REVIEW OF SAFETY-RELATED WELDING AT SOUTH TEXAS PROJECT ELECTRIC GENERATING STATION

FINAL REPORT

APRIL, 1981

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SUMMARY

Houston Lighting & Power Company, the construction permit holder for South Texas Project Electric Generating Station, Units 1 and 2, was directed on April 30, 1980 in an Order to Show Cause by the Nuclear Regulatory Commission, Office of Inspection and Enforcement to review the safety-related structural and piping welding at the South Texas Project. The Order to Show Cause was based on the findings of a special NRC investigation (No. 50-498/79-19 and 50-499/79-19) conducted between November 1979 and February 1980. As a result of the Order, HL&P and Brown and Root, the plant architect-engineer and constructor formed a welding Task Force to perform the review.

The emphasis of the Task Force investigation was on reviewing the completed safety-related piping and structural welds for compliance with the construction codes and was accomplished primarily by evaluating the original nondestructive examinations. Reviews were also conducted of weld documentation, welder and inspector qualifications, construction and nondestructive examination procedures, filler material certifications and other items to determine code compliance.

Based on their investigation, the Task Force concluded that there were deficiencies in the safety-related welding program. These deficiencies, reported in detail in Sections 2.0 through 5.0 of this report, are briefly summarized.

ASME Piping Systems

Safety-related piping fabricated in accordance with American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III was found to be in the early stages of completion, with approximately 1300 piping welds and an additional 600 pipe hanger welds completed or in process.

All of the radiographs of completed ASME piping welds were reviewed by the Task Force. Approximately 25% of these welds were found to have Code noncompliances, either in the film quality or the interpretation of defects. Fifteen percent of these contained indications of weld defects which will require repair.

A random sample of thirty-seven socket welds and fifty groove welds was examined by visual (VT) and liquid penetrant (PT) methods. Thirteen PT noncompliances in the socket welds were disclosed, eight of these were for linear indications in the base metal adjacent to the weld. The maximum length for weld metal indications was 3/32 in., and 3/8 in. for the base metal indications. Three noncompliances were noted in the groove welds, one 1/8 in. long PT indication in the base metal adjacent to the weld, and two instances where the weld groove was underfilled by approximately 1/32 in.

Construction procedures, welding procedure specifications and weld documentation for ASME piping were reviewed and found to be substantially in compliance with the Code, although a number of minor noncompliances were disclosed.

All weld filler materials for both safety-related piping and structural welding were found to have been purchased from project-approved vendors and were traceable to the purchase documents and a Certified Material Test Report (CMTR). A review of the CMTR's disclosed that the materials complied with the Code. There was one instance of a minor noncompliance with an NRC Regulatory Guide regarding delta ferrite measurement.

A potentially significant noncompliance was disclosed in the radiographic evaluation of a number of welder qualification tests. Placement of the penetrameter on the film-side rather than the source-side could have resulted in a decrease in the ability to detect small discontinuities to a level below that required by the Code. Other than this, the qualification of ASME welders was in compliance with the Code.

Reexamination by VT and PT of twelve of the 26 accessible Essential Cooling Water System welds revealed only arc strikes, weld spatter and four liquid penetrant indications. The PT indications are believed to be nonrelevant. The Code requires that nonrelevant indications be removed so that they do not mask relevant indications.

Safety-related Structural Welds

A random sample of 79 welds were visually reexamined and were found to contain a significant number of noncompliances with the American Welding Society's D1.1, "Structural Welding Code". These noncompliances ranged from weld spatter to undersize welds. No cracks were found.

The construction procedures were found to contain a number of minor noncompliances and two that were considered significant enough to question the adequacy of some of the inspections. Both pertained to the frequency of inspection.

AWS welding procedure specifications were found to be substantially in compliance with the Code, although a number of minor noncompliances were disclosed.

The structural weld documentation was found to be deficient because in many instances it was not possible to trace an inspection report back to the weld for which it was written.

The review of welder qualifications revealed that ASME radiographic acceptance criteria had been used to evaluate some AWS welder qualification tests. Both codes have similar, but not identical acceptance criteria. This noncompliance was judged to have no effect on the weld quality.

It was not possible to verify through documentation that the structural welders were qualified for each weld that they made because the documentation system did not require that each welder be identified. However, a system was established which required that three individuals, the weld supervisor, the QC inspector and the weld technician who issued filler material verify welder qualification.

Review of the PSAR and FSAR revealed inconsistencies in the specified edition of AWS D1.1 for structural welding. Other similar inconsistencies were disclosed when the Engineering Specifications were compared with the implementing construction procedure. However, these inconsistencies were not judged to have affected the quality of the welding.

Fourteen audit reports were reviewed, but from the records it was not possible to determine their thoroughness. It was disclosed that written audit plans had not been used as was required.

Nonconformance Reports, Corrective Action Reports and Field Requests for Engineering Action were reviewed, but not in sufficient detail to provide meaningful results.

As a result of the Task Force findings, HL&P and Brown and Root have undertaken a comprehensive reexamination and repair program. All accessible ASME Section III pipe and pipe hanger

welds will be reexamined by the original nondestructive examination method, visual, liquid penetrant or both. All deficiencies identified in this reexamination will be repaired. In addition, all radiographic discrepancies identified by the Task Force will also be repaired and brought into Code compliance. The Essential Cooling Water System (ECW) will be unearthed and all welds will be reradiographed except those welds which had previously been entirely radiographed and accepted by the Task Force. All of the ECW system welds will also be reexamined visually and by liquid penetrant. All deficiencies identified in this reexamination will be repaired. All ASME welds which are now inaccessible because of subsequent construction activities will be analyzed for acceptability.

All accessible safety-related structural steel welds will be visually reexamined and repaired. All of the reexaminations and repairs will be performed by requalified and recertified inspectors and welders. Welds which are now inaccessible for reexamination and repair because of subsequent construction activities will be analyzed for acceptability.

1.0 INTRODUCTION

In April, 1980 the United States Nuclear Regulatory Commission, Office of Inspection and Enforcement issued a report of their investigation of the safety-related construction activities at the South Texas Project Electric Generating Station[1]. Based on the findings of this investigation, the Commission directed Houston Lighting and Power Company, the designated manager for the joint utility-owned project, to conduct a review of welding of safety-related piping and safety-related structural steel. In response to this directive, Houston Lighting and Power in conjunction with Brown and Root, Inc., the plant architect-engineer and constructor formed a special Task Force to assess the state of safety-related welding at South Texas Project. This is the report of that Task Force.

The welding Task Force was made up of two groups, the Review Team, and the Independent Review Committee. The Review Team was the working group which formulated the investigation plan and conducted the investigations. The Independent Review Committee reviewed and approved the Task Force investigation plan and monitored the activities of the Review Team to assure that the

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(1) U. S. Nuclear Regulatory Commission, Office of Insepction and Enforcement, IE Investigation Report, 50-498/79-19, 50-499/79-19, April 28, 1980.

approved plan was being implemented. Occasionally, the Review Committee was asked to provide advice on ASME Code questions.

The Review Team was headed by personnel from the Materials Engineering Discipline of Brown and Root and by personnel from NUTECH, Inc., an engineering consulting firm. Additional personnel for the investigation were provided by other departments from Brown and Root and Houston Lighting and Power. NUTECH obtained a number of specialists in nondestructive examination from Southwest Research Institute to assist in reviewing the radiographic, visual and liquid penetrant examinations.

The Review Team was empowered to investigate all aspects of safety-related welding which they considered necessary, within the scope specified in the NRC Order to Show Cause. No other constraints were placed on the Review Team investigation by Brown and Root or Houston Lighting and Power.

The Independent Review Committee was composed of two engineers from NUTECH, experienced with the American Society of Mechanical Engineers Boiler and Pressure Vessel Code and nuclear power plant design and construction, and one engineer from Southwest Research Institute, experienced in nondestructive examination.

The investigation commenced on May 19, 1980 at the South Texas Project site near Bay City, Texas. The initial period of the investigation was spent in orientation and familiarization with project procedures, determination of the scope and depth of the investigation and formulation of the investigation plan.

On June 9th the preliminary investigation plan was issued for comment to the Independent Review Committee, Brown and Root, and Houston Lighting and Power. After the comments were incorporated, the investigation plan was issued on June 23, 1980 as a South Texas Project Technical Reference Document, (TRD) 5A700GP004, "Review of Safety Related Welding". The TRD was revised several times to provide additional detail, modify task descriptions and incorporate the results of the investigation.

The major part of the investigation was conducted at the STP site between May 19, and July 20, 1980. During that period, the Independent Review Committee visited the site to monitor the investigation, and review changes to the TRD. Independent Review Committee meetings were also held at the Brown and Root offices in Houston and at NUTECH in San Jose.

On July 21, 1980, the welding Task Force met in Houston to review the draft of the Review Team's investigation report. During this meeting the Independent Review Committee made recommendations for redirecting the investigation based on the initial results and

for correcting deficiencies identified in the review. The comments and recommendations of the Independent Review Committee were incorporated into the report and it was issued as an addenda to the Technical Reference Document on August 15, 1980.

After August 15, the Review Team continued its investigations, but on a reduced scale, working toward completing the work previously started. After reviewing the Interim Report, the last task of the Independent Review Committee was to attend the public meeting held by the NRC on August 19, 1980 in Bay City. With the consent of all parties, the Independent Review Committee was dissolved in the later part of August.

This is a report of the entire welding Task Force investigation from May 1980 through April 1981. It supersedes the Interim Report. With its issuance, all Review Team investigations are brought to a close. Those items identified in this report as requiring corrective action or further investigation are the responsibility of Brown and Root, and Houston Lighting and Power.

The charter of the welding Task Force was to evaluate the state of safety-related welding at STP. This was accomplished by repeating the nondestructive examinations required by the construction codes, and by reviewing NDE records, construction and NDE procedures, personnel qualifications and documentation for compliance with the governing codes. The basic assumption

was that the welds were suitable for service if they met the code requirements. The two major fabrication codes were the ASME Boiler and Pressure Vessel Code, Section III, for piping and AWS D1.1 "Structural Welding Code" for safety-related structural steel. All examinations were evaluated in strict compliance with the acceptance criteria of the governing ASME or AWS Code.

The Review Team did not address the question of whether the welds might be suitable for service even though they did not comply with all of the acceptance criteria. Therefore, it is possible that some noncompliances are acceptable without repair, but this determination can only be made by the designer after appropriate analysis.

In the Interim Report the Review Team recommended that Brown & Root correct the noncompliances identified to date and reexamine nearly all other safety-related welds in order to identify all other noncompliances. Based on these recommendations, Brown and Root instituted a comprehensive Reexamination and Repair Program in October, 1980 to identify and repair all noncompliances. In this program Brown & Root committed to:

1) Visually examine the accessible safety-related structural welds and repair the noncompliances. Analyze the inaccessible structural welds to determine whether they are adequate for the intended service.

2) Reexamine by visual, liquid penetrant and radiographic methods all girth welds made by Brown and Root in the Essential Cooling Water system except those from welds buried in or beneath concrete, and repair all the noncompliances.

3) Reexamine by visual and liquid penetrant methods the accessible welds in all other ASME Section III piping systems and repair the noncompliances.

4) Repair all welds identified by the Review Team as containing radiographic discrepancies.

5) Visually reexamine the accessible ASME pipe support welds and repair the noncompliances.

Although this program was based on the Task Force recommendations, it is being conducted by site Quality Assurance and Construction personnel and is not part of the Task Force activities.

2.0 REVIEW OF ASME SECTION III PIPE WELDING

2.1 REEVALUATION OF RADIOGRAPHS OF COMPLETED ASME SECTION III PIPE WELDS

2.1.1 Scope

The scope of this task was to reevaluate the radiographs for all completed ASME Section III pipe welds. The reevaluation was performed in accordance with the acceptance criteria established in ASME Section III, 1974 Edition with Addenda through Winter 1975, and the STP NDE procedure, ST-NDEP-2.1, "Radiographic Examination". Included in this task was an investigation to determine that the original radiographs were unique for each weld.

2.1.2 Method

All of the radiographs for completed ASME Section III Class 1, 2 and 3 piping welds were evaluated by the Review Team for compliance with the radiographic technique and acceptance criteria required by ASME Section III and project procedures. Excluded from the review were the radiographs for welds still "in-process" and those taken for "information only". Radiographs were considered complete when accepted by Brown and Root Quality Assurance.

The reevaluation was conducted by members of the Review Team qualified as NDE Level III examiners in radiography in accordance with the ASME Code.

Each radiograph was examined for two categories of discrepancies. The first category, more significant to the integrity of the welds, was the proper identification and interpretation of defects. This means that all the images of weld defects were located and properly interpreted. The second category was discrepancies in specific film characteristic required by ASME Section III and project radiographic procedure. These characteristics include:

Identification. The radiographs are required to be identified by a permanent mark traceable to a particular weld. In addition, the manufacturer's name and the date of the radiograph are required to be permanently marked on the radiograph.

Use and Documentation of the Penetrameter. The radiograph is required to show the image of the penetrameter, its essential hole and the identifying numbers and letters of the penetrameter. In addition, the Code provides specific rules on penetrameter placement.

Sensitivity. The Code requires that the image of the specified essential hole of the penetrameter be visible on the radiograph in order to demonstrate the ability to detect small defects. In addition, this category includes the assurance against back-scattered radiation which is manifested by the appearance of the letter "B" on the processed film.

Processing. The film processing and handling must render the film free of blemishes to the extent that they cannot mask or be confused with the image of any discontinuity in the area of interest. Typical blemishes include fogging, streaks, water marks, and scratches.

Density. The Code requires that film density (film darkness) be controlled within specified limits. The density is normally measured by a calibrated densitometer.

Coverage. The Code requires that the image of the location markers placed on the part appear on the film in order to locate the area of interest and to provide evidence of complete coverage.

The initial results of the reevaluation were reported in the Interim Report. Subsequent to that report, all the radiographs determined in the initial review to contain discrepancies were evaluated again by the Brown & Root NDE Level III with the

concurrence of the Review Team Level III. This joint review was conducted so that Brown & Root Quality Assurance could endorse the final list of discrepant radiographs.

The Review Team verified the authenticity of ten original radiographs. Six original radiographs which exhibited readily identifiable surface indications were compared with the actual surfaces of the welds. New radiographs were taken of the remaining four welds and compared to the original radiographs. No discrepancies were found between the original and new radiographs or between the original radiographs and the weld surfaces.

2.1.3 Results

The list of all 545 welds for which the radiographs were reevaluated by the Review Team is given in Appendix A1. Of this total, the radiographs for 143 welds were determined in the final joint review by Brown & Root and the Review Team to contain discrepancies which require either weld repair, reradiography, or visual examination of the weld surface. The results of the reradiography or visual examination will clarify whether that the weld is acceptable or requires repair. Appendix A2 lists these welds, the location and type of indication and the required corrective action. A summary of the number of welds with each type of discrepancy is provided in Table 2.1-1. In this table the results for the Essential Cooling Water System (ECW) are reported

instances, only spot radiography was performed for the purpose of monitoring welder performance. There was no ASME Code requirement for the radiography for this Class 3 system. The radiography performed on all other ASME systems was required by the Code except for a few Class 3 welds which were radiographed in order to comply with NRC regulations for limited accessibility welds.

