. The two week mockup training session was essentially conducted on a one shift/day, six day/week schedule. Once actual repair efforts started, the crews were shifted to three shifts/day, seven day/week for the duration of the job.

Due to the high radiation levels in the OTSG, craft labor had to be used for most of the non-technical work in order to minimize exposure to the B&W technicians. This required an extensive training program for the boilermakers. The training program consisted of video tape training aides and hands-on mockup training or equipment setup and teardown. In addition, boilermaker welders were trained and qualified to perform manual weld repairs if required. Attachment 2.20-D provides a breakdown of the man rem exposure for the repair efforts, which totaled ~112.8 Rem.

In general, the use of this labor force worked fairly well, and it is recommended that its use be continued for any future repair efforts. One point should be noted, that any manway cover removal and replacement was done

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with FPC mechanics and this should be continued since they are felt to be better qualified for these efforts.

E. Procedures

All repair procedures for this effort were written on-site by B&W Construction Company and issued as field construction procedures. The procedures to cover the surveillance program were written as a PRR to MP-104. The source document for these procedures was the B&W Field Change Authorization #3062 which was converted into MAR #79-4-68.

In general, this approach worked well and for this type of effort, with B&W providing the technical expertise, is probably the best approach. The only real procedural problem that arose during the repair effort involved the use of the muslin cloth during the lower head cleanup. The repair procedures did not adequately specify how to clean up the lower head nor what materials should and should not be used in the primary system. This needs to be corrected in future repair procedures. Attachment 2.20-E provides an index of the procedures used for this repair effort.

F. Parts and Tools

The special tooling used for the repair effort was designed by, and procured from, B&W. The original design goals for the equipment were to perform a major repair effort as remotely as possible. The repair equipment essentially consisted of the following items:

1. Eddy current manipulator for use in freeze frame photography and with an air cylinder and 0.500" gauge for tube end gauging.

2. Grinding machine for use in large scale tube end and/or weld removal (not used this outage).

3. Ring girder machine with straight-on and right angle heads for tube machining. Cutters are capable of both spotfacing and/or tube ID opening.

4. Welding head that mounts on ring girder machine with power supplies. Used for performing the tube to tubesheet weld.

5. Brushes for mounting in milling machine head for tube end deburring and weld brushing.

6. Roll expander for mounting on ring girder for expanding the top 1/8" of tube end.

7. Heaters for drying out the crevice area.

8. Penetrant testing rig for applying phosphorescent dye penetrant for remote PT examination of new welds.

9. Temporary lower manway cover with nozzle and valve to be connected to a pump for a recirculation flush of the tubes.

10. Surveillance inspection equipment for use in obtaining high resolution pictures of the welds for the surveillance program.

11. Vacuum system

12. Control cables and special penetration cover for Penetration 120 in order to allow use of control center exterior to containment.

With the exception of installation, removal and repairs, the above equipment is remotely operable from outside the OTSG. Items 3, 4, 5, 6 and 8 above are operated from a control center which was housed in a vehicle located on the west end of the Turbine Building. Control cables (400') were run from the B-OTSG through containment Penetration 120 and then through the chemical cleaning penetration at the west end of the Intermediate Building to the control center.

As noted in Section C above, problems with the repair equipment resulted in ~78% (~19 days) of the total repair effort delays. The major problems in this area were the welder units and the ring girder itself. The welder units' problems appeared to center on the following areas:

1. Sturdiness of the hardware/handling.
2. Electrical feedback and grounding problems.
3. Proper operation of the indexing/centering finger and controls.
4. Control of argon cover gas.

With respect to the ring girder operation, the main problem area appears to be lack of maneuverability. For angular rotation, it is required that the front cross brace be installed in order to provide rigidity to the rails during movement. However, when performing work in the outer periphery region of the tubesheet, the front cross brace must be removed for access. Thus, any extensive outer periphery work requires repeated, time consuming OTSG entries to install and remove this cross brace. The multitude of control cables are also an interference problem. Since they are not self-tending,

ring girder movement can cause them to go slack and hangup on the unit or to go too tight. Either of these can restrict movement, cause pulling apart at connectors, or cause misalignment of cameras. In addition, the number of cables running in through the manway are interference problems for the men making entries, which can result in cable pulling problems as described above. The remaining delays caused by repair equipment problems can mainly be written off to first-of-a-kind problems and were not extensive. The one exception is the recirculation flush system using the temporary lower manway cover. The delays this setup caused due to leakage problems far overshadowed any potential benefits of the system. Since the demineralized water flush from the upper head proved to be efficient, both for last outage and as a backup for this outage, it is recommended that the recirculation flush system, including the temporary manway cover, not be used in the future.

