MAR 11 1968

H. D. Thornburg, Senior Reactor Inspector
Region III, Division of Compliance

L. Kornblith, Jr., Assistant Director
for Technical Programs
Division of Compliance Original Signed by L. Kornblith, Jr.

NORTHERN STATES POWER CO. (MONTICELLO)
CONSTRUCTION PERMIT NO. CPPR-31

Attached are copies of CO Report No. 50-263/68-2 covering the recent inspection that G. W. Reinmuth made at Northern States Monticello Plant. This report should be handled in whatever manner you consider appropriate. In our opinion, the work is being performed in the manner in which CB&I said it would be and we have no recommendations at this time.

Attachment:
CO Rpt 50-263/68-2
by G. W. Reinmuth, dtd 3/4/68

Distribution:
H. D. Thornburg, CO:III (Orig. & 24 copies)
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	See me about this.		For concur		For action.
	Note and return.		For signature.		For information.

TO (Name and unit)	INITIALS	REMARKS
J P O'Reilly		Followup on the subjects highlighted by our consultant (Clyde) is a matter of concern to me. I am preparing a memo to Technical
	DATE	
TO (Name and unit)	INITIALS	REMARKS
		Program Branch stating that the responsibility is theirs (Reinmuth's) for following up in these areas
	DATE	
TO (Name and unit)	INITIALS	REMARKS
		I have no other problem with this report
	DATE	
FROM (Name and unit)		REMARKS
J D Keppler		
PHONE NO.	DATE	
	4-2-68	

USE OTHER SIDE FOR ADDITIONAL REMARKS

C43—16—73903-1 GPO : 1967 —277-337

OPTIONAL FORM NO. 10

UNITED STATES GOVERNMENT

Memorandum

TO : J. P. O'Reilly, Chief, Reactor Inspection & Enforcement Branch
Division of Compliance, Headquarters

DATE: March 19, 1968

FROM : H. D. Thornburg, Senior Reactor Inspector
Region III, Division of Compliance
Chicago

SUBJECT: NORTHERN STATES POWER COMPANY (MONTICELLO)
DOCKET NO. 50-263

The attached report of a visit to the subject facility by two Headquarters specialists on February 8 and 9, 1968 is forwarded for information.

Mr. Chyle's comments regarding the local microfissuring of the pressure vessel cladding are attached to the subject report.

The inspectors concluded that the field erection of the pressure vessel was proceeding according to the application. At the time of the visit, no final in-place installation had taken place. Mr. C. Jones, Reactor Inspector, Region III, visited the site on March 4 and 5 to observe the fit up and a portion of the welding of the first shell course. This matter will be reported separately. Mr. Jones reported that no significant difficulties had been encountered.

Attachment:
CO Rpt No. 50-263/68-2 by
G. W. Reinmuth dtd 3-4-68 (2 cys)

cc: E. G. Case, DRS
R. S. Boyd, DRL (2)
S. Levine, DRL (4)
D. J. Skovholt, DRL (3)
L. Kornblith, Jr., CO:HQ
Regional Directors
REG files

S/RHE 4-8-68
O'R has seen
FR 4-5-68
JBL 3-30-68
LK sep. cpy

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U. S. ATOMIC ENERGY COMMISSION
DIVISION OF COMPLIANCE
HEADQUARTERS

Report of Inspection

CO Report No. 50-263/68-2

Licensee: NORTHERN STATES POWER CO. (MONTICELLO)
CONSTRUCTION PERMIT NO. CPPR-31
Category A

Date of Inspections: February 8-9, 1968
November 13, 1967

Date of Previous Inspection: September 5-6, 1967
(Birmingham, Ala., shop inspection)

Inspected By: G. W. Reinmuth G. W. Reinmuth 3/4/68
Reactor Inspector (Program Standards (Date)

Reviewed By: L. Kornblith, Jr. L. Kornblith, Jr. 3/5/68
Assistant Director for Technical Programs (Date)

Proprietary Information: No X Yes ____ Pages None

SCOPE

Announced visits were made to the construction site of the Monticello power reactor by Messrs. C. E. Jones, W. J. Collins and G. W. Reinmuth. The purpose of the visits was to review the progress of field fabrication of the reactor pressure vessel.