Of the 143 welds with radiographic discrepancies, 82 welds contain one or more indications of weld defects which require repair. An additional 23 require visual examination of the weld surface or reradiography to determine whether the radiographic indication is relevant and requires repair. The radiographs of 36 welds did not meet the minimum Code sensitivity requirements, 6 did not meet the density requirements, 24 were not processed properly, and one weld was not radiographed in its entirety. The number of welds with discrepant radiographs in Table 2.1-1 is less than the sum of number of welds in the "type of discrepancy" column because one weld may have more than one radiographic discrepancy.

2.1.4 Discussion

Brown and Root discovered problems with the interpretation of the radiographs and had initiated an internal reevaluation of completed radiographs in November, 1979. By June, 1980, when the

Review Team began its reevaluation, the Brown and Root effort was substantially complete. The Brown & Root reevaluation also found that a significant number of radiographs which had been originally accepted contained discrepancies ranging from film artifacts to weld defect indications.

A comparison of the final results reported here with those reported in the Interim Report shows a number of changes. The number of occurrences for each type of discrepancy reported here is generally less than reported in the Interim Report, while the total number of welds reviewed and the total number of welds with discrepancies increased. The changes occurred for three reasons.

First, a number of radiographs initially considered discrepant by the Review Team were accepted in the final joint review by Brown and Root and the Review Team. The changes in status were made with the full concurrence of the Review Team for one or more of the following reasons:

1. A change was made in the <u>interpretation</u> of the type of defect.

2. Unsatisfactory <u>identification</u> was corrected by annotation on the reader sheet or film by the Brown and Root Level III.

3. Processing was determined to be acceptable in the area of interest on at least one of the two films. Annotation was made to the reader sheet by the Brown and Root Level III.

4. Sensitivity was determined to be acceptable on at least one of the two films. Annotation was made to the reader sheet by the Brown and Root Level III.

5. Unsatisfactory documentation of the penetrameter was corrected by annotation to the reader sheet by the Brown and Root Level III.

6. Density was determined to be acceptable on at least one of the two films. Annotation was made to the reader sheet by the Brown and Root Level III.

The second reason for the change in results was due to the evaluation of 30 additional radiographs. The third reason was because there were approximately 20 welds which were acceptable to the Review Team in the first reevaluation but unacceptable to Brown & Root based on their internal reevaluation. These radiographs were never evaluated jointly, but it was agreed to classify them as unacceptable.

The question of the number of radiographic discrepancies which should be expected in a detailed reevaluation was not specifically addressed by the Review Team. Judging from discussion on the subject, there does not appear to be universal agreement on the question. However, a recent study of the detectability of flaws in heavy section welds by one of the Review Team Level III radiographic interpreters from Southwest Research Institute[1] concluded that the agreement among six teams of experienced radiographers approached 90% for three dimensional flaws (slag, lack of fusion) but was significantly lower for planar indications such as cracks. This means that among the six teams in the study some team failed to detect approximately 10% of the flaws detected by other teams. Although the situation in the study is not precisely the same as at the South Texas Project, the study points out that there can be considerable disagreement in radiographic interpretation even among experienced competent radiographers.

2.1.5 Conclusions

The reevaluation of radiographs for all completed welds disclosed a number of noncompliances with the Code and project requirements. The radiographs of approximately 25% of the 545 completed

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(1) Ruescher, E. H., Graber, H. C., "Analysis of the Radiographic Evaluation of PVRC Weld Specimens 155, 202, 203, and 251J", Welding Research Council Bulletin No. 259, June 1980.

welds were found to contain discrepancies either with technique, film quality or interpretation of indications.

Fifteen percent of all the completed welds were found to contain relevant defect indications which will require repair. The number of minor noncompliances corrected during the joint review by Brown and Root and the Review Team, and the number of significant noncompliances reported here indicates that inadequate attention was given to the radiograhic program at South Texas Project to ensure compliance with the Code and project requirements.

2.1.6 Recommendations

All of the radiographic discrepancies indentified in this investigation should be corrected in order to comply with ASME Code and project requirements. The specific discrepancies and the corrective action required are listed in Appendix A2.

Brown & Root should identify the causes of their problems with radiography and take positive action to prevent recurrence. Among the possible corrective actions are improved training and supervision of the Level II examiners and increased surveillance of the radiographic interpretations by Level III examiners.

Table 2.1-1

SUMMARY OF THE RESULTS OF THE REVALUATION OF RADIOGRAPHS

TYPE OF DISCREPANCY	NUMBER OF WELDS WITH DISCREPANCIES		
	ALL SYSTEMS	ECW SYSTEMS (2)	NON-ECW SYSTEMS
Improper Identification of Radiograph	0	0	0
Improper Use or Documentation of Penetrameter	0	0	0
Improper Sensitivity	36	34	2
Improper Film Processing	24	21	3
Improper Density	6	3	3
Improper Coverage	1	0	1
Relevant Weld Defects	82(1)	61	21

	ALL SYSTEMS	ECW SYSTEM	NON-ECW SYSTEMS
Number of Welds Reevaluated	545	427	118
Number of Welds with Radiographic Discrepancies	143	113	30

(1) Twenty-three additional welds require visual examination or radiography to clarify whether radiographic indication is relevant and requires repair.

(2) Spot radiography

2.2 EVALUATION OF WELD SURFACE EXAMINATIONS

2.2.1 Scope

The scope of this task was to verify that the original liquid penetrant and visual examinations for final acceptance of ASME Section III pipe welds were performed and evaluated in accordance with the Code and other project requirements defined in A040KPMECP-4, "Field Fabrication and Welding of Piping Systems and Component Supports for Nuclear Systems".

2.2.2 Method

Verification of the original surface nondestructive examinations (NDE) was accomplished by reexamining randomly selected completed welds which had been accepted by Brown and Root Quality Control. The reexamination methods were the same as those used in the original examination, namely, liquid penetrant (PT) and visual (VT).

To facilitate random selection the ASME welds were divided into two populations. The first population was the 26 welds in the Essential Cooling Water system (ECW) which were still accessible. The remainder of the ECW system welds were either buried under earth or coated with epoxy. The second population was all the remaining ASME pipe welds. Random samples were drawn

from these two populations in accordance with MIL-STD-105D, dated March 29, 1963 with change 2 dated March 20, 1964, "Sampling Procedures and Tables for Inspection by Attributes". The general inspection level was Level III, utilizing sampling by replacement. In the ECW system, 12 of the 26 welds were selected for reexamination. In the other ASME systems, 80 welds out of a population of approximately 400 were originally selected. These 80 welds consisted of 43 socket welds and 37 groove welds. Later the sample size was increased by 13 groove welds in order to increase the level of confidence in the results for groove welds.

Reexaminations were performed by South Texas Project QC personnel qualified to Level II in the applicable visual and penetrant method. Each reexamination was witnessed by a member of the Review Team certified to Level III in accordance with the ASME Code in the penetrant and visual examination methods. Technique or procedural errors noted during the reexamination were corrected immediately by the witnessing Level III. The procedures for liquid penetrant examination, ST-NDEP 4.1, Rev. 7 dated 1/14/80, and visual examination, ST-NDEP 3.1, dated 8/12/79, were utilized. The standard report forms specified in the referenced PT and VT procedures were used.

2.2.3 Results

2.2.3.1 Essential Cooling Water System

The results of the penetrant and visual reexaminations of the ECW system are presented in Table 2.2-1. The liquid penetrant reexamination results indicate four discrepancies, two for weld spatter and two for other nonrelevant indications. The nonrelevant indication discovered in line number EW 2205, FW 0024 resulted from an abrupt contour change at the toe of the weld. The remaining welds contained other nonrelevant indications and weld spatter. All of the discrepancies were due to improper or incomplete surface preparation.

During the visual reexamination of the outside surfaces, arc strikes were noted near two welds and spatter was noted near another weld. The visual reexamination of the inside surfaces of the welds revealed arc strikes near two welds.

2.2.3.2 Other ASME Systems

A summary of the results of the liquid penetrant and visual re-examinations is given in Table 2.2-2. Of the fifty groove welds reexamined, the only PT indication was a 1/8 in. long linear indication in the base metal adjacent to the weld in line CC 1120, FW0003. There were also two visual discrepancies, one in

line CC 1413, FW0001 and the other in line CC 1414, FW0004. Both were for inadequate weld reinforcement, that is, the weld face was 1/64 in. to 1/32 in. below the base metal surface in some locations around the circumference.

Of the 43 socket welds reexamined, all had been fabricated in the shop at the construction site. Thirteen had PT indications, and one of these welds had both a PT indication and an unsatisfactory visual indication. Eight of the PT indications occurred in the base metal, either in the pipe or the fitting. It is believed that PT indications which occurred at the weld toe and similar locations are probably nonrelevant indications which could be remedied by blend grinding and reexamination. The indications in the weld metal (excluding those judged to be nonrelevant indications) were 3/32 in. or less in length. The indications in the fittings were 3/8 in. or less in length.

2.2.4 Discussion

2.2.4.1 ECW System

The conditions noted by liquid penetrant and visual reexamination, that is arc strikes, weld spatter and other nonrelevant indications are surface indications that should have been corrected by appropriate surface preparation. The ASME Code and the PT examination procedure require that an indication believed

to be nonrelevant be regarded as a defect and be reexamined to verify whether or not an actual defect exists. Nonrelevant indications and broad areas of pigmentation which could mask defect indications are not permitted. Although the Review Team Level III examiners did not believe that the nonrelevant indications were actually weld defects, it was their opinion that these nonrelevant indications should have been removed by carefully grinding the surface prior to acceptance of the original PT examination in order to verify that no relevant indications had been masked.

The discrepencies noted by visual reexamination, i.e., weld spatter and arc strikes are violations of self-imposed workmanship standards.

Due to the small sample size and the nonrandom sample distribution, the results obtained in the reexamination are not statistically sufficient to assess the acceptability of the visual and liquid penetrant examinations performed originally on the inaccessible portions of the ECW system.

2.2.4.2 Other ASME Systems

The initial sample size for all other ASME systems except the ECW system was 80 welds, 37 groove welds and 43 socket welds. In the Interim Report it was recommended that an additional 13 groove

welds be reexamined to increase the sample size to 50 in order to meet the requirements for a Level III random sample size per MIL-STD-105D. The intent was to separate the population of groove welds from the socket welds since it was apparent from the initial reexamination that there were a significant number of discrepancies (13) in the socket welds and only one discrepancy in the groove welds. However, since two additional descrepancies were found during visual examination of the 13 additional groove welds, the Review Team concluded (without rigorous statistical analysis) that an acceptable level of quality had not been attained for groove welds either.

2.2.5 Conclusions

2.2.5.1 Essential Cooling Water System

The ECW system reexamination was inconclusive because of the small size and nonrandom distribution of the sample available for reexamination. Of the welds inspected, no relevant weld defects were found. The indications caused by weld spatter and the abrupt edge of the weld reinforcement can be corrected by blend grinding and subsequent reexamination. The fact that the nonrelevant indications had not been removed at the time of the original examination indicates a deficiency in implementation of the surface examination program.

2.2.5.2 Other ASME Systems

The high discrepancy rate in the liquid penetrant examination of socket welds indicates that the original NDE was not effective in detecting and correctly interpreting relevant indications. These relevant indications should have been repaired at the time of the original examination. Although the nonrelevant indications are not evidence of actual defects, they should also have been removed at the time of the original examination.

The three discrepant conditions noted in the reexamined groove welds, one base metal PT indication and two welds exhibiting inadequate reinforcement, indicate a deficiency in the implementation of the NDE program, but not to the extent exhibited in the socket welds.

2.2.6 Recommendations

It is recommended that all the discrepancies found by the Review Team in all ASME systems should be repaired. All of the accessible ASME Class 1, 2, and 3 socket and groove welds, except those in the ECW system, should be reexamined by the visual and liquid penetrant methods by Brown and Root, and all discrepancies should be repaired.

The data available to the Review Team on the ECW welds was insufficient to allow conclusions for the entire system to be drawn. Therefore, it is recommended that Brown and Root gather sufficient data to allow conclusions to be drawn on the adequacy of the surface examination for the remainder of the system. One method of accomplishing this is by reexamining by visual and liquid penetrant methods those welds which must already be unearthed for repair of radiographic discrepancies. These surface examinations should be done after the epoxy coating has been carefully removed, but before any repairs are made.

Brown and Root should determine the reason why the PT and VT discrepancies were not detected and corrected in the original examination and take positive steps to preclude their recurrence. Possible corrective action includes additional inspector training, increased supervision, and surveillance by the Level III Examiner.

An engineering evaluation should be made of the welds not accessible for penetrant and visual reexamination. The types and extent of the defects in the inaccessible welds should be infered from the data taken in the reexamination of the accessible ASME welds.

Table 2.2-1

SUMMARY OF PENETRANT AND VISUAL EXAMINATIONS

ESSENTIAL COOLING WATER SYSTEM

WELD IDENTIFICATION	PT OF OUTSIDE SURFACE	VT OF OUTSIDE SURFACE	VT OF INSIDE SURFACE
EW1105, FW0025	Accept	Accept	Accept
EW1205, FW0026	Weld Spatter	Arc Strike	Accept
EW1305, FW0024	Accept	Arc Strike	Arc Strike
EW1305, FW0026	Accept	Accept	Accept
EW2102, FW0004	Nonrelevant Indications	Accept	Accept
EW2105, FW0022	Accept	Accept	Accept
EW2105, FW0023	Accept	Accept	Arc Strike
EW2105, FW0024	Accept	Accept	Accept
EW2105, FW0025	Accept	Accept	Accept
EW2205, FW0024	Nonrelevant Indications	Accept	Accept
EW2205, FW0025	Accept	Accept	Accept
EW2302, FW0003	Weld Spatter	Weld Spatter	Accept

(1) Weld spatter is considered a nonrelevant indication in penetrant examination

Table 2.2-2

SUMMARY OF PENETRANT AND VISUAL REEXAMINATIONS

OF ASME PIPE WELDS IN SYSTEMS OTHER THAN ECW

SYSTEM	NUMBER OF WELDS EXAMINED	NUMBER OF UNSATIS-FACTORY WELDS	JOINT TYPE	LOCATION OF FABRICATION
BR	5	0	Groove Weld(1)	MEAB-1 Field
CC	7	3(2)	Groove Weld(1)	MEAB-1 Field
CH	[illegible]	0	Groove Weld(1)	MEAB-1 Field
CV	16	0	Groove Weld(1)	MEAB-1 Field
RC	2	0	Groove Weld(1)	RCB-1 Field
CS	13	3(3)	Socket Weld	Fab Shop
SI	30	10(3)	Socket Weld	Fab Shop
CRDM (FSP-0241)	17	0	Groove Weld(1)	CRDM Controlled Area
TOTALS	93	16		

(1) Consumable insert, full penetration
(2) One weld with a PT indication and 2 welds with underfill.
(3) Eight of the thirteen socket weld indications were in base metal.

3.0 REVIEW OF SAFETY-RELATED STRUCTURAL STEEL WELDING

3.1 EVALUATION OF VISUAL EXAMINATIONS

3.1.1 Scope

The scope of this task was to evaluate the adequacy of the visual examinations that had previously been performed on safety-related structural welds.

3.1.2 Method

It was accomplished by reexamining a sample of the welds in accordance with the requirements of AWS D1.1, "Structural Welding Code", 1975 Edition, and the project requirements stated in MECP-2, "Field Fabrication and Erection of Structural Steel to the Requirements of AWS D1.1".