Presently, the repair equipment is in storage at Crystal River Unit 3. The following attachments provide the present status of the equipment and storage locations:

- Attachment 2.20-F "A" Ring Girder Unit Parts Status
- Attachment 2.20-G "B" Ring Girder Unit Parts Status
- Attachment 2.20-H Repair Equipment Storage Locations

G. Comments and Recommendations

Based upon the results of the repair effort and the status of the equipment to date, the following comments and recommendations are offered:

1. As noted in Section F above, the repair equipment is in various storage locations. Some of the equipment must be maintained in a controlled environment, which should be monitored. In addition, any movement of the equipment needs to be noted for future retrieval. Thus, a system for periodic monitoring of the equipment status (location and environment) should be set up for at least the next cycle.

2. Based upon the problems encountered with the repair equipment, it is suggested that B&W be asked to generate a recommended list of improvements. A meeting of all parties should be held to discuss the course of action on equipment improvements and for replacement of damaged or missing pieces.

3. B&W is presently reviewing the results of the surveillance program conducted during the outage. The report on the surveillance program still needs to be submitted by B&W. In addition a determination

needs to be made as to whether or not to submit the results of the surveillance to the NRC, in what format, and by whom.

4. The resolution to the four tubes that were suspected of being relaxed was based upon some interim test results. These tests showed that the new welds are satisfactory for the next cycle of operation. However, a more extensive testing program needs to be initiated in order to permit continued operation with these welds in service after the next outage. In addition, a decision as to what inputs on this subject should be given to the NRC needs to be made.

5. Future repair procedures need to be more specific as to what materials should not be used in the OTSG in order to prevent a reoccurrence of the muslin cloth incident. This fact needs to be fed back to B&W for future procedure generation and needs to be enforced during PRC review of the procedures.

6. A decision needs to be made as to the extent of repairs to be conducted at the next refueling outage.

   Items that need to be considered are as follows:

   - Surveillance inspection program
   - Additional tube end opening for eddy current testing
   - Extent repair equipment is to be maintained for a possible major repair
   - Necessary repair techniques if additional work needs to be done on the four suspect relaxed tubes