SUMMARY

All pieces of the vessel, with the exception of the top closure head, are on site in varying stages of pre-assembly. No final in-place installation had taken place at the time of the last visit.

Radiographic and ultrasonic test procedures, control of heat treatments, the quality control program including the record system and the stub tube design were reviewed during the visit. Each of the areas was found to be satisfactory and complied with the initial proposals as documented in the pressure vessel fabrication report submitted in November 1966.

The cause and repair of microfissuring in local areas of the vessel cladding are reviewed in the report. Mr. Chyle, consultant, attended a DRL meeting on January 25, 1968, at which time the problem was explained in detail. His comments are included in Attachment B.

(continued)

DETAILS

I. Scope of Visits

Visits were made to the Monticello reactor site to review the progress of field fabrication of the reactor pressure vessel. Accompanying the inspector on the February 8-9 visit was W. J. Collins, Metallurgical Engineer. Mr. Collins' report covering the specific areas which he reviewed, is attached as Attachment A.

The principal persons who participated in the various discussions held, were as follows:

Clifford Tice, Supt. of Construction, Northern States Power (NSP)
W. J. Jokela, Ch. Test Engineer, NSP
J. B. Violette, Project Manager, General Electric (G-E)
G. A. Larson, Site Manager, G-E
Jack Lingafelter, Principal Proj. Engr., G-E
Hugh Stock, Welding Engineer, G-E
C. C. Roof, Q. C. Representative, G-E
Jay Bland, Mfg. Services Consultant, G-E
P. Arnold, Vice President, Chicago Bridge & Iron (CB&I)
E. Varnum, Q. C. Manager (Monticello), CB&I
Don L. Mowry, Q. C. Manager (Vermont Yankee), CB&I
Daniel P. Hegglin, Q. C. Co-Ord. (Monticello), CB&I
W. Spaulding, Q. C. Co-Ord. (Vermont Yankee), CB&I
Ollie Johnson, Project Manager, CB&I
E. Ripley, Testing Engineer, CB&I
O. W. Briggs, Testing Engineer, CB&I
Mr. Rosetta, Site Manager, Bechtel

II. Results of Visits

A. Status of Vessel (Feb. 9, 1968)

With the exception of the top dome of the upper head, all major pieces of the vessel are on site. This includes the two large flange ring forgings which were shipped directly to the site in integral pieces. The possibility of having to cut each of the rings into two pieces for shipping had been considered at one time. This procedure was found to be unnecessary.

Assembly of the bottom dollar plate, knuckle section and support skirt has been completed. The circumferential welds were stress relieved and radiographed and found to be satisfactory. (See Collins' report - Attachment A.) This piece is ready for positioning in the containment vessel.

(continued)

The lower shell course containing the main recirculation system nozzles has been assembled, the welds stress relieved and radiographed. Radiographs of the two vertical welds were also reviewed by Collins and found satisfactory. This piece was stored outside and is ready for in-place assembly.

The remaining three shell courses were in varying stages of welding, stress relief and testing. Work on each was going on in protective enclosures commonly referred to as wigwams or tepees. These insulated structures serve as combination furnaces, work shops and radiographic test facilities. See Figures IV-8, IV-9, and IV-10 in the special Monticello Reactor Vessel report.

Installation of cladding to the upper vessel shell flange forging was observed. The cladding was being applied by a two pass, stick electrode, manual process. When questioned about the rough as-welded surface condition, CB&I stated that sufficient grinding and polishing would be performed to permit both dye penetrant and ultrasonic testing. Since these tests require a relatively smooth surface, the finished condition may be expected to be equivalent to the cladding surfaces applied by automatic methods.