A random sample was taken from the safety-related structural welds identified in the documentation review task (see Section 3.3). The original sample size was 200 welds. Random sampling was done in accordance with MIL-STD-105D, dated April 20, 1963 with change 2, dated March 20, 1964, "Sampling Procedures and Tables for Inspection by Attributes". The general inspection level was Level III, utilizing sampling by replacement. Based on

the large number of discrepancies found in the initial 50 welds examined, the reexamination was terminated. Twenty-nine welds which had previously been examined were added to the sample, bringing the total number of welds examined to 79. Welds were distributed as follows:

Reactor Containment, Unit 1	39 welds
Reactor Containment, Unit 2	2 welds
Fuel Handling, Unit 1	13 welds
Fuel Handling, Unit 2	8 welds
Mechanical Electrical Auxiliary Unit 1	15 welds
Mechanical Electrical Auxiliary Unit 2	2 welds

All 79 welds were examined by Brown & Root Level II inspectors and witnessed by a member of the Review Team certified in accordance with SNT-TC-1A as Level III in VT and certified by the American Welding Society as a Certified Welding Inspector. The examiners performed the examinations in accordance with construction procedure A040KPMECP-2, Revision 7, dated March 5,

1980, visual examination procedure ST-NDEP 3.1, Revision 8, dated December 14, 1979, and in accordance with the requirements of AWS D1.1.

The majority of the welds to be examined had to be cleaned to remove paint, rust, dirt, oil or other material which might have interfered with visual examination. Cases where accessibility precluded total cleaning were noted. The examiners performed the visual examinations using standard tools and gauges such as flashlights, fillet weld gauges, rulers, magnifiers and inspection mirrors.

The examination addressed the following items as required by the Code and the construction procedure. A brief explanation of each item is provided in Appendix E2.

1. Weld Size: Compliance with the drawing requirements and AWS D1.1, paragraph 8.15.1.6.

2. Weld Contour: Compliance with AWS D1.1, Section 3 (Workmanship), including Figure 3.6.

3. Overlap: Compliance with AWS D1.1, paragraph 3.6.6.

4. Undercut: Compliance with AWS D1.1, paragraph 3.6.4

5. Toe Contour: Compliance with MECP-2, paragraph 3.4.5(a).

6. Cracks: Compliance with AWS D1.1, paragraph 8.15.1.1.

7. Porosity: Compliance with MECP-2, paragraph 3.19.3(b), and AWS D1.1, paragraph 8.15.1.5.

8. Crater Fill: Compliance with AWS D1.1, paragraph 8.15.1.3.

9. Arc Strikes: Compliance with AWS D1.1, paragraph 8.15.1.3.

10. Spatter/Slag: Compliance with AWS D1.1, paragraph 3.10.1 and MECP-2, paragraph 3.10.5.

11. Fit-up: Compliance with AWS D1.1, paragraph 3.3.1, and MECP-2, paragraph 3.4.3.

12. Tack Welds: Compliance with MECP-2, paragraph 3.9.5.

13. Temporary Attachments: Compliance with MECP-2, paragraph 3.16.3.

14. Edge Melting: Compliance with AWS D1.1, paragraph 2.7.1.2, and MECP-2, illustration 5.

3.1.3 Results

Appendix E1 contains a summary of the examination results describing the weld identification, Code compliance status and the unsatisfactory conditions found. Of the 79 welds examined, 18 were in compliance with all requirements and 61 welds displayed one or more noncomplying conditions. The frequency of noncompliance with each criteria is as follows:

Criteria	Number of Occurrences
Edge Melting	35
Arc Strikes	26
Undersize Weld	25
Porosity MECP-2 criteria	25
D1.1 criteria	5
Weld Contour	24
Overlap	20
Spatter/Slag	9
Toe Contour (base metal thinning)	5
Undercut (greater than 1/32 in.)	4
Underfilled Crater	3
Cracks	0

Fit-up	0
Tack Welds (not removed)	0
Temporary Attachments (not removed)	0

3.1.4 Discussion

When a noncomplying condition was found in a weld, only the condition was noted, not the extent. For example, a one inch length of undercut in a 25 inch long weld was recorded the same as if the undercut had been 25 inches long. This tends to make the noncompliances appear more extensive than they were.

It is clear from the number of noncompliances that the welding and NDE program for structural welds did not meet the Code and project requirements. However, it should not be concluded that these welds are unfit for the intended service because many of the noncompliances are with acceptance criteria which are workmanship standards rather than criteria which affect weld integrity. To determine suitability for service, it would be necessary to analyze the effect of each noncompliance on the load carrying capacity of the welds.

3.1.5 Conclusion

A significant percentage of the welds reexamined were found to be not in compliance with all of the acceptance criteria of the

governing code, AWS D1.1, "Structural Welding Code", or the site construction procedure MECP-2. The most serious noncompliance was that 32% of the welds were found to be, at least in part, smaller than the minimum specified size.

It can be concluded that the original weld inspections were not performed in strict compliance with the Code and construction procedure requirements, and as such, represents a failure to meet a project commitment. Additional analysis by the designer would be required to determine the suitability for service of the noncomplying welds.

3.1.6 Recommendations

The recommendations are basically the same as those made in the Interim Report. They address action to be taken to prevent recurrence, and action to be taken to correct the existing noncompliances. The following recommendations are made:

1. Train all structural weld inspectors in the detailed requirements of the Code and construction procedure MECP-2. Such training must result in complete familiarity with the duties and responsibilities of the inspector, the accepted techniques of examination, use of measuring tools, extent of required examinations, and the applicable acceptance criteria.

2. Instruct the welders, fitters and grinders in the welding requirements of the Code. Such personnel must be familiar with Code acceptance criteria.

3. Reexamine all accessible safety-related structural welds in accordance with the requirements of the Code and repair all welds which are not in compliance. The reexamination and repair should be done by inspectors and welders retrained as described above.

4. Recommendation No. 4 is provided as an alternate to No. 3. As allowed by AWS D1.1, a modified set of acceptance criteria may be established by the designer which consider only those items which affect the capability of the weld to support the design loads. The existing welds should be reexamined for compliance with the new acceptance criteria, and repaired when not in compliance.

5. Perform an engineering evaluation of the adequacy of the inaccessible welds based on the type of defects found in the reexamination of the accessible welds.

3.2 REVIEW OF SHOP WELDING DOCUMENTATION

3.2.1 Scope

The scope of this task was to evaluate the documentation for safety-related structural welding performed by Brown and Root in the site fabrication shop.

3.2.2 Method

A random sample of all Shop Work Requests for structural fabrication was selected in accordance with MIL-STD-105D, dated April 29, 1963, with Change 2, dated March 20, 1964, "Sampling Procedures and Tables for Inspection by Attributes". The general inspection level was Level III utilizing sampling by replacement. A sample of 315 Shop Work Requests were selected and their associated documentation packages were reviewed. The packages included Shop Fabrication Data Cards, Record of Welding Qualification for Stud Welding and Quality Control Examination Checks (EC).

3.2.3 Results

Welding and inspection documentation was generally found to be adequate to meet Code and project documentation requirements, although a number of minor deficiencies were noted. The records

identified base material heat codes and documentation of final visual inspections for each shop work request, along with surveillances of welder qualification, fit-up, and cleanliness. Welding procedure specifications were usually noted on the Work Request.

Typical deficiencies noted during the review were: (1) illegible signatures of the QC Inspectors on sign-offs, (2) insufficient or incorrect documentation of heat codes or heat numbers of various components on the Data Cards, (3) omission of dates of QC acceptance sign-off for production testing of stud welds, and (4) omission of the required record of stud welder qualification.

Since it was not a Code or project requirement that the welders be identified for each weld, this information was not consistently recorded. It was therefore not possible for the Review Team to verify the qualifications of the welders from the documentation. However, a system for ensuring that only qualified welders were allowed to weld was in use and surveillance of the welder qualification was documented by Q. C. on the Examination Checks.

3.2.4 Discussion

Documentation for the welds made in the site fabrication shop was generally better than that for erection welding because it was

easier to identify the inspection and surveillance reports which applied to a particular weld. The number of ECs varied by Work Request, depending on the number of applicable construction procedures, but all ECs referenced the Work Request number, so it was possible to determine the group of welds to which the reports applied.

3.2.5 Conclusions

The documentation of field shop welding was adequate to meet the requirements of AWS D1.1 although some deficiencies in recording the data were noted in some of the data packages. The documentation did not require that the identity of the welder be recorded, so it was not possible to subsequently verify the welder qualifications from the documentation.

3.2.5 Recommendations

It is recommended that the documentation system be modified to identify the welder and the welding procedure specification to allow subsequent verification that only qualified welders were used. Positive steps should be taken to assure that all required data is accurately recorded an each data package. This could be accomplished by additional inspector training and a review of the completed data packages before they are finally accepted.

3.3 REVIEW OF ERECTION WELDING DOCUMENTATION

3.3.1 Scope

The scope of this task was to evaluate the documentation for welds made during the erection of safety-related structural steel.

3.3.2 Method

3.3.2.1 Documentation System Description

The documentation system for Category I structural steel erection welds requires explanation. The QC inspectors maintain a set of erection drawings on which they indicate the joints for which they have witnessed the fitup, and the joints for which they have performed the final visual inspection. Accompanying the fitup and final visual inspection marks are the inspector's initials and the date of inspection. Two forms called Examination Checks (EC), one documenting the inspection requirements of MECP-2, "Fabrication and Erection of Structural Steel to the Requirements of AWS D1.1", and the other documenting the inspection requirement of CCP-17, "Erection of Category I Structural and Miscellaneous Steel" are then completed, signed, and dated. The inspection items listed on the ECs are noted to be either satisfactory, unsatisfactory, or NA. NA indicates that the item

does not apply or had not been checked. The ECs are filed in the records vault after all welds on the drawing have been completed or when the drawing is superseded.

3.3.2.2 Review Method

The starting point in the review was to identify all the welds which had been welded and inspected. This was done by reviewing the current and previous revisions of the QC inspection drawing in the records vault. Since each weld had not been given a unique designation on the drawings, each weld was assigned an identification number by the Review Team. The ECs corresponding to each weld were identified as accurately as possible and reviewed.

3.3.3 Results

A total of 572 drawings, including sheet revisions, were identified as containing safety-related structural welding. Of these drawings, 152 sheet revisions contained QC weld inspection marks, 151 sheet revisions did not contain inspection marks, and 269 sheet revisions were not found in the records vault and, therefore, were not reviewed. It is not known whether these missing drawings contained QC inspection marks. If they did, the primary documentation for the Code-required visual examination is missing.

The marked-up erection drawings generally provided adequate documentation that the fitup and final visual inspections had been performed. However, on drawings of complex structures where each weld was not shown, or not shown clearly, as in the Ring Duct in the Reactor Containment Building, it was difficult to determine for which welds the inspection marks applied.

The Examination Checks were used in conjunction with the marked-up drawings and provided documentation of Q. C. surveillances such as welder qualifications. Final visual examinations were also documented on the ECs.

It was found that one EC often referred to more than one weld on a drawing, and sometimes to several welds on more than one drawing. The method used to identify the weld for which the EC applies was to record on the EC the drawing number and the inspection date. All welds on a referenced drawing which had the same inspection date were covered by one EC. Although difficult to review, this method was satisfactory except in cases where the dates did not correspond exactly to the dates on the marked-up drawing. When this occurred, it was not possible to determine with certainty which EC applied to a particular weld.

Since it was not a Code or project requirement that the welder be identified for each weld, this information was not recorded. It

was therefore not possible for the Review Team to verify the qualifications of the welder from the documentation. However, a system for ensuring that only qualified welders were allowed to weld was in use and surveillance of welder qualifications was documented by the Q.C. inspector on the EC.

3.3.4 Discussion

The review of the documentation revealed that there were 269 sheet revisions which could not be found. CCP-17 requires that QC inspection drawings with welding or erection inspection mark-ups be delivered to the records vault upon completion of work in that area or when the drawing is superseded. The fact that the drawings were not in the vault could indicate that, for various reasons, no welding or erection was done while that revision was current, or it could mean that the marked-up drawings are missing. Without the marked-up drawings, it is not possible to demonstrate that the weld had been inspected.

The only tie between an EC and a particular weld or welds on the drawings is the date of inspection on the drawing and the date of the EC. Some ECs were written several days after inspections were performed. When this occurred, it generally was not possible to determine if this EC covered all the welds inspected by that inspector since the last EC was written, or if the intervening ECs are missing. By referencing only a date, and no

other identification such as a beam number, the ECs are of no value if the drawing is lost, destroyed, or rendered illegible.

Other problems were noted in the review of the documentation system. MECP-2, "Field Fabrication and Welding of Structural Steel to the Requirements of AWS D1.1" Revisions 2 through 5 required that all of the items listed on the EC be inspected, checked, or surveyed at least twice each week. This included performing final visual inspections. It was not until Revision 6 that visual inspections were required to be performed daily. The Code requires that the inspector visually examine all welds.

3.3.4 Conclusions

The documentation system for erection welding was adequate to meet the documentation requirement of AWS D1.1, but the inconsistencies in the implementation of the system appear to have resulted in loss of traceability of some inspectors to the welds they inspected. The documentation system did not require that the welder or the welding procedure be identified so that subsequent verification that only qualified welders were used was not possible. The frequency of inspection as specified in MECP-2 raises questions as to whether all the inspection and surveillance requirements of AWS D1.1 had been met, and available documentation was not adequate to establish that these requirements had been met.

3.3.5 Recommendations

The questions regarding the integrity of the structural welding raised by the documentation problems can be resolved by a reinspection of all accessible safety-related structural welds. Therefore, the recommendations made in Section 3.1.6 to reexamine all accessible safety-related structural welds should be adopted.

The documentation system should be modified to ensure compliance with AWS D1.1 and to provide additional information such as welder, and weld procedure specification so that verification of compliance to AWS D1.1 can be demonstrated.

3.4 REVIEW OF STRUCTURAL STEEL CONSTRUCTION PROCEDURES

3.4.1 Scope

The scope of this task was to review the structural steel construction procedures related to welding for compliance with the AWS D1.1 "Structural Welding Code", 1975 Edition.

3.4.2 Method

The following construction procedures have been reviewed:

PROCEDURE	CODE OF RECORD
A040KPCCP-15, Fabrication of Miscellaneous and Structural Steel	AWS D1.1(1975)
A040KPMECP-2, Fabrication and Erection of Structural Steel to the Requirements of AWS D1.1	AWS D1.1(1975)
A040KSWES-1, Stud Welding	AWS D1.1(1975)

The original intent of the review was only to identify inconsistencies between the procedures and the applicable Code. As the review continued, it was decided to include comments which, when

incorporated into the procedures, would make the procedure more complete or more clear. Therefore, not all of the comments included here represent inconsistencies with the Code. In addition, some of the Code comments are more significant than others. Comments which were judged by the Review Team to represent inconsistencies with the Code if implemented as-written are those identified by an asterisk. These comments are addressed further in the discussion.

3.4.3 Results

Appendix F contains the detailed comments on the three construction procedures. Of the comments made, two were considered significant. In three of the earlier revisions to MECP-2, the frequency of visual examinations is specified to be at least twice per week. AWS D1.1 requires visual examination of every weld. WES-1, the stud welding procedure, did not adequately identify all the stud welds which must be bend tested.