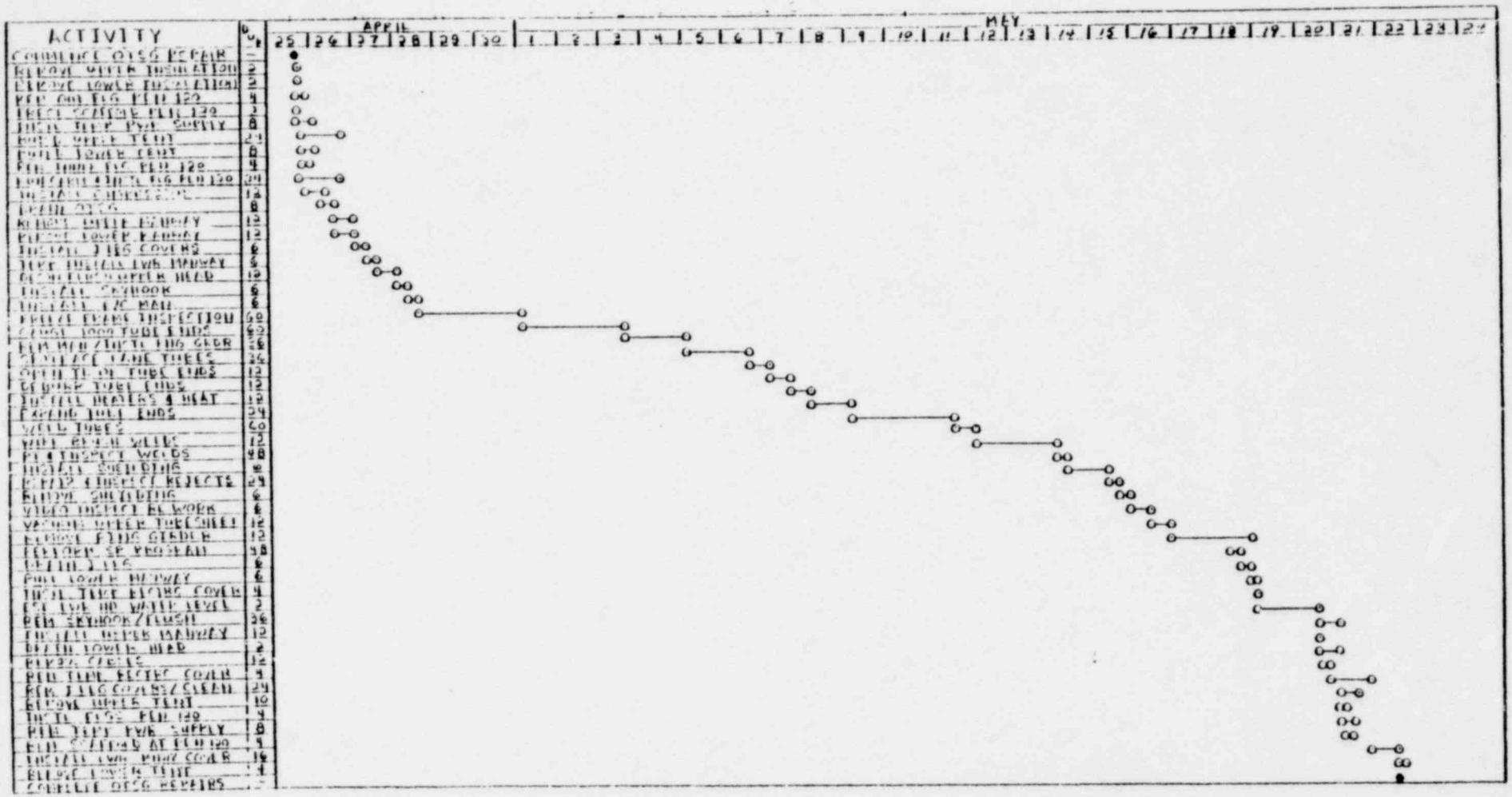
   It is suggested that a meeting of interested parties needs to be held soon after this outage in order to discuss these topics and lay out the future repair program.

7. Misplacement of a large amount of the ring girder equipment and eventual loss of a number of pieces points to a need for better control and staging of contaminated equipment. Procedures need to be generated in order to impose a better control system in order to minimize future losses.

8. Delays in manway cover removal and replacement point to a need for improved procedures, equipment and/or training. This needs to be pursued for next outage.

ACTION ITEM		RESPONSIBLE DEPT/PERSON	RECOMMENDED COMP. DATE
1.	Monthly Monitoring of Repair Equipment Status.	Maintenance/G. Westafer Chem Rad/G. Perkins B&W/ W. P. Ellsberry	Monthly starting 8/1/79 to next outage
2.	Equipment Improvement/Replacement Meeting.	Engineering/ J. Colby B&W/J. Janis	9/1/79
3.	Submittal of Surveillance Inspection Report.	B&W/J. Janis	9/1/79
	Determination of Input to NRC.	Engineering/J. Colby Licensing/B. Simpson	9/15/79
4.	Establish Testing Program for Tube Welds.	Engineering/J. Colby B&W/J. Janis	9/1/79
	Determination of Input to NRC.	Engineering/J. Colby Licensing/B. Simpson	9/15/79
5.	Update Future Repair Procedures to Reflect Materials Restrictions.	B&W/J. Janis	By next refueling outage
6.	Future Repair Program Meeting.	Engineering/J. Colby B&W/J. Janis	9/15/79
7.	Contaminated Equipment Control Procedures.	Chem Rad/G. Perkins Maintenance/G. Westafer	By next refueling outage
8.	Improvements in Manway Cover Removal/Replacement.	Maintenance/G. Westafer	By next refueling outage