B. Cladding Problem

Microfissuring of the stainless steel cladding in local areas on several vessel pieces was detected by CB&I prior to shipment to the field. The problem was reported during the visit of November 13 and fully explained in a meeting with Regulatory personnel on January 25, 1968. (See Attachment B - Report by Parameter, Inc.)

The cause was attributed to a miscalculation of the clad ferrite content during the initial procedure qualification. Specifications called for 5-10% ferrite; however, because of the miscalculation, the as-applied clad checked out at 4% and lower. CB&I pointed out that cladding containing 4% and lower ferrite does not necessarily mean that microfissuring would automatically occur. Mr. Arnold stated that CB&I had successfully clad petroleum type vessels with 1-2% ferrite. Because microfissuring is less likely to occur at the higher ferrite values, the 5-10% was specified.

Microfissuring on the Monticello vessel was found on about 30% of the area on the bottom shell course, 5% of the surface on the bottom knuckle section and approximately 1% of the area on the remainder of the vessel. Any area that tested less than 4% was considered suspect and was further investigated and repaired as necessary.

(continued)

Repair consisted of grinding out the microfissuring until dye indications disappeared. Sufficient cladding thickness was available to permit the light grinding required for defect removal. In nozzle areas where microfissuring occurred, all clad was removed and replaced with a manual process as a precautionary measure. The extent of investigation was evident by observation of the ground areas. One shell ring was noted to have had a circumferential strip of cladding ground smooth at approximately each foot of elevation. Vertical strips from top to bottom had also been ground at about 6 foot intervals around the circumference. As a final confirmation that the cladding is satisfactory, a 100% surface dye check will be made following the hydrostatic pressure test.

Subsequent to the January 25 meeting, the question of "depth of microfissuring" was raised by Mr. Chyle. (See Parameter report, Attachment B.) Mr. Arnold was questioned on this point. His answer was that representative full thickness samples had been taken and metallurgically examined which confirmed the microfissuring to be limited to the surface. He also pointed out that only light grinding was necessary to remove the microfissures.

C. Quality Control System

1. Records

A review of the records maintained at the site disclosed the system in use is similar to that observed in other fabrication plants. The basic ingredients of the system are pre-planned work sequences, test and inspection points and required sign-offs by CB&I, G-E and Northern States Power (NSP) representatives. Work methods and test procedures have been prepared which spell out the details and acceptance limits. These procedures are cross-referenced in the specific work sequences.

These record files will be periodically audited during assembly of the Monticello vessel.

2. Personnel Assignment

CB&I maintains full time at the site a quality control coordinator, a project manager and two testing engineers. These persons are in addition to supervisory personnel who are in direct charge of the work being performed. Workman to supervision ratio was stated to be 8 to 1.

(continued)

Monitoring the CB&I work on the pressure vessel is a full time G-E quality control engineer having extensive experience in pressure vessel fabrication. He is independent of the project management group in that he receives his direction from the G-E Quality Control Division in San Jose, California. Backing up this engineer is a G-E company consultant, Jay Bland, who is completely independent. He is held accountable to upper company management only.

3. Welder Qualifications

Before performing any work on the vessel itself, each welder was individually trained and qualified on site by experienced CB&I supervisors. CB&I stated the welders were pre-selected from a group of code qualified welders prior to participation in the training program. Training included practice welding on full thickness pieces of vessel type material (ASTM-A533). The success of the program is verified by the fact that no post radiography repairs to the welds have been required to date.

D. Stub Tube Design

Some of the basic design parameters of the rod system stub tubes are as follows:

1. Stub tube material is inconel. The stub tube will not be exposed to a final heat treatment since this operation is performed locally on individual weld seams.

2. Length from top of vessel weld to top of stub tube is a minimum of 4½ inches.

3. Stub tubes will be installed in the field. Holes in the head for receiving the stub tubes were rough machined in the shop and will be final machined in the field. The weld preparations in the head were inconel "buttered" to eliminate the need for field preheat and post heat at this stage.