3.4.4 Discussion

The comments made in Appendix F which are identified with an asterisk represent inconsistencies with AWS D1.1 (1975). All of the Code inconsistencies did not, in the judgment of the Review Team, permit violations to the Code which would jeopardize the integrity of the welds made in accordance with the procedure.

There were, however, two inconsistencies which were judged to be significant. These are discussed below.

A040KPMECP-2, Comment 3. In three of the earlier revisions to this procedure, the frequency of final visual inspections was specified as at least twice per week. This statement is clearly not in accordance with the Code, which requires that all of the welds be examined visually. This inconsistency may have, in part, contributed to the poor quality of visual examination reported in Section 3.1.

A040KSWES-1, Comments 5, 7, 9, 11, 14. All of these comments are concerned with the proper identification of welds which must receive additional bend testing to insure they meet the soundness criteria. In the judgment of the Review Team, failure to address some of the Code inspection requirements for stud welding could have resulted in some substandard welds being accepted.

3.4.5 Conclusion

The review of the procedures has disclosed that in two instances the procedures allowed violations to AWS D1.1 which were judged significant enough to warrant an investigation into the suitability for service of those welds made in accordance with the procedures. Both violations pertained to the frequency or extent of weld inspections. Neither violation would have caused

substandard welds to be made, but may have allowed substandard welds to have been accepted.

3.4.6 Recommendations

The three construction procedures should be revised to incorporate the Review Team comments. Future revisions to the procedure should be carefully reviewed by Brown and Root to ensure Code compliance.

It should be verified by Brown and Root that the welds made in accordance with the two noncomplying procedures received adequate visual examinations. The recommendations to reexamine all accessible welds and to analyze the inaccessible welds made in Section 3.1.6, if adopted, would provide such verification.

3.5 REVIEW OF AWS WELDING PROCEDURE SPECIFICATIONS

3.5.1 Scope

The scope of this task was to review all current and past revisions to the AWS D1.1 welding procedure specifications for compliance with the Code.

3.5.2 Method

The AWS D1.1 welding procedure specifications were reviewed for compliance with the requirements of AWS D1.1 "Structural Welding Code", 1975 Edition.

3.5.3 Results

Forty-two AWS welding procedure specifications were reviewed. These included procedures which the Code considered prequalified, that is, not requiring qualification testing, and those for which qualification testing was required. Discrepancies with one or more of the Code details were found in many of the WPSs. Most of the discrepancies were judged not to have any significant effect on the integrity of the welds, but they are an indication that adequate attention to the Code details was not given, particularly in the early revisions of the procedures. In later revisions, the quality of the procedures improved.

There were two discrepancies which were judged potentially more significant than the rest because they related to the method of controlling the weld heat affected zone cooling rate. These plus other more frequently occurring discrepancies are listed below.

1. In several welding procedure specifications the requirement for 150°F preheat for thicknesses greater than 1-1/2 inches was not clearly stated. These preheat requirements were clearly stated in MECP 2, the general procedure for structural steel welding which must be used in conjunction with all the WPSs.

2. Several WPSs allowed smaller fillet welds than the minimum allowed by the Code. The Code specifies minimum weld sizes, not for strength, but to control the heat affected zone cooling rate which influences heat affected zone mechanical properties.

3. In several procedures, the configuration of the test specimen for procedure qualification did not fully comply with the configuration specified in the Code.

4. In several procedures, the amperage and voltage ranges were not shown for all electrode sizes.

5. In several prequalified procedures, the Code conditions for prequalification were not entirely met.

3.5.4 Discussion

In writing a prequalified WPS or in writing and qualifying a WPS, a large amount of information is required to be specified and compliance with a number of detailed rules is required. Most of the WPSs reviewed did not fully comply with all the Code requirements. This indicates a lack of attention to detail or a lack of understanding of the Code requirements. It does not necessarily mean that the welds made according to the procedures were deficient.

Two discrepancies (numbers 1 and 2, above) were identified which had the potential to increase the chance of cracking in the base metal. Both of these requirements, preheat and weld size, were properly addressed in MECP-2, the construction procedure for structural steel which is required to be used in conjunction with the WPSs.

3.5.5 Conclusion

The review of welding procedure specifications disclosed a number of discrepancies with the details of the Code requirements. This is an indication of a lack of attention to detail or a lack of understanding of the Code requirements. Two omissions in the Code requirements were considered significant enough to have potentially adverse effects on the welds. It is unlikely that any adverse effects did occur because the omitted information was included in the construction procedure, MECP-2, which must be used in conjunction with the WPSs.

3.5.6 Recommendations

The WPSs to be used for future structural welding should be revised to incorporate the Review Team comments. More attention should be given to identifying and complying with all of the details of the Code requirements.

3.6 REVIEW OF SAFETY-RELATED STRUCTURAL MATERIAL CERTIFICATIONS

3.6.1 Scope

The scope of this task was to determine if the materials used by the field shop for safety-related structural fabrication could be traced back to the applicable purchase order and Certified Material Test Report (CMTR), and to determine if the materials met the requirements of the latest edition of the applicable ASTM Specification as required by AWS D1.1 (1975), "Structural Welding Code".

3.6.2 Method

A list was prepared of all heat codes and heat numbers for materials (i.e., plates, angles, channels, studs) identified in the field shop weld documentation review. The review was conducted on a random sample of 200 documentation packages. The heat numbers of materials identified by heat codes were obtained from a heat code/heat number log generated by the site Receiving and Inspection Group. A list of corresponding purchase orders was prepared from the fabrication shop's Material Inventory Log. Copies of the purchase orders and the corresponding CMTRs were obtained from the records vault. The vendors referenced on

the purchase orders were reviewed against the list of vendors approved by Quality Assurance.

3.6.3 Results

All the suppliers referenced on the purchase orders and CMTRs were found to be on the approved vendors list. The CMTRs were reviewed for material type, description, heat number, and size and compared with the material descriptions on the work request package. The review indicated no discrepancies.

The CMTRs were then reviewed for compliance with the applicable ASTM specifications. This review included mechanical properties and chemical composition. No discrepancies were noted.

3.6.4 Conclusions

The review of the shop fabrication records completed to date indicated that there are records tracing the material from the purchase orders to the CMTRs to the shop fabrication data cards. The review of the CMTRs against the applicable ASTM and purchase specifications has indicated no discrepancies.

4.0 REVIEW OF NDE SOFTWARE

4.1 REVIEW NONDESTRUCTIVE EXAMINATION PROCEDURES

4.1.1 Scope

The scope of this task was to verify compliance of current and past revisions of nondestructive examination (NDE) procedures with the applicable Code and project requirements for radiography (RT), magnetic particle (MT), liquid penetrant (PT), and visual (VT) examination methods.

4.1.2 Method

The NDE procedures were reviewed for compliance with Code and project requirements by Review Team members certified to NDE level III, in accordance with ASME Code Section III, in the applicable NDE method. Checklists were used to insure a uniform and complete review. The evaluation was performed by comparing the procedure to the applicable primary documents, the ASME Code Section III, 1974 Edition thru Winter 1975 Addenda, and AWS D1.1 "Structural Welding Code", 1975 Edition. The review comments are limited to code compliance deficiencies and procedural deficiencies.

4.1.3 Results

The specific comments on the nondestructive examination procedures are presented in Appendix G.

4.1.4 Discussion and Conclusions

4.1.4.1 Radiographic Examination Procedure

Since the radiographic film itself contains the essential information to evaluate the adequacy of each radiograph to detect rejectable indications, the comments applicable to the radiographic examination procedure do not affect the validity of any past or present radiographic examinations. The comments apply to improved control and documentation of radiography for future work.

4.1.4.2 Visual Examination Procedure

ASME Section III requires visual examination as a nondestructive examination method only for welds governed by Subsection NF. Therefore, the discrepancies with Section V affect the validity of the visual examination only for Subsection NF welds.

4.1.4.3 Penetrant Examination Procedure

The comments applicable to the penetrant examination procedure do not directly influence the sensitivity of this examination technique. The procedure as noted in comments 2 and 3 does not specifically exclude the use of penetrant materials and cleaning agents that are not certified for trace element chemistries, nor does it exclude, as noted in comment 4, the use of the procedure at temperatures below 60°F and above 125°F. Comment 4 can be resolved by requalifying the procedure within the temperatures range likely to be encountered during the examination. Comment number 6 did not affect the validity of the examination because this method for drying excess penetrant has been accepted in later editions of the ASME Code.

4.1.4.4 Magnetic Particle Examination Procedure

The current revision of the procedure has resolved the two items of noncompliance with Code requirements. The Review Team has determined that no ASME Code magnetic particle examinations have been performed to date.

4.1.5 Recommendations

Comments pertaining to the nondestructive examination procedures should be reviewed by B&R Level III for incorporation into the procedures.

4.2 REVIEW OF INSPECTOR QUALIFICATIONS

4.2.1 Scope

The scope of this task was to determine if all personnel who examined ASME Section III piping and safety-related structural welds were properly qualified and certified in accordance with the applicable code and project requirements. The applicable Edition of ASME Section III was 1974 with Addenda through Winter 1975. AWS D1.1, 1975 Edition applies to safety-related structural welds.

4.2.2 Method

A list of all QC inspectors who documented inspection reports for ASME piping welds, safety-related structural welds, and welder performance qualification test welds was obtained by reviewing the Weld Data Cards for inspector's initials and date of inspection. The structural weld inspectors were identified from initials and dates of inspection found on the marked-up QC erection drawing and Examination Checks (EC). Inspectors for welder performance qualification tests were obtained from test records. Qualification and certification records of NDE operators were reviewed and compared to the guidelines of SNT-TC-1A, "Recommended Practice for Personnel Certification", 1975 Edition. Particular attention was given to required training,

education, and experience and the contents of the NDE certification examinations.

Additionally, a similar review of inspectors performing AWS visual examination was conducted. Level III certification records were reviewed with emphasis on previous experience. The personnel qualification and certification documents include the "Quality Assurance Personnel Training Manual", "QA Department Personnel Development, Instruction DQI 500", "Training Instruction, DQI 501", and "Examination and Certification Procedure, DQI 502". Effective dates of these documents were:

QA Personnel Training Manual	3-15-75 to 10-17-79
DQI 500, DQI 501, DQI 502	10-17-79 to 3-31-80

After March 31, 1980, the QA Procedures Manual ST-QAP, Section 2.1 and 2.3, became the PQ&C program control document.

Additional personnel qualification and certification documents reviewed are as follows:

A. Training Courses

Magnetic Particle

Liquid Penetrant

Radiography

B. Radiographic Examination

RT-I-G-01 RT-II-S-05

RT-I-G-02 Y-II-RT-S-06

RT-I-G-03 RT-II-F-01

RT-I-S-01 RT-II-F-02

RT-I-S-02 RT-II-F-03

RT-I/II-P-03 RT-II-F-04

RT-II-G-03 RT-II-F-03

RT-II-S-04 IIIG-ALL-01

RT-II-S-03 IIISP-ALL-01

RT-II-S-04

C. Ultrasonic Examination

UT(L)-II-G-01 CP-UT-II-S-02

UT-III-G-01 UT-II-P-01

UT(L/THKNS)-II-G-01 UT-(L)-II-P-01

THKNS-II-S-01

UT(L)-II-S-01

UT(L/THKS)-II-S-01

D. Magnetic Particle Examination

MT-I-G-01	MT-II-S-01
MT-I-G-02	MT-II-S-02
MT-I-S-01	MT-II-S-03
MT-I-S-02	MT Y-II-MT-S-04
MT-I-P-01	MT-II-P-01
MT-II-G-01	MT-II-P-02
MT-II-G-02	IIG-ALL-01
MT-II-G-03	IIISP-ALL-01
MT-II-G-04	
MT-II-G-05	

E. Liquid Penetrant Examination

PT-I-G-01	PT-II-S-02	IIIG-ALL-01
PT-I-S-01	PT-II-S-05	IIISP-ALL-01
PT-I-P-02	PT-II-S-06	
PT-II-G-03	PT-II-01	
PT-II-G-04	PT-II-P-02	
PT-II-G-05	PT-II-P-03	
PT-II-G-06	PT-II-P-04	

F. Visual Examination

IIIG-ALL-01

IIISP-ALL-01

4.2.3 Results

Approximately 145 certifications for 70 inspectors were checked. Primarily, only certifications in those methods in which NDE examinations were performed were reviewed; however, a few additional certifications were checked for information. Notable discrepancies found in the records of 21 inspectors have been tabulated below:

DISCREPANCY	NUMBER OF INSPECTORS
Questionable training and experience	2
Questionable training	2
Questionable experience	5
Not certified while performing examinations	7
Not recertified after rehire	3
Signed as higher level*	5
No eye exam while performing NDE examinations	1
Eye exam lapsed (1 month)	1

A list of inspectors and the certifications reviewed is shown in Appendices H1 and H2, including a list of inspectors and the associated discrepancies found during the review. A comparison of QA Procedures Manual ST-QAP-2.3, Revision 1, August 31, 1979,

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*In three cases, trainee or Level I signed as Level II. In two cases, trainee or Level I signed with Level II operators without designating level for each operator.

with SNT-TC-1A (1974) was conducted. This procedure appears to provide sufficient control on the personnel qualification and certification system. Conformance to the guidelines of SNT-TC-1A were good with the exception of experience requirements in the liquid penetrant (PT) and magnetic particle methods where the SNT-TC-1A guidelines have been significantly reduced. A comparison of the experience requirements of ST-QAP-2.3, Revision 1 and SNT-TC-1A (1975) for Level II in PT, RT, UT, and MT is provided.

METHOD	SNT-TC-1A(1975)	ST-QAP-2.3, Rev. 1
PT	3 Months	4 weeks
MT	4 months	6 weeks
RT	12 months	12 months
UT	12 months	12 months

Other requirements for certification under ST-QAP-2.3 include a visual acuity test, method examination, verified education, training and experience records, and form PD-1402 "QC Inspector Performance Evaluation and Certification Recommendations", signed by the Corporate Discipline Level III or the QC Superintendent.

The PQ&C program control documents in effect prior to April 1, 1980, were generally in accordance with the guidelines of SNT-TC-1A. The training, education, and experience requirements were as

recommended, with the following minor exceptions in Training Instruction, DQI 501 and Examination and Certification Procedure, DQI 502.

In DQI 501, the training course length for Weld Inspectors is not given. The 10-hour duration for the Liquid Penetrant (PT) training course is less than the 12 hours (accumulated) as recommended in SNT-TC-1A for Level II Certification. Course outlines in the control document are scant but the course material reviewed is well planned and satisfactory. In DQI 502, training and experience for grammar school graduates and for candidates with 2 years technical college completion are not specified. Certification categories "RTS" and RTI" are not identified although qualification requirements are given. Examinations reviewed were judged appropriate to the designated levels. Many "General Examination" questions were selected from the ASNT published lists. "Specific" and "practical" questions were primarily Brown & Root products.

Level III examinations in the "general" category contained 40 Level II method questions except Visual (VT), which contained 30. SNT-TC-1A suggests that, as a minimum, there should be 30 questions on the method and 30 on other NDE methods if certification is for one method. Both Level III individual certifications reviewed were in accordance with the personnel qualification and certification control document in effect at the

time of certification. Both individuals had justifiable experience and both passed the Level II examinations in at least 5 methods, thus demonstrating their broad knowledge of the NDE technology. Verification of education, training, and experience prior to Brown & Root (B&R) employment is performed, to the degree practical, by the B&R Personnel Department through direct contact with schools and previous employers.