Attachment 2.20-A - Pre-outage Schedule of B-OTSG Repair Effort



CRYSTAL RIVER NUCLEAR PLANT

WORKING SCHEDULE

FLORIDA POWER

RUN DATE 10JUL79 1440HRS

PROJECT START 23APR79

PROJECT REFUEL1 1979 REFUELING

CURRENT COMPLETION 16JUL79

DATA DATE 10JUL79 PAGE 1

ACTIVITY DESCRIPTION	MODE=C/FE SORT START 23APR79	3MAY79	13MAY79	23MAY79	2JUN79	12JUN79	22JUN79
	MTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTW						
ERECT SCAFFOLDING AUX BLDG PEN 120 20060030	A						
REMOVE INSULATION UPPER MANWAY B OTSG 20001020	AA						
BUILD TENT UPPER MANWAY B-OTSG 20002000	AFFFFA						
BUILD TENT FOR LOWER MANWAY B-OTSG 20024000	AA						
REMOVE INSULATION LOWER MANWAY B OTSG 20025010	AA						
REMOVE OUTER FLANGE PEN 120 20058000	A						
REMOVE INNER FLANGE PEN 120 20059000	A						
ERECT SCAFFOLDING AT PEN 120 RB 20060000	A						
INSTALL TEMP POWER SUPPLY AT B OTSG 20061000	A						
RUN CABLES & INST TEMP FLANGE PEN 120 20057000	AFA						
COMMENCE OTSG PART REPAIR 20045000	A						
INSTALL COMPRESSOR 20006020	A						
INSTALL VACUUM SYSTEM 20006010	A						
ERECT D RING PLATFORM FOR B OTSG 20003011	A						
DRAIN - OTSGS 20027000	AA						
ERECT SCAFF @ SHIELD WALL PEN FOR B OTSG 20095091	A						
REMOVE LOWER MANWAY B OTSG 20025000	AA						
REMOVE UPPER MANWAY B OTSG 20001000	AA						
INSTALL J-LEG COVERS B-OTSG 20026000	A						
TEMP INSTALL LOWER MANWAY 20043000	AA						
MOVE MANWAY WITH CRANE 20001010	A						

ACTIVITY DESCRIPTION	MODE=C/FE 23APR79	3MAY79	13MAY79	23MAY79	2JUN79	12JUN79	22JUN79
	MTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTW						

ATTACHMENT 2.20-B AS BUILT SCHEDULE

"B" OTSG Repair Effort

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CRYSTAL RIVER NUCLEAR PLANT — FLORIDA POWER

RUN DATE 10JUL79 1440HRS — W O R K I N G S C H E D U L E — PROJECT START 23APR79

PROJECT REFUEL1 1979 REFUELING — CURRENT COMPLETION 16JUL79

SORT START — DATA DATE 10JUL79 PAGE 2

MODE=C/FE 30APR79 10MAY79 20MAY79 30MAY79 9JUN79 19JUN79 29JUN79

M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W

ACTIVITY DESCRIPTION	
DECON FLUSH UPPER HEAD & OTSG 20047000	AA
INSTALL SKYHOOK 20029000	A
INSTALL E/C MANIPULATOR B-OTSG FOR PRE-GRIND INS 20003000	A
PHOTO/FREEZE FRAME INSP. 20004000	AA
GAUGE 1000 TUBE ENDS FOR E/C 20030000	AFFA
REMOVE E/C MANIPULATOR AND INSTALL RING GIRDER 20006000	AFFA
SPOTFACE LANE TUBES 20098000	AFA
OPEN TUBE ENDS 20031000	AFFFA
DEBURR TUBE ENDS 20099000	A
INSTALL HEATERS & HEAT TUBE ENDS 20050000	A
EXPAND TUBE ENDS 20051000	AA
INSTALL WELDER & WELD TUBE ENDS 20052000	AFFFFFFFFFFFA
INSTALL SHIELDING 20036000	A
MANUAL REPAIR & INSP. REJECT WELDS 20037000	AFFA
WIRE BRUSH WELDS 20053000	A
PI & INSP. 100 LANE TUBE WELDS 20035000	AFFFA
REMOVE SHIELDING B-OTSG 20015000	A
VIDEO INSPECT REWORKED WELDS 20054000	A
REMOVE RING GIRDER 20056000	AA
VACUUM UPPER TUBESHEET 20055000	A
PERFORM SP PROGRAM 20032000	AFFA

MODE=C/FE 30APR79 10MAY79 20MAY79 30MAY79 9JUN79 19JUN79 29JUN79

M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W T F S S M T W

ACTIVITY DESCRIPTION

Attachment 2.20-B (Continued)