4. Both the stub tube to vessel weld and stub tube to rod guide tube (housing) will be inconel and field welded. Bechtel personnel will perform the stub tube to rod guide tube weld utilizing G-E developed automated welding equipment.

Attachments:
Attachments A & B

February 15, 1968

ATTACHMENT A

BY: W. J. Collins, Metallurgical Engineer

SUMMARY

The radiography, ultrasonic testing and heat treatment processes being utilized in field fabrication of the reactor pressure vessel were reviewed at the construction site. The operations and quality control records, associated with these processes, were found consistent with procedural guidelines for the initial stage of field fabrication of the vessel. In addition, a meeting with Region III and management personnel was held to discuss the contractor's (CB&I) investigation of the weld cracking problem associated with field installation of the containment vessel inserts and penetrations. A report on CO investigation of this problem is being prepared by Region III for distribution.

DETAILS

I. Scope of Visit

An announced visit to the Northern States Power Company's nuclear construction site at Monticello, Minnesota, was made by the writer and G. W. Reinmuth, on February 8-9, 1968. The writer's attention was directed to: (a) providing technical assistance to Mr. C. E. Jones, Reactor Inspector, Region III, in the investigation of cracking problems encountered in field welds on the containment vessel inserts and penetrations; and (b) observations of the radiography, ultrasonic and heat treatment processes which are being utilized in field fabrication of the reactor vessel.

A tour of the construction site was made for purposes of personal familiarization only. ? We should always tour construction sites!

It is worthy to mention that a complete report on item (a) is being prepared for distribution by the Region III office. Consequently, only the information concerning item (b) is presented herein. The following personnel were contacted:

(continued)

Details (continued)

C. C. Roof, Quality Control Representative, G-E
P. Arnold, Vice President, CB&I
E. E. Varnum, Quality Control Manager, CB&I, Monticello
O. B. Johnson, Project Coordinator, CB&I, Monticello
J. B. Violette, Project Manager, G-E, Monticello
O. W. Briggs, Production Control, Radiography, CB&I
E. Ripley, Production Control, Ultrasonic Testing, CB&I

II. Results of Visit

A. Radiography - Reactor Vessel

The CB&I procedure for radiographic examination of completed field welds was available and currently up-to-date. The procedure set forth all parameters of the radiography process, referenced acceptance standards for both radiography and welds, and prescribed quality assurance records to be maintained. Procedure details were adequate and within the scope of requirements established by ASME Code, Section III.

Radiographs and associated records of three full penetration butt welds were evaluated for compliance to procedural requirements and applicable acceptance standards of the ASME Code. The individual radiographs were identified and traceable to quality assurance records maintained on each weld seam. Radiographic film density, weld image contrast and radiographic quality level (2T sensitivity parameter) were acceptable. Weld defects, as shown by the radiographs, were within the acceptance standards established by ASME Code and CB&I's procedure. The welds identified with this review were:

1. No. F-1: Vertical seam, second shell course from bottom (core region).

2. No. F-2: Vertical seam, second shell course from bottom (core region).

3. Lettered H-J: Circular seam attaching bottom dollar plate to knuckle section.

B. Ultrasonic Testing - Reactor Vessel

The CB&I procedure for ultrasonic examination of heavy wall, field welded, vessels was available and currently up-to-date. The procedure prescribed the ultrasonic techniques to be employed, equipment calibration methods, bases for weld rejection, and established the quality assurance records to be maintained. The details of this procedure were within the scope of ASME Code, Section III, requirements.

(continued)

Results of Visit (continued)

Since welding and heat treating were being accomplished on vessel sections, only the equipment calibration for UT of "cold" welds could be observed. On the basis of these observations, and a discussion of records presented by quality control representatives, it was concluded that UT of welds is consistent with CB&I's procedural requirements for the initial phases of field fabricating the vessel.