The Review Team made an attempt to review B&R qualifying work-time experience records. No records prior to April 1, 1980 were found. Since that date, the NDE (RT) Superintendent has maintained a record of days in which the candidate has worked in the method. This list did not contain the time the employee worked in the method nor an account of the activities during the remainder of the day. Some personnel qualification files contained a memo attesting to qualifying work-time experience stating the fact that "this candidate for certification spent at least 25% of actual work-time during this period in this NDE method and that performance was satisfactory". The new work-time experience accounting method will provide adequate documentation if continued. Work activities are categorized into several functions such as "surface examinations" or "radiographic interpretation", each of which is assigned a code number on the employee's timesheet. Daily work activities are recorded on an hourly basis on the timesheet by the supervisor under each job code. Periodically, these work hours are entered on a form which

accumulates the experience record. These records are usually limited to candidates for additional certification.

4.2.4 Discussion

The findings indicate that inspector qualifications is a potential problem area. The number (21) of discrepancies of inspection personnel records is an indication of problems in administrative control of inspector qualification documentation. The review has identified that the documentation of nine inspectors contains significant errors. These errors may have resulted in personnel with insuffucient training and experience performing examinations which may have an impact on the quality of the examinations.

Prior to April 1, 1980, two different personnel qualification and certification program control systems were in effect. The first, governed by the QA Personnel Training Manual, was superseded by DQI 500, DQI 501, and DQI 502. The latter were superseded on April 1, 1980, by ST-QPA-2.1 and 2.3. All three documents provided a foundation on which to build a personnel qualification and certification program. Minor differences from the guidelines of SNT-TC-1A are not considered significant. Personnel qualification and certification program improvements since April 1, 1980, should reduce the previously disclosed irregularities reported in the Interim Report.

4.2.5 Conclusions

A number of significant unresolved irregularities were noted that could have impacted the quality of examinations.

NDE qualification examinations and training courses are appropriate to the certification level.

The new PQ&C program procedures should ensure that personnel are qualified before certification.

4.2.6 Recommendations

The Brown & Root South Texas Project NDE Level III examiner should review all inspector qualifications for final acceptability and resolution. Any inspection completed by an unqualified inspector should be reexamined.

The NDE qualification examinations should be updated by replacing old ASNT Level II questions in the Level II and III examinations with new Level II and III questions as appropriate.

An additional review step in the certification procedure should be provided to ensure that all in-house claimed experience is in NDE.

5.0 SUPPLEMENTARY REVIEWS

5.1 REVIEW OF CODE AND REGULATORY COMMITMENTS

5.1.1 Scope

The scope of this task was to establish for safety-related piping and structural steel, the applicable Edition and Addenda of all codes and standards specified in PSAR/FSAR and verify compliance of current and past revisions of Engineering Specifications and Construction/Quality Control Procedures.

5.1.2 Method

The review was conducted by comparing the commitments found in the PSAR/FSAR, Engineering Specifications and Technical Reference Documents with the implementing Construction/Quality Control Procedures. Engineering Construction and Quality Control documents (Appendix J1) were reviewed, and the code and standard commitments were identified. When codes and standards or the applicable edition and addenda were not identified, referenced documents were reviewed to determine if adequate identification of commitments had been made. Furthermore, upper tier documents, i.e., Engineering Specifications, were compared to applicable lower tier documents, i.e., construction and quality control procedures, to verify that the same commitments had been made.

5.1.3 Results

Appendix J2 identifies PSAR/FSAR code and standard commitments. Appendix J3 identifies the codes and standards referenced in engineering documents and construction/quality control procedures. A comparison of Appendices J2 and J3 identifies the following inconsistencies:

1. The AWS D1.1, 1975 Edition is generally referenced throughout the construction procedures. The one exception is 3A010SS030, which references the 1974 Edition. The FSAR also commits to the 1974 Edition for welds inside Containment. Outside Containment, the 1972 Edition was committed in the FSAR. A Change Notice has been issued to the FSAR to address a consistent commitment to the 1975 Edition. The review was based on the 1975 Edition since this was the prevalent edition referenced.

2. The AISC Code of Standard Practice for Steel Buildings and Bridges, Seventh Edition, is referenced in A040KPMECP-2; the 1970 Supplement is referenced in 3A010SS026; the 1972 Supplement is referenced in 3A010SS012 and 3A010SS030; and the "latest edition" is referenced in A040KPCCP-17. The PSAR commitment

was to the Seventh Edition and the FSAR commitment upgraded to the 1971 Supplement for structural steel inside the Containment (structural steel outside the Containment remained to the Seventh Edition).

3. The AISC Specification for the Design, Fabrication and Erection of Structural Steel for Buildings, 1970 or Seventh Edition, including all Supplements, is referenced in A040KPMECP-2; the Seventh Edition excluding Supplements is referenced in 3A010SS026. 3A010SS012 and 3A010SS012 reference the 1971 Supplement. The PSAR commitment is to the Seventh Edition. The FSAR is inconsistent in identifying commitments for structural steel inside Containment. The Seventh Edition of the AISC Specification with Supplements 1, 2 and 3 (1970, 1971 and 1972 Supplements) is referenced in FSAR section 3.8.3.2.1, the 1971 Supplement in FSAR sections 3.8.3.4.5, 3.8.3.6.4 and 3.8.3.6.4.3, and the Seventh Edition in FSAR section 3.8.3.6.4.3 for examination and testing of material. Outside Containment, the FSAR in section 3.8.4 commits to the Seventh Edition. The discrepancies discussed in 2 and 3 above have no effect on the welding because both documents refer to AWS D1.1 for welding requirements.

4. The ASME Section IX, 1974 edition through Winter of 1975 addenda is referenced in 1L020PS100, whereas in A040KPMECP-4, the "latest edition" is referenced. The applicable code edition and addenda committed for welding and NDE in ASME Section III was the 1974 Edition through the Winter 1975 Addenda (which was based on the first piping material purchase order commitment).

5. For Containment internal steel structures under section 3.8.3.2.2 of the FSAR, commitment is made to Regulatory Guide 1.94, "Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel during the Construction Phase of Nuclear Power Plants". However, under section 3.12 of the FSAR, partial exception is taken to this Regulatory Guide in Table 3.12-1 and 3.8.4.2.3 regarding sampling of concrete.

6. The ANSI N45.2 Standard is generally referenced to the 1971 Edition, which is consistent with PSAR/FSAR commitment. However, 3A010SS030 references the 1972 Edition.

A comparison of upper tier documents to the implementing lower tier procedures resulted in identification of the following observations:

1. Ferritic steel components which will be field welded to an austenitic stainless steel component are required by A010PQ002 in section 3.2.2, for all revisions, to have the weld end buttered with an Inconel filler metal when PWHT is required. A040KPMECP-4 does not address this requirement or reference A010PQ002 in any revision issued.

2. Requirements for welding austenitic stainless steel in addition to ASME III requirements are identified in A010PQ002. A040KPMECP-4 does not address these requirements.

3. Limited accessibility is also addressed in A010P002. It requires that Safety Class 1 and 2 welds made in limited access condition shall be volumetrically inspected by radiography and accepted to the requirements of ASME Section III, Subsection NB, irrespective of the safety class of the weld. A040KPMECP-4 does not address this requirement.

A frequent problem observed in construction procedures was the lack of identification of the applicable Edition and Addenda to the code or standard. Examples where this problem occurs are A040KPMECP-1, A040KPMECP-4, A040KPCCP-15, A040KPCCP-17, A040KPWCP-2, A040KPWCP-3, A040KPWCP-5, A040KPMCP-2, and A040KPMCP-7. However, procedures A040KPCCP-15, A040KPCCP-17, A040KPMCP-2 and A040KPMCP-7 do reference Engineering documents that provide this missing information. This problem was not as prevalent in Engineering documents, but it did occur in 1L019PD002 (inactive), 1A890WQ002, A040KSWES-1 and A040KSWES-4.

In some cases, code commitments were identified through reference documents only. Examples of this occurrence are A040KPMECP-8, A040KSWES-11, A040KSWES-12 and A040KSWCP-1. Although A040KSWES-11 and A040KSWES-12 are acceptable in identifying code commitments through reference since these procedures are addressed as supplemental requirements to specific references, code commitments should be identified in A040KPMECP-8 (which replaced A040KPWCP-1) since it is a primary procedural document.

Another problem identified through this review is the lack of identification of reference revision status. Construction procedures generally reference engineering documents and other construction procedures, but do not identify the revision number. Engineering documents generally do not reference construction procedures. Therefore, changes could be made to

either a Construction procedure or Engineering document and that change would not be communicated on a controlled basis to the affected documents. Examples where this lack of control is present in current revisions are A040KPMECP-8, which references an inactive Engineering document, 1L019PD002, and A040KPCCP-17 which also references an inactive document, A040KPWCP-5. Either the revision numbers should be identified or a controlled matrix of all welding and NDE project documents should be constructed to ensure that all documents are addressed when changes are considered.

5.1.4 Discussion

A number of inconsistencies in the applicable editions of several codes were discovered, mainly with regard to AWS D1.1 and the AISC Codes and Specifications. There were no discrepancies in the edition for the ASME Code other than the fact that the edition and addenda were not always specified in the implementing procedures, although the edition and addenda were properly identified on the upper-tier documents. The seventh edition of the AISC Code and Specification was consistently specified, but the reference to the applicable supplement was not always consistent. This had no effect on the welding requirements because AISC refers to AWS D1.1 for welding requirements. Review of the applicable construction procedures for structural steel did not disclose any discrepancies which were believed to be

caused by confusion about the applicable code edition of AWS D1.1.

Other discrepancies between the TRD, A010PQ002 and the construction procedure A040KPMECP-4 regarding buttering of ferritic material for dissimilar metal welds, requirements for stainless steel welding, and volumetric inspection of limited access welds were not specifically investigated. In the process of reviewing the ASME piping documentation, it was verified that volumetric inspection was being performed on limited access welds, although no attempt was made to identify all limited access welds and verify that the volumetric inspection had been performed.

5.1.5 Conclusions

This review has identified that inconsistencies exist between the PSAR and FSAR which are reflected in Engineering Specifications and Technical Reference Documents, and in some cases in the construction procedures. Although an exhaustive investigation of the effect of these inconsistencies was not performed, no cases were identified where uncertainty in the applicable code edition caused any welding to be improperly performed.

Three project requirements specified in TRD A010PQ002 were not included in the implementing procedure A040KPMECP-4. The effect of these ommissions, if any, was not investigated.

5.1.6 Recommendation

PSAR/FSAR commitments should be reconciled to remove inconsistent identification of codes, standards or regulations. Engineering Specifications, Technical Reference Documents and construction procedures should be reviewed and revised to reflect the reconciled commitments identified for the project.

Inconsistencies in the requirements specified in the TRD A010P002 and construction procedure A040KPMECP-4 should be reconciled. The effect of these inconsistencies, if any, should be investigated by Brown and Root.

5.2 REVIEW OF PAST AUDIT REPORTS

5.2.1 Scope

The scope of this task was to review all past audit reports concerning safety-related welding and nondestructive examination to determine if they had been properly initiated and closed out.

5.2.2 Method

Each audit report was reviewed to determine if an audit plan with checklists had been written, if the deficiencies had been identified, if the responses to the deficiencies were satisfactory to the auditor, and if the report had been closed out.

5.2.3 Results

Ten audits of the safety-related welding and nondestructive examination at STP were reviewed. Four were performed by Brown and Root, and six by Houston Lighting and Power Company. Four additional audits by Brown & Root of the Brown and Root Materials Engineering Laboratory were reviewed. The laboratory qualifies welding procedure specifications for STP.

None of the fourteen audit files had written audit plans as required by ANSI N45.2.12 "Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants", but all audit files contained the required checklists for the elements to be audited. In a number of cases all of the elements of the checklist were not addressed. All of the deficiencies and concerns identified in the audit reports had auditee responses that were accepted by the auditor, and all of the audit reports had been closed out.

5.2.4 Discussion

ANSI-N45.2.12 requires that a written audit plan be prepared before the start of the audit. The plan should identify the audit scope, the requirements, the activities to be audited, organizations to be notified, the applicable documents, the schedule and a written checklist. The only element of the plan found in the audit files during the review was the audit checklists.

The review addressed only the items identified under Section 5.2.2. Not addressed were other important items such as auditor qualifications, the adequacy of the responses to audit deficiencies or the effectiveness of the corrective action.

5.2.5 Conclusion

The only deficiency identified during the limited review of the past audits was that none of the audit files contained written audit plans as required by ANSI N45.2.12.

5.2.6 Recommendations

The requirements of ANSI N45.2.12 should be reviewed by the auditing organizations and action should be taken to assure compliance of future audits.

5.3 REVIEW OF FIELD-GENERATED DOCUMENTS

5.3.1 Scope

The scope was to review Nonconformance Reports (NCR), Corrective Action Reports (CAR), and Field Requests for Engineering Action (FREA) to determine that they had been properly initiated, dispositioned, and closed-out.

5.3.2 Method

Two criteria were used in this limited review of field-generated documents. First, were the documents properly initiated, dispositioned, and closed-out; second was the approved disposition adequate to correct the deficiency.

The first criterion was evaluated simply by verifying that a signature was in place in each of the required spaces. Not verified was whether the signature was authorized or whether the procedures in the STP Quality Assurance Manual had been followed for initiating, dispositioning, and closing-out the documents.

The second criterion was evaluated on the basis of only the information presented on the document. A judgment was then made whether the corrective action was adequate. Additional

investigations such as review of specifications, procedures, drawings or calculations were not conducted.

5.3.3 Results

The limited review of Nonconformance Reports (NCR), Corrective Action Reports (CAR), and Field Requests for Engineering Action (FREA) was conducted and reported in the Interim Report. The results were reviewed after the report was issued and it was concluded that the review was not conducted in sufficient depth to determine if the project procedures had been followed or that the corrective actions were adequate.

Three NCR's were identified as being potentially deficient and should be further evaluated. NCR S-M1407 identified rejectable weld indications yet was approved to "use as-is". NCR S-M1522 did not properly identify the NDE method used to examine the weld. NCR S-M3289 did not have the required signatures.

It was also noted that the last 38 NCR's listed in the Interim Report did not pertain to safety-related welding or nondestructive examination and should be deleted from further investigation.

5.3.4 Discussion

The Review Team concluded that their review was not conducted in sufficient depth to identify either noncompliances with the procedure for processing the documents required in the Quality Assurance Manual or to determine if the disposition or corrective action was adequate.

To conduct the review properly, it would be necessary for the reviewers to be more familiar with the procedures for processing the documents, to verify that the approved signatures belonged to personnel of the appropriate engineering or quality assurance organization, and to do the research necessary to determine that the corrective action was adequate.

The three NCR's were identified because they appear to represent code or project noncompliances. A more thorough investigation is required to determine if this is the case or if, for instance, the disposition was correct but the NCR was poorly written.

5.3.5 Conclusion

The review of the CR, CAR's and FREA's was not performed in sufficient depth to determine if the correct procedures for processing the documents had been used, or that the corrective

action was adequate. With the limited review that was conducted, three NCR's were identified as potentially deficient.