1475 079

CRYSTAL RIVER NUCLEAR PLANT

WORKING SCHEDULE

FLORIDA POWER

RUN DATE 10JUL79 1440HRS

PROJECT START 23APR79

PROJECT REFUEL1 1979 REFUELING

CURRENT COMPLETION 16JUL79

DATA DATE 10JUL79 PAGE 3

SORT START

MODE=C/FE

ACTIVITY DESCRIPTION	3JUN79	13JUN79	23JUN79	3JUL79	13JUL79	23JUL79
	SMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSM					
REMOVE CABLES & TEMP FLANGE PEN 120 20057010	AA					
REMOVE TEMPORARY POWER SUPPLY FROM B OTSG 20061010	A					
INSTALL OUTER FLANGE PEN 120 20058010	A					
ESTABLISH WATER LEVEL IN LOWER HEAD 20039030	A					
INSTALL INNER FLANGE PEN 120 20059010	AA					
REMOVE SKYHOOK/CLEAN & FLUSH UPPER HEAD 20039000	AA					
REMOVE RB SCAFFOLDING AT PEN 120 20060010	A					
REMOVE INT BLDG SCAFFOLDING AT PEN 120 20060020	A					
DRAIN WATER FROM LOWER HEAD 20039040	A					
REMOVE J-LEG COVERS CLEAN LOWER HEAD 20040000	AA					
REMOVE TEMP RECIRC CVR FROM LOWER MANWAY 20039020	A					
COMPLETE OTSG PART REPAIR 20046000	A					
INSTALL LOWER MANWAY B-OTSG 20019000	AFFFA					
INSTALL UPPER MANWAY & HAND HOLE B-OTSG 20023000	AA					
REMOVE UPPER MANWAY TENT AND SCAFFOLD B-OTSG 20022000	AA					
REMOVE TENT & SCAFFOLD LOWER MANWAY B-OTSG 20028000	A					
REPLACE UPPER & LOWER PRIMARY MANWAY INSUL 20080000	A					

MODE=C/FE

ACTIVITY DESCRIPTION	3JUN79	13JUN79	23JUN79	3JUL79	13JUL79	23JUL79
	SMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSMTWTFSSM					

Attachment 2.20-B (Continued)

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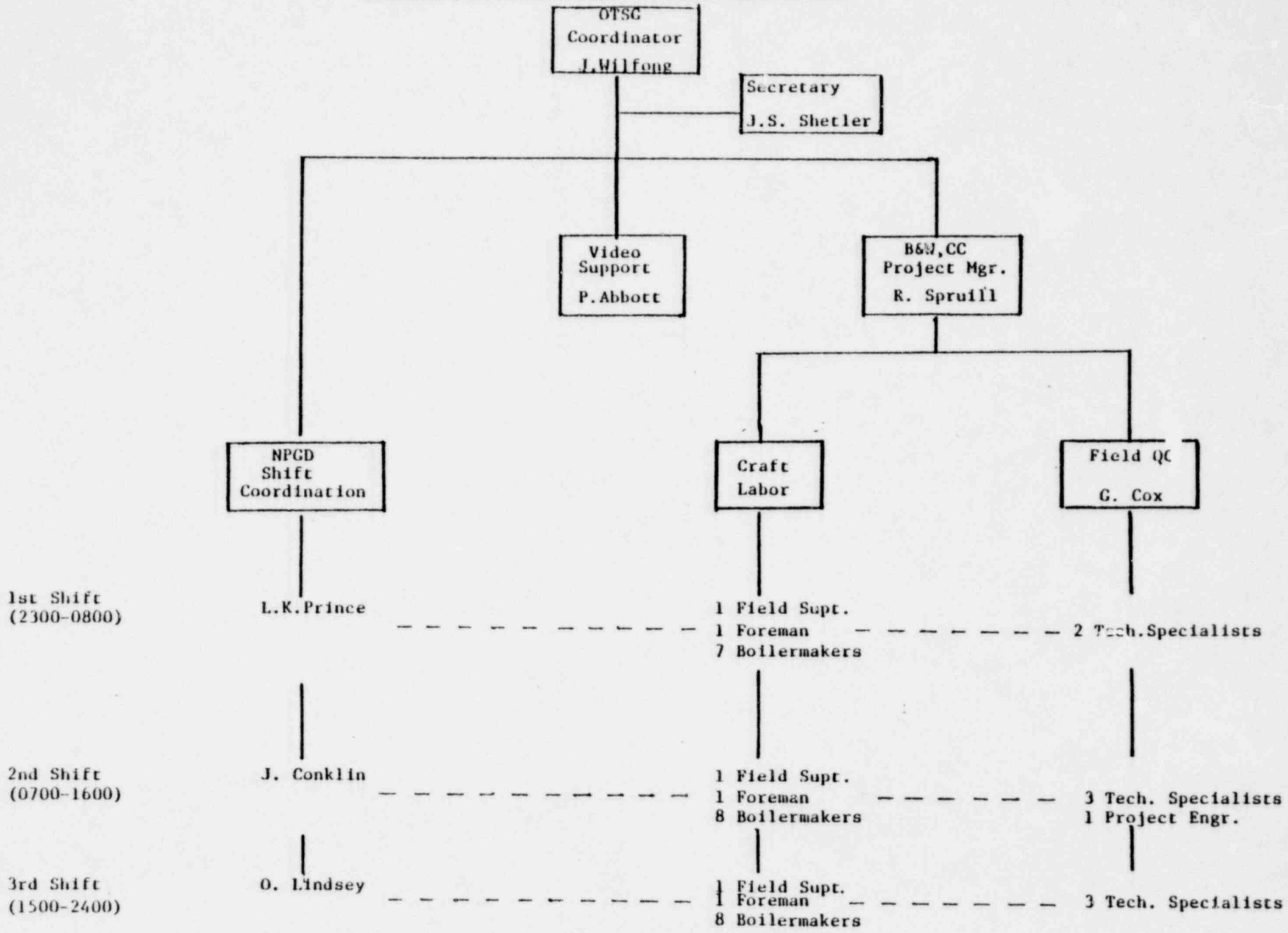
Attachment 2.20-C - Repair Effort Organization