C. Stress Relief Heat Treatment - Reactor Vessel

A tour of the heat treatment facilities was made in order to observe the methods employed in controlling pre-weld, post weld and stress relief temperatures during fabrication of vessel sections.

The furnaces are portable, circular, steel enclosures and are heavily lined with a steel mesh-fireclay matte insulation. The furnaces rest on deeply piled, granulated, vermiculite to prove additional insulation from the environment. Furnaces are fired by natural gas and are designed to prevent flame impingement on the vessel sections during stress relieving operations.

Temperatures of both furnace and vessel sections are controlled and monitored by indicating/recording instruments connected to thermocouples which are attached to the furnace wall and on the vessel section. The temperature monitoring device incorporates a telephone alarm system to alert "offshift" supervisors in the event that heat loss occurs on offshift hours. Portable electric generators are also available for heat control purposes if complete power failure occurs during stress relief operations.

When stress relief operations are not being performed, the furnaces are used for environmental control during welding operations. Weld preheat and post weld heat treatment is accomplished by attaching electrical heating coils to the vessel section. Temperatures are controlled and monitored with the system described above.

A stress relieving operation (cooling cycle) was in progress at the time of the tour. The indicating/recording instrument showed 12 locations at which temperatures were being monitored. The temperature differential for the 12 locations was $50^{\circ}F$ at a cooling rate of $\sim 100^{\circ}F$ per hour. These temperature gradients were well within the requirements established by CB&I's heat treatment procedure.

ATTACHMENT B

REPORT OF MEETING ON

NORTHERN STATES POWER COMPANY

MONTICELLO PLANT

Bethesda, Md. Jan. 25, 1968

No. DC-18 Feb. 5, 1968

AEC Contract No. (11-1)-1658
Task "A"

PARAMETER, Inc. No. 67-68A

John J. Chyle, P.E.
Jack Chyle, Welding Consultants
Subcontract No. 1

Richard A. Lofy, P.E.

PARAMETER, Inc.
Consulting Engineers
Elm Grove, Wisconsin

Distribution:	Copies:
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AEC Contracts Division	
Chicago Operations Office H. N. Miller, D. Dixon	(1)
PARAMETER, Inc.	
J. J. Chyle	(1)

Contents:

REPORT OF MEETING ON MONTICELLO PLANT

January 25, 1968

Introduction:

Mr. John J. Chyle and the writer attended a meeting at AEC Regulatory Headquarters in Bethesda on January 25, 1968 in which a general status report of construction progress on the Monticello Nuclear Generating Plant was presented by NSP-GE-CBI-Bechtel representatives.

The subject of particular interest at this meeting was CB&I's resolution of micro-fissuring which they had experienced in some areas of stainless steel cladding in the pressure vessel. Mr. Chyle comments on this problem in the following section of this report.

As the BWR pressure vessel for Monticello is being field assembled, Chicago Bridge & Iron Company's report of progress on the vessel to date was also of general interest.

Some of those who were noted to be in attendance at the meeting were:

Northern States Power Company

Mr. D. F. McElroy, V.P. Engineering

Northern States Power Company - continued

Mr. A. Ward
Mr. C. Larson, Plant Superintendent, Monticello

General Electric Company

Mr. J. Viollette
Mr. J. Bland

Chicago Bridge and Iron Company

Mr. P. Arnold, V.P.
Mr. E. Varnum, Manager, Quality Control, Monticello

Bechtel Corporation

Mr. G. Parkinson, Manager, Monticello Project

Division of Reactor Licensing - AEC

Mr. D. Muller
Mr. J. Shea
Mr. L. Porse and others

Division of Safety Standards - AEC

Mr. A. Holt

Division of Compliance - AEC

Mr. G. W. Reinmuth
Mr. C. Jones, Region III
Mr. W. Collins

Advisory Committee for Reactors Safeguards

Dr. S. Bush

Discussion:

Mr. Chyle has covered most of the agenda items of the meeting in the section which follows. Thus, this section will serve only to record some information which ties in with our previous work on Monticello. (Ref: Report DCL-1, DCL-4 and DCL-5)

In earlier reports of study of field fabrication, we suggested that the direction and amount of "spring" of the cold formed shell course be observed when the shell halves are cut apart after cladding. This would be a good indicator of residual stress and a factor in achieving good fit-up when the shell halves are reassembled in the field. In his presentation, Mr. Arnold indicated that the shells were only two inches out-of-round as shipped. The shells sprung inward at the seams as might be expected due to the cladding of the inner surface. (The small amount of spring would indicate the shell to be in a fairly stress free condition.)

Mr. Arnold indicated that, by subsequently controlling the welding sequence on the longitudinal seams in the field, they were able to bring the shells back to within Code ovality tolerances. The most out-of-roundness was experienced on the nozzle shell course.

Dr. Bush asked whether the material planned for surveillance had been cold formed to be representative of the as-built pressure vessel. Mr. Arnold of CBI indicated that the surveillance material was removed from the plate after forming and from areas where a representative elongation had occurred.

Mr. Porse asked whether there would be a check on the clad after cold plastic strain (hydrotest). Mr. Arnold indicated that a dye penetrant check would be made.

Mr. Porse asked about the design basis (cyclic life) for the stub tubes on Monticello. GE and CBI representatives indicated that their stress analysis people were not present to discuss this item.

The meeting on Monticello adjourned at about noon. The afternoon was spent in a general discussion of reactor plant problem areas with Mr. Reinmuth.

Richard A. Lofy, P.E.
PARAMETER, Inc.
Consulting Engineers
Elm Grove, Wisconsin

Jack Chyle, P.E. Welding Consultants

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February 1, 1968

Mr. Richard Lofy, President,

Parameter, Inc.,

13545 Watertown Plank Road,

Elm Grove, Wisconsin 53122

Dear Mr. Lofy:

I am submitting a trip report on a meeting which you and I attended at Bethesda A.E.C. offices on the subject of fissuring in cladding of the Monticello Nuclear Reactor. The meeting was held on Januaru 25, 1968, and began at 9:00 A.M. E.S.T. Mr. D.E.McElroy of Northern States Power opened the meeting with representatives of Northern States Power, Chicago Bridge and Iron and A.E.C. staff present.

It was stated at the beginning of this meeting that the cracking encountered in the welding of the penetrations in the containment vessel will not be discussed at this meeting. It was also indicated that the subject priority for the morning session would be on the Reactor vessel status and micro fissuring of the cladding followed by discussion on quality assurance items 5 and 7 on the agenda. (Agenda not given us).

Mr. Perry Arnold was the first speaker and discussed the various operations in progress and the status of their Monticello operations. He stated that the control rod holes were bored at their Greenville Plant. The series

submerged arc welding process was used for overlay cladding. He stated the containment vessel is almost completed. Cracking was encountered in the heavy plate fitting or insertions. All the component parts were at site with the exception of top head which would be shipped within a day or two.

The bottom head and knuckle section were welded together. The skirt is welded on the head. Bottom head has had a five hour stress relieve, one additional and final stress relieve operation is to be done. So far no real difficulties have been experienced and the progress of assembly appears to be on schedule. First ring section assembled and vertical joints welded and heat treated (stress relieved), x-rayed and overlay welded at penetration areas. Second ring and two vertical seams welded ultrasonically tested and given the first stress relieve. Third and fourth ring sections at site ready for vertical welds for third ring. Head flange for top head being prepared. Fourth ring flange also at site. Will start machining flange ring surface. No significant welding problems encountered with exceptions of some cutouts due to slag entrapment in weld.

Microfissuring found in overlay welding and extent of fissuring found in bottom head and first ring section.