5.3.6 Recommendations

Brown and Root should conduct a review of the NCR's, CAR's and FREA's in sufficient depth to determine that they had been processed according to the procedure specified in the Quality Assurance Manual and that the action taken to resolve the problem was in compliance with the codes and was adequate to ensure the integrity of the weld.

5.4 REVIEW OF UNRESOLVED ITEMS IN NRC INVESTIGATION REPORT

5.4.1 Scope

The scope of this task was to investigate the unresolved items concerning safety-related welding identified in the NRC Investigation Report. The complete list of unresolved items is on pages 110 through 112 of the NRC Report.

5.4.2 Method

The investigation was conducted by reviewing the applicable documents and interviewing personnel familiar with the items.

5.4.3 Results

The four unresolved items pertaining to safety-related welding are listed below:

NRC Tracking No.	Description
79-19-31	Questionable Practices During Welder Qualifications
79-19-35	Declassification of the Lower Steam Generator Support Columns and Steam Generator Alignment Procedure

79-19-36	Declassification of Fuel Transfer Tube
79-19-37	Control of Attachment Welds to Heat Treated Equipment Supports

Seven separate concerns were identified in the four unresolved items. These concerns are identified and discussed in detail in Appendix K. Two of the concerns, the alignment procedure for the steam generators and the attachment welding to the equipment supports were not investigated by the Review Team.

Of the five concerns investigated, only one represented a noncompliance with the ASME Code. In unresolved Item 79-19-31, the root spacing during welder qualification was increased beyond that allowed by the welding procedure specification. This represents a noncompliance with a nonessential variable in the weld procedure specification, but it should not invalidate the welder qualification test.

5.4.4 Discussion

The unresolved items appeared to be items that had not yet been fully investigated by the NRC inspectors, but seemed to warrant further review. Upon investigation, the Review Team considered only one concern to be an ASME Code noncompliance. This concern required a minor revision to the appropriate WPS.

Other noncompliances or questionable practices may be identified upon investigation by Brown and Root of the other two unresolved items.

5.4.5 Conclusions

One minor code noncompliance in the qualification of welders was identified in the investigation of the unresolved items concerning safety-related welding indentified in the NRC Investigation Report. Two of the unresolved items were not investigated by the Review Team.

5.4.6 Recommendations

The weld procedure specification used for welder qualification cited in 79-19-31 should be revised to reflect the actual root spacing used during qualification testing.

The two unresolved items identified by the NRC but not investigated by the Review Team should be investigated by Brown & Root.

APPENDICES

APPENDIX A1

LIST OF ALL RADIOGRAPHS REEVALUATED

	SYSTEM	LINE NO./WELD NO.		SYSTEM	LINE NO./WELD NO.		SYSTEM	LINE NO./WELD NO.
1	AF	1001/0005	32.	CS	1004/0013	63.	CV	1088/0001
2.	AF	1002/0005	33.	CS	1004/0014	64.	CV	1088/0008
3.	AF	1003/0005	34.	CS	1007/0001	65.	CV	1088/0009
4.	AF	1004/0005	35.	CS	1007/0002	66.	CV	1088/0010
5.	AF	1004/0006	36.	CS	1007/0003	67.	CV	1088/0011
6.	AF	2002/0005	37.	CS	1007/0004	68.	CV	1088/0012
7.	AF	2004/0005	38.	CS	1007/0006	69.	CV	1088/0013
8.	AF	2004/0006	39.	CS	1007/0007	70.	CV	1088/0018
9.	BR	1022/0011	40.	CS	1007/0008	71.	CV	1088/0013
10.	BR	1022/0014	41.	CS	1007/0009	72.	CV	1092/0006
11.	BR	1022/0023	42.	CS	1010/0001	73.	CV	1092/0017
12.	CC	1111/0001	43.	CS	1010/0004	74.	CV	1092/0019
13.	CC	1120/0003	44.	CS	1010/0006	75.	CV	1098/0006
14.	CC	1309/0007	45.	CS	1012/0002	76.	CV	1170/0001
15.	CC	1412/0004	46.	CS	1012/0004	77.	CV	1173/0001
16.	CC	1430/0003	47.	CS	1012/0005	78.	CV	1180/0001
17.	CC	1430/0004	48.	CS	1102/0001	79.	CV	1180/0015
18.	CC	1432/0010	49.	CS	1102/0002	80.	CV	1189/0002
19.	CC	1433/0006	50.	CS	1202/0002	81.	CV	1204/0004
20.	CH	1001/0002	51.	CS	1203/0002	82.	CV	1215/0003
21.	CH	1002/0005	52.	CS	1302/0002	83.	CV	1215/0007
22.	CH	1016/0009	53.	CS	1303/0001	84.	FC	1101/0002
23.	CS	1004/0002	54.	CV	1006/0013	85.	FC	1101/0003
24.	CS	1004/0003	55.	CV	1006/0015	86.	FC	1201/0002
25.	CS	1004/0004	56.	CV	1006/0018	87.	FC	1201/0003
26.	CS	1004/0006	57.	CV	1019/0005	88.	FC	1213/0002
27.	CS	1004/0007	58.	CV	1019/0006	89.	FC	1213/0003
28.	CS	1004/0008	59.	CV	1019/0008	90.	FC	1213/0004
29.	CS	1004/0009	60.	CV	1086/0002	91.	FC	1213/0006
30.	CS	1004/0011	61.	CV	1086/0011	92.	FC	2101/0003
31.	CS	1004/0012	62.	CV	1086/0020	93.	FC	2201/0003

APPENDIX A1 (Continued)

LIST OF ALL RADIOGRAPHS REEVALUATED

	SYSTEM	LINE NO./WELD NO.
94.	FC	2213/0002
95.	FC	2213/0003
96.	FC	2213/0004
97.	RH	1304/0002
98	RH	1304/0003
99.	RM	1015/0009
100.	RM	1015/0017
101.	SI	1101/0002
102.	SI	1101/0003
103.	SI	1101/0004
104.	SI	1101/0005
105.	SI	1101/0006
106.	SI	1101/0007
107.	SI	1102/0004
108.	SI	1105/0017
109.	SI	1106/0048
110.	SI	1106/0049
111.	SI	1118/0003
112.	SI	1118/0005
113.	SI	1118/0006
114.	SI	1118/0010
115.	SI	1205/0017
116.	SI	1205/0019
117.	SI	1205/0021
118.	SI	1206/0042
119.	EW	1102/0001
120.	EW	1102/0002
121.	EW	1102/0005
122.	EW	1102/0006
123.	EW	1102/0007
124.	EW	1102/00009
125.	EW	1102/0010
126.	EW	1102/0011
127.	EW	1102/0012
128.	EW	1102/0013
129.	EW	1102/0014
130.	EW	1102/0015
131.	EW	1102/0016
132.	EW	1102/0017
133.	EW	1102/0018
134.	EW	1102/0019
135.	EW	1102/0022
136.	EW	1102/0023
137.	EW	1102/0024
138.	EW	1102/0025
139.	EW	1102/0026
140.	EW	1102/0027
141.	EW	1102/0028
142.	EW	1102/0029
143.	EW	1105/0002
144.	EW	1105/0003
145.	EW	1105/0004
146.	EW	1105/0005
147.	EW	1105/0006
148.	EW	1105/0007
149.	EW	1105/0008
150.	EW	1105/0011
151.	EW	1105/0012
152.	EW	1105/0013
153.	EW	1105/0014
154.	EW	1105/0015
155.	EW	1105/0016
156.	EW	1105/0017
157.	EW	1105/0018
158.	EW	1105/0019
159.	EW	1105/0020
160.	EW	1105/0021
161.	EW	1105/0022
162.	EW	1105/0023
163.	EW	1105/0024
164.	EW	1105/0025
165.	EW	1105/0028
166.	EW	1105/0030
167.	EW	1105/0032
168.	EW	1105/0036
169.	EW	1105/0039
170.	EW	1105/0040
171.	EW	1105/0041
172.	EW	1105/0042
173.	EW	1106/0001
174.	EW	1106/0002
175.	EW	1106/0003
176.	EW	1106/0004
177.	EW	1106/0005
178.	EW	1106/0006
179.	EW	1106/0007
180.	EW	1107/0001
181.	EW	1107/0002
182.	EW	1107/0003
183.	EW	1107/0004
184.	EW	1107/0005
185.	EW	1107/0006
186.	EW	1107/0007

APPENDIX A1 (Continued)

LIST OF ALL RADIOGRAPHS REEVALUATED

	SYSTEM	LINE NO./WELD NO.
187.	EW	1202/0001
188.	EW	1202/0002
189.	EW	1202/0003
190.	EW	1202/0004
191.	EW	1202/0005
192.	EW	1202/0006
193.	EW	1202/0007
194.	EW	1202/0008
195.	EW	1202/0009
196.	EW	1202/0010
197.	EW	1202/0011
198.	EW	1202/0012
199.	EW	1202/0013
200.	EW	1202/0014
201.	EW	1202/0015
202	EW	1202/0016
203.	EW	1202/0017
204.	EW	1202/0018
205.	EW	1202/0021
206.	EW	1202/0022
207.	EW	1202/0023
208.	EW	1202/0024
209.	EW	1202/0025
210.	EW	1202/0026
211.	EW	1202/0027
212.	EW	1202/0028
213.	EW	1202/0029
214.	EW	1202/0032
215.	EW	1202/0033
216.	EW	1205/0002
217.	EW	1205/0003
218.	EW	1205/0004
219.	EW	1205/0005
220.	EW	1205/0006
221.	EW	1205/0007
222.	EW	1205/0008
223.	EW	1205/0009
224.	EW	1205/0012
225.	EW	1205/0013
226.	EW	1205/0014
227.	EW	1205/0015
228.	EW	1205/0016
229.	EW	1205/0017
230.	EW	1205/0018
231.	EW	1205/0019
232.	EW	1205/0020
233.	EW	1205/0021
234.	EW	1205/0022
235.	EW	1205/0023
236.	EW	1205/0024
237.	EW	1205/0025
238.	EW	1205/0026
239.	EW	1205/0028
240.	EW	1205/0030
241.	EW	1205/0032
242.	EW	1205/0036
243.	EW	1205/0039
244.	EW	1205/0040
245.	EW	1205/0041
246.	EW	1205/0042
247.	EW	1206/0001
248.	EW	1206/0002
249.	EW	1206/0003
250.	EW	1206/0004
251.	EW	1206/0005
252.	EW	1206/0006
253.	EW	1206/0007
254.	EW	1206/0008
255.	EW	1207/0001
256.	EW	1207/0002
257.	EW	1207/0003
258.	EW	1207/0004
259.	EW	1207/0005
260.	EW	1207/0006
261.	EW	1207/0007
262.	EW	1207/0008
263.	EW	1302/0001
264.	EW	1302/0002
265.	EW	1302/0005
266.	EW	1302/0006
267.	EW	1302/0007
268.	EW	1302/0008
269.	EW	1302/0009
270.	EW	1302/0010
271.	EW	1302/0011
272.	EW	1302/0012
273.	EW	1302/0013
274.	EW	1302/0014
275.	EW	1302/0015
276.	EW	1302/0016
277.	EW	1302/0017
278.	EW	1302/0018
279.	EW	1302/0021

APPENDIX A1 (Continued)

LIST OF ALL RADIOGRAPHS REEVALUATED

	SYSTEM	LINE NO./WELD NO.
280.	EW	1302/0022
281.	EW	1302/0023
282.	EW	1302/0024
283.	EW	1302/0025
284.	EW	1302/0026
285.	EW	1302/0027
286.	EW	1302/0028
287.	EW	1302/0029
288.	EW	1302/0030
289.	EW	1302/0033
290.	EW	1302/0034
291.	EW	1305/0002
292.	EW	1305/0003
293.	EW	1305/0005
294.	EW	1305/0006
295.	EW	1305/0007
296.	EW	1305/0008
297.	EW	1305/0009
298.	EW	1305/0010
299.	EW	1305/0013
300.	EW	1305/0014
301.	EW	1305/0015
302.	EW	1305/0016
303.	EW	1305/0017
304.	EW	1305/0018
305.	EW	1305/0019
306.	EW	1305/0020
307.	EW	1305/0021
308.	EW	1305/0022
309.	EW	1305/0023
310.	EW	1305/0024

	SYSTEM	LINE NO./WELD NO.
311.	EW	1305/0025
312.	EW	1305/0026
313.	EW	1305/0029
314.	EW	1305/0031
315.	EW	1305/0033
316.	EW	1305/0037
317.	EW	1305/0040
318.	EW	1305/0041
319.	EW	1305/0042
320.	EW	1305/0043
321.	EW	1306/0001
322.	EW	1306/0002
323.	EW	1306/0003
324.	EW	1306/0004
325.	EW	1306/0005
326.	EW	1306/0006
327.	EW	1306/0007
328.	EW	1306/0007A
329.	EW	1306/0007B
330.	EW	1306/0007C
331.	EW	1306/0007D
332.	EW	1306/0008
333.	EW	1306/0009
334.	EW	1307/0001A
335.	EW	1307/0001B
336.	EW	1307/0001C
337.	EW	1307/0002
338.	EW	1307/0003
339.	EW	1307/0004
340.	EW	1307/0005
341.	EW	1307/0006

	SYSTEM	LINE NO./WELD NO.
342.	EW	1307/0007
343.	EW	1307/0008
344.	EW	1307/0009
345.	EW	2102/0001
346.	EW	2102/0002
347.	EW	2102/0003
348.	EW	2102/0004
349.	EW	2102/0008
350.	EW	2102/0010
351.	EW	2102/0012
352.	EW	2102/0016
353.	EW	2102/0018
354.	EW	2102/0020
355.	EW	2102/0023
356.	EW	2102/0024
357.	EW	2102/0025
358.	EW	2102/0026
359.	EW	2102/0027
360.	EW	2102/0028
361.	EW	2102/0029
362.	EW	2102/0030
363.	EW	2102/0031
364.	EW	2102/0033
365.	EW	2102/0034
366.	EW	2102/0035
367.	EW	2102/0036
368.	EW	2102/0037
369.	EW	2102/0038
370.	EW	2102/0039
371.	EW	2102/0040
372.	EW	2102/0043

APPENDIX A1 (Continued)