ATTACHMENT 2.20-D B-OTSG REPAIR MAN-REM EXPOSURE

WORK DESCRIPTION	EXPOSURE (MREM)	RWP
Misc. Support	187	065
Work Outside Lower Head	740	064
Install Screens in Lower Head	1944	066
Install Skyhook & E.C. Manipulator	5924	067
Perform Freeze Frame Photography	2304	067
Remove Skyhook & E.C. Manipulator & Install Ring Girder	27585	285
Gage 1000 Tube Ends	4908	076 (40%)
Spotface Lane Tubes	1840	076 (15%)
Deburr Tube Ends	613	076 (05%)
Open IDs of "X" Tube Ends	4908	076 (40%)
Heat Tubesheet	966	077 (05%)
Roll Expand Tubes	1932	077 (10%)
Install Welder & Weld Tubes	39186	077, 386, 429
Inspect & Repair Welds (Manual)	8177	429 (25%)
PT Inspect Welds	3990	429 (25%)
Vacuum Upper Tubesheet	407	082
Flush Upper Tubesheet & Tubes	1080	069
Clean Lower Head/Remove Screens	1707	086
Perform Surveillance	3910	This figure was derived by computation
Search Waste Drums	515	515
TOTAL*	112,823	

*This total agrees with the total exposures of all B&W individuals employed in the performance of the OTSG repair.

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ATTACHMENT 2.20-E INDEX OF B-OTSG REPAIR PROCEDURE

CRR-2-12 - Installation and Removal of Skyhook and Eddy Current Manipulator

CRR-2-13 - Inspection of Tubes to be Used for Ring Girder Holddown

CRR-2-14 - Installation and Removal of the Ring Girder Assembly and Milling Vacuum System

CRR-2-15 - Installation and Removal of J-leg Screens

CRR-2-16 - Spotfacing and Opening of Designated Tubes

CRR-2-17 - Deburring of Machined Tubes

CRR-2-18 - Heating and Expanding of Tubes to be Welded

CRR-2-19 - Installation of Welding Equipment and Remote Welding and Brushing of Spotfaced Tubes

CRR-2-20 - Installation of PT Equipment and PT Inspection of Welded Tubes

CRR-2-21 - Installation and Removal of Shielding, Manual Welding of Outer Row Tubes and Reworking of Rejected Tubes

CRR-2-22 - Installation and Removal of Temporary Lower Manway Cover and Recirculation Flush System