30% of area showed fissuring indications. The cause for fissuring is due to lack of control of weld metal composition. The weld deposit is low in ferrite content and is nearly all austenitic. Metallurgically fissures are avoided when the ferrite content is above 5% and in preferred range of 5 to 10%. The ferrite content can be checked by a magnetic gage.

Samples of clad bend tests were passed around for examination. One sample revealed open cracks of some width that appeared to be black. This discoloration may be due to heat treatment of open cracks. On questioning Mr. Arnold on reworking we were told that fissures will be ground without rewelding except in areas adjacent to nozzles. These areas will be ground out and rewelded using stick stainless steel electrodes. Mr. Arnold indicated that the cause for fissures was due to lack of control on weld metal composition and that stricter control of alloying elements in the flux and welding wire would be enforced.

A discussion was also held on the subject of stub tubes for Monticello which are of inconel composition. The inconel stub tubes are extruded and machined after annealing. The writer questioned if stress relieving after machining was used and was informed that no heat treatment after welding was performed. The writer also questioned Mr. Arnold on the conversion of ferrite to sigma at stress relieving temperatures and the time effect at

temperature. Mr. Arnold said that in his opinion 1% of ferrite converted to sigma. This opinion in regards to ferrite conversion is a subject that should warrant further investigation and determination as to its effect on the performance of the reactor vessel.

follow up ?
will check with Rennuth

After Mr. Arnold's presentation the balance of the morning was a discussion of item 5 on the agenda which dealt with quality assurance. Mr. Charles Larson recently designated plant superintendent for Monticello reviewed a number of items which concerned the following.

Stress analysis of the pressure vessel was discussed and it was reported that an independent stress analysis review would be performed by an outside party. This review may be one of the three being considered i.e. Franklin Institute, Teledyne, or Illinois Institute of Technology. In the Montecello quality assurance program Bechtel Corporation is doing the Q.C. on piping and has men at site. G.E. has men at site and N.S.P. also has men at site with one man at full time and assistants. N.S.P. has reviewed 2500 radiographs on welds. N.S.P. has transferred a number of individuals from Pathfinder. It was indicated that Bechtel and G.E. have more Q.C. people at Monticello than at other sites.

A quality control plan was discussed in detail. It was also indicated that Monticello Reactor was similar to Dresden Millstone and Quad Cities construction. Also that Dresden II

precedes Monticello and Millstone in completion.

During the final discussion in the morning it was brought out that information on the reasons why changes were made as well as listing all changes that were made for the various installations would be of great interest and information. The meeting adjourned at approximately 12:00.

In the afternoon a conference was had with Mr. Reinmuth in his office. At this conference the discussion concerned a number of the items discussed in the morning's session. The question of the importance of fissuring in cladding was discussed. It was my opinion at this meeting that I did not believe the micro fissuring to be alarming or important. Upon further deliberation I would like to modify my viewpoint and bring out the following information on fissuring. The significance of fissuring is related to the extent that it is encountered and that a full metallurgical report of this problem should be submitted. It is logical to assume that fissuring when found on the surface may also be present within the full depth of the cladding. The significance of this is evident that if the fissuring is near the interface of cladding and base plate the propagation in the face plate may be of concern. It is for this reason that a metallurgical report should be submitted to indicate the distribution and extent of the fissuring encountered. The areas where this has occurred should be mapped out and a check at several areas

should be made if fissuring extends to the entire depth of the cladding deposit. The second point of consideration is the effect of stress relieving on the conversion of ferrite to sigma. It was stated that the conversion is 1%, however verification of this should be established. Sigma is a non magnetic brittle phase in stainless steel that decreases the ductility of the weld metal. The third point in reference to fissuring is what effect will the hydrostatic pressure test have on its presence, its propogation and generating new fissures. The presence of fissures on the cladding should also be evaluated on the basis of thermal cycling of the vessel in service. And, finally, the presence of fissures in the cladding should be evaluated from the standpoint of corrosion both of the general and the stress corrosion type.

The balance of the afternoon was devoted to a number of minor subjects.

John J. Clyle