LIST OF ALL RADIOGRAPHS REEVALUATED

	SYSTEM	LINE NO./WELD NO.
373.	EW	2102/0044
374.	EW	2105/0002
375.	EW	2105/0003
376.	EW	2105/0004
377.	EW	2105/0005
378.	EW	2105/0006
379.	EW	2105/0007
380.	EW	2105/0008
381.	EW	2105/0010
382.	EW	2105/0011
383.	EW	2105/0012
384.	EW	2105/0013
385.	EW	2105/0014
386.	EW	2105/0015
387.	EW	2105/0016
388.	EW	2105/0017
389.	EW	2105/0018
390.	EW	2105/0019
391.	EW	2105/0020
392.	EW	2105/0021
393.	EW	2105/0022
394.	EW	2105/0023
395.	EW	2105/0024
396.	EW	2105/0025
397.	EW	2105/0027
398.	EW	2105/0029
399.	EW	2105/0031
400.	EW	2105/0033
401.	EW	2105/0035
402.	EW	2105/0037
403.	EW	2105/0039
404.	EW	2105/0043
405.	EW	2105/0044
406.	EW	2105/0045
407.	EW	2105/0046
408.	EW	2106/0001
409.	EW	2106/0002
410.	EW	2106/0004
411.	EW	2107/0003
412.	EW	2107/0005
413.	EW	2107/0006
414.	EW	2202/0001
415.	EW	2202/0002
416.	EW	2202/0003
417.	EW	2202/0003-1
418.	EW	2202/0005
419.	EW	2202/0009
420.	EW	2202/0011
421.	EW	2202/0015
422.	EW	2202/0017
423.	EW	2202/0019
424.	EW	2202/0023
425.	EW	2202/0024
426.	EW	2202/0025
427.	EW	2202/0026
428.	EW	2202/0027
429.	EW	2202/0028
430.	EW	2202/0029
431.	EW	2202/0030
432.	EW	2202/0032
433.	EW	2202/0033
434.	EW	2202/0034
435.	EW	2202/0035
436.	EW	2202/0036
437.	EW	2202/0037
438.	EW	2202/0038
439.	EW	2202/0039
440.	EW	2202/0042
441.	EW	2202/0043
442.	EW	2205/0002
443.	EW	2205/0003
444.	EW	2205/0004
445.	EW	2205/0005
446.	EW	2205/0006
447.	EW	2205/0007
448.	EW	2205/0008
449.	EW	2205/0009
450.	EW	2205/0011
451.	EW	2205/0012
452.	EW	2205/0013
453.	EW	2205/0014
454.	EW	2205/0015
455.	EW	2205/0016
456.	EW	2205/0017
457.	EW	2205/0018
458.	EW	2205/0019
459.	EW	2205/0020
460.	EW	2205/0021
461.	EW	2205/0022
462.	EW	2205/0023
463.	EW	2205/0024
464.	EW	2205/0025
465.	EW	2205/0026

APPENDIX A1 (Continued)

LIST OF ALL RADIOGRAPHS REEVALUATED

	SYSTEM	LINE NO./WELD NO.		SYSTEM	LINE NO./WELD NO.		SYSTEM	LINE NO./WELD NO.
466.	EW	2205/0028	497.	EW	2302/0027	528.	EW	2305/0022
467.	EW	2205/0030	498.	EW	2302/0028	529.	EW	2305/0024
468.	EW	2205/0032	499.	EW	2302/0029	530.	EW	2305/0026
469.	EW	2205/0034	500.	EW	2302/0031	531.	EW	2305/0028
470.	EW	2205/0036	501.	EW	2302/0032	532.	EW	2305/0030
471.	EW	2205/0038	502.	EW	2302/0033	533.	EW	2305/0032
472.	EW	2205/0040	503.	EW	2302/0034	534.	EW	2305/0034
473.	EW	2205/0044	504.	EW	2302/0035	535.	EW	2305/0036
474.	EW	2205/0045	505.	EW	2302/0036	536.	EW	2305/0038
475.	EW	2205/0046	506.	EW	2302/0037	537.	EW	2305/0040
476.	EW	2205/0047	507.	EW	2302/0038	538.	EW	2305/0044
477.	EW	2206/0001	508.	EW	2302/0039	539.	EW	2305/0045
478.	EW	2206/0003	509.	EW	2302/0042	540.	EW	2305/0046
479.	EW	2206/0004	510.	EW	2305/0002	541.	EW	2305/0047
480.	EW	2206/0006	511.	EW	2305/0003	542.	EW	2307/0003
481.	EW	2207/0004	512.	EW	2305/0004	543.	EW	2307/0005
482.	EW	2207/0006	513.	EW	2305/0005	544.	EW	2307/0007
483.	EW	2207/0007	514.	EW	2305/0006	545.	EW	2307/0008
484.	EW	2302/0001	515.	EW	2305/0007			
485.	EW	2302/0002	516.	EW	2305/0008			
486.	EW	2302/0003	517.	EW	2305/0009			
487.	EW	2302/0008	518.	EW	2305/0011			
488.	EW	2302/0010	519.	EW	2305/0012			
489.	EW	2302/0014	520.	EW	2305/0013			
490.	EW	2302/0016	521.	EW	2305/0014			
491.	EW	2302/0018	522.	EW	2305/0015			
492.	EW	2302/0022	523.	EW	2305/0016			
493.	EW	2302/0023	524.	EW	2305/0017			
494.	EW	2302/0024	525.	EW	2305/0018			
495.	EW	2302/0025	526.	EW	2305/0019			
496.	EW	2302/0026	527.	EW	2305/0020			

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION (1)
1. AF 1004 0005	4-6	Backscatter	T
	6-0	Underfill	R
2. AF 1004 0006	2-4	Root Concavity, Processing	R
	2-6	Root Concavity, Processing	R
3. CS 1004 0012	6-0	Concavity	R
4. CS 1007 0003	2-4	Concavity	R
5. CS 1007 0004	2-4	Concavity	R
	4-6	Concavity	R
6. CS 1007 0006	0-2	Processing (Film Scratches)	T
7. CS 1007 0008	0-2	Melt Thru	R
8. CS 1102 0001	0-2	1" and 2" Incomplete Fusion	R
	2-4	Incomplete Penetration	R
	6-0	1" Incomplete Fusion	R
9. CS 1303 0001	All	O.D. Surface Indications	R
10. CV 1006 0013	All	Density	T
11. CV 1006 0015	2-4	Unconsumed Insert	R
12. CV 1019 0006	4-6	Incomplete Film Coverage	T

(1) R - Repair
T - Reradiograph
V - Visual Inspection of Weld Surface

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
13. CV 1088 0009	0-2	Crater Crack	R
	4-6	Crater Crack	R
14. CV 1088 0012	0-2	Crater Crack	R
15. CV 1088 0023	0-2	Density	T
	2-4	Density	T
	6-0	Density	T
16. CV 1092 0006	2-4	Unconsumed Insert	R
	4-6	Unconsumed Insert	R
17. CV 1092 0019	0-2	Convexity	R
	6-0	Unconsumed Insert	R
18. CV 1189 0002	0-4	Unconsumed Insert	R
	4-7	Unconsumed Insert	R
	7-11	Root Convexity, Incomplete Fusion	R
19. CV 1204 0004	All	Density	T
20. CV 1215 0003	All	Weld Edge Condition	V
21. CV 1215 0007	All	Weld Edge Condition	V
22. FC 1101 0002	0-3	Root Oxidation	R
	3-5	Root Oxidation	R
	5-7	Incomplete Fusion	R
	7-0	Root Oxidation	R

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
23. FC 1201 0001	All	Root Oxidation	R
24. FC 1213 0003	6-9	Root Oxidation	R
	9-11	Processing	T
25. FC 1213 0004	0-3	2" Linear Indication	T
	11-0	1" Linear Indication	T
26. FC 2101 0003	5-7	Undercut	R
	7-8	3/4" Incomplete Fusion, 1/8" Slag	R
27. SI 1101 0002	12-0	1/4" Incomplete Fusion	R
28. SI 1101 0005	6-9	3/8" Linear Indication	V
29. SI 1101 0006	0-3	5 1/2" Oxide Inclusion	R
	6-9	Backscatter	T
	9-11	Backscatter	T
30. SI 1101 0007	6-8	1/8" Incomplete Fusion, 5/16" Incomplete Penetration	R
	8-0	5/8" Incomplete Fusion	R
31. EW 1102 0002	All	Processing	T
32. EW 1102 0010	6-9	Linear Indication	R
	9-12	Linear Indication	R
	All	Processing	T
33. EW 1101 0012	All	Processing, Double Exposure	T

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
34. EW 1102 0018	6-9	Processing, Backscatter	T
	9-12	Processing, Backscatter	T
35. EW 1102 0024	0-2	1" Linear Indication	T
36. EW 1102 0028	0-1	Wall Thickness	R
37. EW 1105 0003	0-1	Wall Thickness	V
38. EW 1105 0008	0-1	6" Incomplete Fusion	R
39. EW 1105 0014	0-3	3/8" Linear Indication	T
	3-6	Incomplete Fusion	R
	6-9	Processing	T
40. EW 1105 0020	0-1	Linear Indication, I.D.	V
41. EW 1105 0021	0-1	Backscatter	T
42. EW 1105 0023	0-9	Incomplete Fusion	R
43. EW 1105 0024	6-9	Backscatter	T
44. EW 1105 0032	9-12	Backscatter	T
45. EW 1106 0006	0-1	Crater Crack	R
46. EW 1202 0014	0-1	Backscatter	T
47. EW 1202 0015	9-13	Backscatter	T
48. EW 1202 0024	6-9	Backscatter	T
49. EW 1202 0027	0-1	Wall Thickness	V
50. EW 1202 0029	0-1	Density	T

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
51. EW 1202 0032	0-3	I.D. Undercut	R
	3-6	5/8" Linear Indication	R
	17-0	Linear Indications	V
52. EW 1205 0006	0-3	1 1/2" Linear Indication	R
	3-6	Backscatter	T
53. EW 1205 0009	0-3	2" Incomplete Fusion	R
	3-6	2" Incomplete Fusion	R
	6-9	Backscatter	T
	9-12	Processing	T
	12-15	Processing	T
	15-17	Processing	T
	17-0	Processing	T
54. EW 1205 0013	0-1	1/2" Linear Indication	R
55. EW 1205 0016	0-1	Processing	T
56. EW 1205 0018	0-1	Processing, Sensitivity	T
57. EW 1205 0020	0-1	Backscatter, Sensitivity	T
58. EW 1205 0024	0-1	Processing	T
59. EW 1205 0030	0-3	Backscatter, Porosity	R
	3-6	Backscatter	T
60. EW 1205 0032	6-9	Backscatter	T
	9-11	Backscatter	T

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
61. EW 1205 0041	0-3	Aligned Porosity	R
	3-6	1/2" & 1/4" Linear Indications	R
	6-9	Crater Crack, 1" Linear Ind.	R
62. EW 1206 0001	0-1	Melt Thru, Linear Indications	R
	T1,T2	Melt Thru, Linear Indications	R
63. EW 1206 0006	0-1	3/8" Incomplete Fusion	R
64. EW 1206 0007	0-1	3/4" Incomplete Fusion	R
65. EW 1302 0002	0-1	Linear Indications	V
66. EW 1302 0009	0-1	Density	T
67. EW 1302 0015	6-9	Backscatter	T
	9-12	Backscatter	T
68. EW 1302 0017	0-1	3/8" Linear Indication	R
69. EW 1302 0030	0-1	Processing	T
	T1,T2	Processing	T
70. EW 1302 0033	3-6	3/8" Linear Indication	V
	6-9	1/4" Incomplete Penetration	R
	17-0	Processing	T
71. EW 1302 00334	6-9	Processing (Film Scratch)	T
72. EW 1305 0002	0-1	5/8" Incomplete Penetration	R
73. EW 1305 0003	0-1	Concavity	V

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
74. EW 1305 0005	0-1	3/8" Linear Indication, Processing	R
75. EW 1305 0007	0-1	Sensitivity	T
76. EW 1305 0013	0-1	Backscatter	T
77. EW 1305 0015	0-3	Backscatter	T
	6-9	Backscatter	T
	9-12	Backscatter	T
	17-0	Backscatter	T
78. EW 1305 0017	12-15	Edge Condition	T
	17-0	Linear Indication	R
79. EW 1305 0019	0-1	1/4" & 3/8" Linear Indication	R
80. EW 1305 0024	0-14	1" Linear Indication	R
	28-42	1/2" Linear Indication	R
	42-56	1/2" Linear Indication	R
	84-0	1 1/4" & 1" Linear Indication	R
81. EW 1305 0026	24-36	Incomplete Fusion	R
	64-0	1" Linear Indication	R
82. EW 1305 0033	6-9	Backscatter	T
	9-12	1/2" Linear Indication	R
83. EW 1305 0042	0-3	2" Flux Inclusion	R
	3-6	3/8" Linear Indication	R

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
84. EW 1305 0043	0-4	Linear Indications	R
	3-6	Linear Indications	R
	9-12	Linear Indications	R
	12-15	Linear Indications	R
	15-17	Sensitivity	T
85. EW 1306 0001	0-1	1/4" Melt Thru	R
86. EW 1306 0004	0-1	Incomplete Penetration, Crater Crack	R
87. EW 1306 0007C	2-4	1 1/4" & 2-1/2" Incomplete Penetration	R
	4-6	Grind Marks	V
88. EW 2102 0026	0-1	1/2" Linear Indication	V
89. EW 2102 0027	6-9	Backscatter	T
	9-12	Backscatter	T
	17-0	Processing	T
90. EW 2102 0029	0-1	Linear Indication	V
91. EW 2102 0033	6-9	Processing	T
	9-12	Backscatter	T
	12-15	Backscatter	T
92. EW 2102 0043	3-6	Processing	T
	9-12	Processing	T
93. EW 2102 0044	3-6	Linear Indication	T

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
94. EW 2105 0002	0-1	1/2" & 1/4" Lack of Penetration	R
95. EW 2105 0006	15-18	Backscatter	T
	17-0	Sensitivity	T
96. EW 2105 0015	0-3	Linear Indication	R
	6-9	Backscatter	T
	9-12	Backscatter	T
97. EW 2105 0017	0-1	3/8" Linear Indication	R
98. EW 2105 0021	0-1	3/4" Linear Indication	V
99. EW 2105 0022	72-84	Linear Indications	R
	84-0	Linear Indications	R
100. EW 2105 0024	0-12	Wall Thickness	R
	12-24	Lack of Fusion	R
	24-36	Lack of Fusion	R
	36-48	Incomplete Fusion	R
	48-60	Linear Indication	R
	74-86	Linear Indication	R
	86-0	Linear Indication	R
101. EW 2105 0031	0-1	Backscatter	T
102. EW 2105 0035	0-3	Linear Indications	V
	3-6	Linear Indications	V
	9-12	Linear Indications	V

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
103. EW 2105 0039	0-3	1/4" Connected Porosity	R
	17-0	1 1/2" Connected Porosity	R
104. EW 2106 0001	All	Incomplete Fusion	R
105. EW 2202 0005	6-9	Crater Crack, Incomplete Penetration	R
	12-15	Linear Indication	R
106. EW 2202 0017	9-12	Backscatter	T
	12-15	Backscatter	T
107. EW 2202 0019	0-3	Linear Indications	V
	9-12	Backscatter	T
108. EW 2202 0024	0-1	Crater Crack	R
109. EW 2202 0026	9-12	1/2" Incomplete Penetration	R
	15-17	Sensitivity	T
110. EW 2202 0029	0-1	Crater Crack	R
111. EW 2202 0035	3-6	Backscatter	T
	6-9	Backscatter	T
112. EW 2202 0037	9-12	3/4" Incomplete Fusion	T
113. EW 2202 0038	0-3	1/8 Linear Indication	T
	12-15	1/8 Linear Indication	T
114. EW 2202 0039	0-3	Sensitivity	T
115. EW 2202 0042	0-1	Linear Indication	V

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
116. EW 2202 0043	0-1	3/8" Lack of Fusion	R
117. EW 2205 0006	0-1	2" Linear Indication	R
118. EW 2205 0013	6-9	Backscatter	T
	9-12	Backscatter	T
	15-17	Porosity	R
119. EW 2205 0016	0-3	Crater Crack	R
	6-9	Processing	T
120. EW 2205 0021	0-12	Linear Indication	R
	12-14	Linear Indication	R
	48-60	Linear Indication	R
121. EW 2205 0038	0-1	1/4" Crack	R
122. EW 2205 0046	6-9	1/4" Crack, Backscatter	R
	12-15	Incomplete Penetration	R
	15-17	Backscatter	T
123. EW 2205 0047	0-1	1/4" Linear Indication	T
124. EW 2206 0001	All	Linear Indications	R
	0-8	Density	T
	8-15	Density	T