PRR to MP-104 - Surveillance Inspection

ATTACHMENT 2.20-F "A" RING GIRDER UNIT PARTS STATUS

1.	"Y" Axis Ring Segment	In Storage Trailer
2.	"Z" Axis "	"
3.	"W" Axis "	"
4.	"X" Axis "	"
5.	"X" Plus Box Frame Half	"
6.	"X" Minus Box Frame Half	"
7.	Rear Brace	"
8.	Front Brace	"
9.	Rear Spring Support	"
10.	Machining Table	"
11.	Machining Carriage	"
12.	Theta Encoder	"
13.	"R" Drive Motor	"
14.	"X" Drive Motor	"
15.	"Z" Drive Motor	In Storage Trailer
16.	Theta Drive Motor	Missing
17.	Theta Brake	"
18.	"R" Drive Encoder	"
19.	"Z" Gear Rack	"
20.	"Z" Encoder	"
21.	"X" Encoder	"
22.	Hydraulic System	In Storage Trailer
23.	Air Motor Assembly	"
24.	Tool Cutting Head	"
25.	Angle Drive Gear Head	"

ATTACHMENT 2.20-F (Cont'd)

26.	Drive Shaft	In Storage Trailer
27.	Stiffener Bar	"
28.	Rear Zoom Camera	"
29.	Rear Tool Head Camera	Missing
30.	Front Tool Head Camera	"
31.	Light Bar	In Storage Trailer
32.	Swivel Bracket	"
33.	Cable Tray	In Storage Trailer
34.	Manway Support for Cable Tray	"
—	Roll Expander Air Manifold	"
—	Roll Expander Expansion Unit	Missing
--	Liquid Penetrant Test Unit	Partial in Storage Trailer
—	Liquid Penetrant Test Unit Cameras (2)	In Storage Trailer
--	Corner Mount Pan & Tilt Camera	Missing
--	Overhead Pan & Tilt Camera	In Storage Trailer
—	Welding Units (2 NED) (1 Copley)	In Storage Trailer & Warehouse
—	Freepath Equipment	In Storage (Auxiliary Building)
--	Surveillance Equipment	In Storage Trailer
—	Motorhome/Control Center	In Storage at Copley
--	Backup Ring Girder	In Storage (Warehouse)*

*Detailed Inventory on Separate Document

ATTACHMENT 2.20-G "B" RING GIRDER UNIT PARTS STATUS

	PART NO.	# OF PCS.	DESCRIPTION	STATUS
	1 - 4	8 ea.	Ring Segments	Storage at FPC Warehouse
	5	1 ea.	Box Frame Half	"
	6	1 ea.	Box Frame Half	"
	7	1 ea.	Rear Brace	"
(1)	8	1 ea.	Front Brace	With A Unit in Contaminated Storage Trailer
	9	1 ea.	Rear Spring Support	Storage at FPC Warehouse
	10	1 ea.	Machine Table	"
	11	1 ea.	Machine Carriage	"
	12	1 ea.	Theta Encoder	"
	13	1 ea.	"R" Drive Motor	"
	14	1 ea.	"X" Drive Motor	"
	15	1 ea.	"Z" Drive Motor	"
	16	1 ea.	Theta Drive Motor	"
	17	1 ea.	Theta Brake	"
	18	1 ea.	"R" Drive Encoder	"
	19	1 ea.	"Z" Gear Rack	"
	20	1 ea.	"Z" Encoder	"
	21	1 ea.	"X" Encoder	"
	22	1 ea.	Hydraulic System	"
(1)(2)	23	1 ea.	Air Motor Assembly	Stand in FPC Warehouse (Motors & Manifolds used on A Unit & are missing)
(1)(2)	24	1 ea.	Tool Cutting Head	With A Unit in Contaminated Storage Trailer (Needs Repair)
	25	1 ea.	Rt. Angle Drive Cutting Head	Storage at FPC Warehouse

ATTACHMENT 2.20-G (Cont'd)

	PART NO.	# OF PCS.	DESCRIPTION	STATUS
(1)	26	1 ea.	Drive Shaft	With A Unit in Contaminated Storage Trailer
	27	1 ea.	Stiffener Bar	Storage at FPC Warehouse
	28	1 ea.	Camera Bracket	"
	29	1 ea.	"	"
	30	1 ea.	"	"
(1)(2)	31	1 ea.	Light Bar	Bracket with A Unit in Contaminated Storage Trailer (Needs Lights)
(1)	32	1 ea.	Swivel Bracket	With A Unit in Contaminated Storage Trailer
(1)(2)	33	1 ea.	Cable Tray	With A Unit in Contaminated Storage Trailer (Needs Repair)
	34	1 ea.	Cable Tray Manway Support	Not Supplied on B Unit

NOTE: (1) Parts requiring replacement to maintain B Unit as a mock-up unit.

(2) Parts requiring repairs to make B Unit operational.

ATTACHMENT 2.20-H REPAIR EQUIPMENT STORAGE LOCATIONS

I. IN ENVIRONMENTAL STORAGE TRAILER

ITEM #	DESCRIPTION	TAG #
1	Air Dryer	31
2	Weld Cables	1
3	Machining Carriage for Ring Girder	16
4	Pump	13
5	Light Cords and Welding Leads	7
6	Pump	9
7	Air Hose	15
8	Vacuum Cleaner Hose	11
9	Coaxial Cables	17
10	Air Hose	23
11	Welding Leads	19
12	Cable	22
13	Hose Connectors	18
14	Assorted Nuts & Bolts	21
15	Camera Cables	8
16	Templets and Clearcom Headphones	4
17	Conductor Leads for Heaters	14
18	Stress Reliever Heater Power Supply	29
19	Stress Reliever Heater Power Supply	30
20	Air Compressor	27
21	Barberton Welder Power Supply	25
22	Copley Welder Power Supply	33
23	Assorted Extension Cords and Connections	1
24	Machining Table for Ring Girder	6

ATTACHMENT 2.20-H (Cont'd)

ITEM #	DESCRIPTION	TAG #
25	Box of Temp. Manway Spacers	20
26	Tripod for Candy Cane	10
27	Manual Welding Supply	28
28	Welder Stand	5
29	Barberton Welding Head	3
30	Copley Welding Head	2
31	Black Light for PT	12
32	Junction Box and Cables for Welder	22
33	Camera Hanger for Overhead Pan & Tilt	32
34A	Ring Girder Parts:	

34B	GIRDER PART #	DESCRIPTION
	1	"X" Axis Ring Segment
	2	"Z" Axis Ring Segment
	3	"W" Axis Ring Segment
	4	"W" Axis Ring Segment
	5	X "Plus" Box Frame
	6	X "Minus" Box Frame
	7	Rear Brace
	8	Front Brace
	9	Rear Support Spring
	15	"Z" Drive Motor
	22	Hydraulic System
	31	Light Bar
	32	Swivel Bracket
	33	Cable Tray
	34	Tray Manway Support
	--	Roll Expander Manifold
	--	Parts for PT Test Equipment

II. STORED IN MECHANICS' TRAILER

DESCRIPTION:

-- Vacuum System for OTSG Work

— Temp. OTSG Manway Cover (Contaminated)
(These items could not be stored in Environmental Trailer because of lack of space)

ATTACHMENT 2.20-H (Cont'd)

III. ENVIRONMENTAL WAREHOUSE EQUIPMENT STORAGE

BOX #	DESCRIPTION
1	Welding Console, #1, NED (Barberton)
2	Welding Console, #2, NED (Barberton)
3	Power Supply, for Welder, NED (Barberton)
4	Spare Parts, "B" Ring Girder
5	Rails, "B" Ring Girder
6	Pilot Assembly for #1 Weld, NED (Barberton)
7	Spare Parts, Welder, NED (Barberton)
8	Circulating Tank for Belt Grinder
9	Electrolytic Etcher
(A) 10	Belt Sander
(B) 10	Hose Assembly
11	Welding Head, #1, NED (Barberton)
12	Not Listed -- Stored in Mock-up Area
13	Tubesheet Grinder, Spare Parts
14	Cut Off Saw
15	Temp. OTSG Manway Cover
16	Circulating Pump for Cut Off Saw
--	Tubesheet Grinder Oper. Console (2 boxes)
--	Air Manifold for Grinder w/Oilers and Filters
--	Assorted Cable Harness for Tubesheet Grinder
--	Centerpost for Tubesheet Grinder
--	Grinder Arm, #1
--	Grinder Arm, #2
--	Box (2 ea.) Trionics Digital Electronic Readout Panels (for Grinder)

BOX #	DESCRIPTION
—	Penetration Cover w/Adjustable Passthru Port
—	Box Electronic Equipment
—	Box Spare Parts for Grinder

IV. IN MOCK-UP AREA WIRE CAGE

BOX #	DESCRIPTION
12	Ring Girder Cables, Arc Cables and Vacuum Hoses
3 (Spool)	Spare Pan and Tilt Cable
4 (Spool)	NED Welder Cable, Spare
5 (Spool)	NED 300' Spare Welding Cable

V. STORED IN INGLIS

SPOOL #	DESCRIPTION
1	400' Ring Girder Assembly Control Cables
2	400' Welding Control Cables