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
125. EW 2207 0006	0-8	1/4" Flux Inclusion	R
	8-15	5/8" Incomplete Fusion	R
	15-23	3" Incomplete Fusion	R
	23-30	5" Incomplete Fusion	R
126. EW 2302 0023	3-6	5/8" Linear Indication	V
127. EW 2302 0026	3-6	3/4" Linear Indication, Backscatter	V,T
	6-9	Backscatter	T
	9-12	1" Linear Indication	V
	12-15	5/8" Linear Indication	V
128. EW 2302 0028	0-3	3/8" Liner Indication	R
	6-9	Backscatter	T
	9-12	Backscatter	T
129. EW 2302 0029	3-6	1/4" Incomplete Penetration	R
	6-9	Underfill	T
	9-12	Processing	T
130. EW 2302 0042	0-1	1/8" Incomplete Fusion	R
131. EW 2305 0003	0-1	3/16" Linear Indication	V/T
132. EW 2305 0005	0-3	3/16" Inclusion	R
133. EW 2305 0007	9-12	Backscatter	T
134. EW 2305 0012	15-17	Processing	T

APPENDIX A2

WELDS WITH RADIOGRAPHIC DISCREPANCIES

WELD IDENTIFICATION	VIEW	DISCREPANCY	CORRECTIVE ACTION
135. EW 2305 0014	0-1	Porosity	V/T
136. EW 2305 0016	0-1	Processing	T
137. EW 2305 0019	0-14	Linear Indication	R
	14-28	Linear Indication	R
	42-56	2" Inclusion	R
	70-84	1 1/2" Linear Indication	R
138. EW 2305 0020	0-14	Linear Indication	R
	14-28	Linear Indication	R
	56-70	Processing	T
139. EW 2305 0026	0-1	Linear Indication (Tool Mark)	R
140. EW 2305 0034	0-1	3/4" Linear Indication	R
141. EW 2305 0045	3-6	1" Linear Indication	V/T
	12-15	3/8" Linear Indication	T
	17-0	3/8" Linear Indication	R
142. EW 2305 0046	0-3	1/2" Linear Indication	R
	3-6	5/16" Incomplete Penetration	R
	15-17	3/8" Incomplete Penetration	R
143. EW 2307 0007	0-8	1/2" Incomplete Penetration	R
	16-23	4" Incomplete Fusion	R

APPENDIX B

DISCREPANCIES IN ASME PIPE WELD DOCUMENTATION

The following is a description of all of the documentation discrepancies identified during the ASME pipe weld documentation review.

The status of the discrepancy is listed as either "corrected" or "requires evaluation". "Corrected" means that the discrepancy has already been corrected through the normal project channels for correcting documentation errors. "Requires evaluation" means that further evaluation by Brown and Root is required before the discrepancy can be corrected.

Auxiliary Feedwater System (AF) - Ten welds have been started or completed. Three Weld Data Cards were found to have entries requiring correction of further evaluation.

Line No.	Weld No.	Discrepancy
2001	FW0005	Incorrect heat number referenced on WDC for Spool C STATUS: Requires evaluation

Line No.	Weld No.	Discrepancy
2002	FW0005	Incorrect heat number referenced on WDC for Spool C. STATUS: Corrected
2003	FW0005	Incorrect heat number referenced on WDC for Spool C. Weld Data Card indicates that two consumable inserts were issued for this joint with no indication as to status of unused insert. STATUS: Corrected

Boron Recycle System (BR) - Nine welds have been started or completed. Six Weld Data Cards contain entries requiring correction or further evaluation.

Line No.	Weld No.	Discrepancy
1022	FW0013	Incomplete heat number referenced on WDC for Spool J. STATUS: Requires evaluation
1022	FW0014	Incomplete heat number referenced on WDC for Spool L. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1022	FW0015	Incomplete heat number referenced on WDC for Spools A and L. An error in the issue date on the weld filler material log indicated usage of filler material after visual inspection and liquid penetrant examination of repair. STATUS: Corrected
1022	FW0023	Incorrect base material specification used for Spool K. TRD specifies SA403 for fittings; vendor CMTR indicates SA182. STATUS: Requires evaluation
1029	FW0001	Heat number indicated as serial number on WDC for Spool A. STATUS: Corrected
1084	FW0004	Incomplete heat number referenced on WDC for Spool C. Incorrect filler material traceability code referenced on filler material log. STATUS: Corrected.

Component Cooling Water System (CC) - Many Weld Data Cards in this system indicate the base material specification as an ASTM "A" specification rather than the ASME "SA" specification as indicated by the vendor CMTR's. This condition was noted on 48 Weld Data Cards. This is a minor inconsistency because both specifications are identical and the material supplied to both of these specifications are identical.

One hundred and twenty-six welds have been started or completed. Twenty-three Weld Data Cards have entries requiring correction or evaluation.

Line No.	Weld No.	Discrepancy
1103	FW0006	GTAW wire incorrectly indicated as a consumable insert. STATUS: Corrected
1103	FW0007	Incomplete heat number specified on WDC for Spool G. STATUS: Corrected
1111	FW0001	Incorrect base material specification. TRD requires SA234. CMTR indicates SA105. STATUS: Requires evaluation

Line No.	Weld No.	Discrepancy
1116	FW0001	Incorrect base material specification. TRD requires SA234, CMTR indicates SA334. STATUS: Requires evaluation
1120	FW0006	QC hold point not signed (preheat/purge) on WDC. STATUS: Requires evaluation
1128	FW0008	Incorrect heat number specified on WDC for Spool J. STATUS: Corrected
1203	FW0002	Incorrect base material specification indicated on WDC for Spool A. WDC indicates A420, CMTR indicates SA 234. TRD allows either SA420 or SA234. STATUS: Requires evaluation
1203	FW0004	GTAW bare wire incorrectly indicated as consumable insert. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1314	FW0011	Incorrect serial number specified on WDC for Spool L. STATUS: Requires evaluation
1411	FW0003	Incomplete weld filler material log entry. Log indicates material used in joint; Weld Material Requisition indicates material returned unused. STATUS: Requires evaluation
1412	FW0010	Serial number recorded instead of heat number. STATUS: Requires evaluation
1429	FW0007	Incorrect base material specification and heat number indicated on WDC for Spool C. Incorrect filler material traceability code indicated on WDC. STATUS: Corrected.
1430	FW0004	Incorrect heat number indicated on WDC for Spool E. Incorrect serial number indicated on WDC for Spool D. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1432	FW0007	Incorrect heat number indicated on WDC for Spool E. STATUS: Corrected
1209	FW0008	Incomplete weld filler material log entries. Log indicates two consumable inserts used for weld joint approximately six weeks apart. STATUS: Requires evaluation
1217	FW0015	Incorrect base material specification. TRD requires SA420 or SA234. WDC and CMTR indicate base material to be SA105 for Spool R. STATUS: Requires evaluation
1220	FW0005	Incorrect base material specification. TRD requires SA420 or SA234. CMTR indicates SA105 for fitting. STATUS: Requires evaluation
1228	FW0008	Incorrect base material specification. TRD requires SA420 or SA234. CMTR indicates SA105. STATUS: Requires evaluation

Line No.	Weld No.	Discrepancy
1303	FW0007	QC hold point not signed (cleanliness) on WDC. Status: Requires evaluation
1309	FW0006	Welder symbol not clear on weld filler material log. STATUS: Corrected
1314	FW0005	Incorrect filler material traceability code. Material indicated as E7018; traceability code is for GTAW wire. STATUS: Corrected
1432	FW0007	Incorrect heat number indicated on WDC for Spool F. STATUS: Corrected
1432	FW0010	Incorrect heat number indicated on WDC for both Spools. STATUS: Requires evaluation
1527	FW0013	Incorrect welder symbol indicated on WMR (WDC has AQN, WMR has AQM). STATUS: Requires evaluation

Chilled Water System (CH) - Eleven welds have been started or completed. No discrepancies were found during the documentation review.

Containment Spray System (CS) - Ninety-nine welds have been started or completed. Sixteen Weld Data Cards have conditions requiring correction or evaluation.

Line No.	Weld No.	Discrepancy
1004	FW0013	Incorrect heat number specified on WDC for Spool L. STATUS: Corrected
1007	FW0009	QC signature for fit-up inspection not dated. STATUS: Corrected
1012	FW0002	Incorrect heat number specified on WDC for Spool D. STATUS: Corrected
1012	FW0003	Incorrect base material specification indicated on WDC. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1012	FW0004	Incorrect heat number specified on WDC for Spool B. STATUS: Corrected
1012	FW0005	Inaccurate indication on weld filler material log regarding the use of consumable insert and/or bare wire. STATUS: Corrected
1202	FW0001	Incorrect base material specification and heat number specified on WDC for Spool B. STATUS: Corrected
1202	FW0002	Incorrect heat number specified on WDC for Spool D. STATUS: Corrected
1202	FW0028	Incorrect heat number specified on WDC for Spool R. STATUS: Requires evaluation
1203	FW0001	Incorrect heat number specified on WDC for Spool D. STATUS: Requires evaluation

Line No.	Weld No.	Discrepancy
1302	FW0001	Heat numbers indicated on WDC are reversed for the two spool pieces. STATUS: Corrected
1302	FW0002	Incorrect heat number indicated on WDC for Spool D. STATUS: Corrected
1302	FW0005	Incorrect heat number specified on WDC for Spool G. STATUS: Corrected
1302	FW0030	Incorrect base material specification and heat number specified on WDC for Spool R. STATUS: Corrected
1303	FW0002	Incorrect heat number specified on WDC for Spool B. STATUS: Corrected
1308	FW0006	QC signature for cleanliness and fit-up inspections were not dated. STATUS: Corrected

Chemical and Volume Control System (CV) - One-hundred and one welds have been started or completed. Twenty-six Weld Data Cards have conditions requiring correction or evaluation.

Line No.	Weld No.	Discrepancy
1044	FW0004	Incorrect heat number specified on WDC for Spool L. STATUS: Corrected
1047	FW0001	Incorrect base material specification. TRD requires fittings to be SA403. WDC specifies SA403. CMTR for heat number reference on WDC indicates material is SA312. STATUS: Requires evaluation
1049	FW0001	Filler material traceability codes and material descriptions incorrectly transcribed to weld filler material log. (Entries reversed for consumable insert and GTAW filler wire) STATUS: Corrected

Line No.	Weld No.	Discrepancy
1050	FW0006	Incorrect base material type for Spool V. WDC indicates type 304 material. CMTR indicates type 316 material. Incorrect base material specification indicated on WDC for heat exchanger nozzle. The vendor documentation indicates material as SA312 pipe; the WDC indicates an SA403 fitting. Incorrect weld filler material. The WPS requires type 316 filler material, WDC indicates type 308 was actually used. STATUS: Requires evaluation
1050	FW0005	Incorrect heat number specified on WDC for Spool U. STATUS: Corrected
1081	FW0001	Incorrect base material type for Spool A. WDC indicates type 304. CMTR indicates type 316. Incorrect base material specification indicated for nozzle. The vendor documentation indicates SA312, the

Line No.	Weld No.	Discrepancy
1081	FW0001	(Continued) WDC indicates SA403. Incorrect weld filler material. The WPS requires type 316 filler material, WDC indicates type 308 actually used. STATUS: Requires evaluation
1086	FW0007	Incorrect base material specification indicated for Spool N. WDC indicates SA312, CMTR indicates SA403. STATUS: Corrected
1086	FW0019	Incorrect base metal specification and heat number indicated on WDC for Spool H. QC signature for inspection points not dated. STATUS: Corrected
1086	FW0021	QC signature for inspection points not dated. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1088	FW0001	Incorrect heat number indicated on WDC for Spool A. STATUS: Corrected
1088	FW0018	Incorrect serial number indicated on WDC for both spools. STATUS: Requires evaluation
1088	FW0023	Incorrect heat number specified on WDC for Spool A. STATUS: Corrected
1092	FW0006	Incorrect heat numbers indicated on WDC. STATUS: Corrected
1098	FW0002	Incorrect heat number indicated on WDC for Spool B. STATUS: Corrected
1098	FW0004	Incorrect heat number indicated on WDC for Spool D. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1171	FW0008	Incorrect heat number indicated on WDC for Spool D. STATUS: Corrected
1190	FW0001	Incorrect heat number indicated on WDC for Spool A. STATUS: Corrected
1215	FW0007	Incorrect base material type indicated on WDC. STATUS: Corrected
1044	FW0007	Incorrect heat number indicated on WDC for Spool M. STATUS: Corrected
1123	FW0031	Heat number of coupling is not heat number specified by CMTR for the PO/Item and Material Receiving Requisition used to issue material. No CMTR was found for heat number on coupling. STATUS: Requires evaluation

Line No.	Weld No.	Discrepancy
1123	FW0032	Incorrect heat number indicated on WDC. STATUS: Requires evaluation
1171	FW0007	Incorrect heat number indicated on WDC for Spool E. STATUS: Corrected
1173	FW0001	Incorrect base material specification indicated on WDC for tank nozzle. STATUS: Under evaluation
1180	FW0017	Incorrect heat number specified on WDC for Spool E. STATUS: Corrected
1189	FW0001	Incorrect base material specification indicated on WDC for nozzle. STATUS: Requires evaluation
1189	FW0002	Incorrect heat number specified on WDC for Spool A. STATUS: Corrected

Essential Cooling Water System (EW) - Two generic documentation problems were disclosed for the ECW system. The base material for the 10-inch aluminum bronze pipe is manufactured to ASME SB315 with chemical composition and mechanical properties conforming to ASME SB169 alloy CA614. Many of the Weld Data Cards for the 10-inch piping specify ASME SB315 as the base material.

Forty-one Weld Data Cards indicate that in-process repairs were made for mismatch of pipe ends. Notations made on the Weld Data Cards indicate additional welding was required to correct unacceptable mismatch. The entry data for the repairs indicate that they were made after the weld joint was basically complete, but only one of these repairs is indicated on the Weld Data Card as having been performed to achieved the 3 to 1 taper required when acceptable mismatch is present. Discussions with QC personnel have indicated that this material has localized out of roundness conditions resulting in small areas of unacceptable mismatch on the ID of the joint. This condition was frequently not discovered until the weld joint had been completed and the ID fit-up jacks removed to allow inspection of the internal surface. When this condition was found additional weld metal was added to achieve a 3 to 1 taper at the area of the mismatch.

The technical review of the documentation for the Essential Cooling Water System has indicated that sixteen Weld Data Cards have

discrepancies which require correction or evaluation. The majority of discrepancies are incorrect or incomplete entries on the Weld Data Cards. In most cases the correct entry can be established by other documentation such as manufacturer's Spool Data Sheets, Welding Material Requisitions, or NDE reports for liquid penetrant and visual inspections. Seven of the discrepancies will require further evaluation to determine the appropriate corrective action. A detailed tabulation of discrepancies is provided below:

Line No.	Weld No.	Discrepancy
1102	FW0016	A WDR Card was issued to repair unacceptable ID weld conditions. Weld repair was performed 5-1-78. WDR does not indicate that a liquid penetrant examination was performed after repair, although radiographic examination of repair was performed. Original weld was examined by liquid penetrant on the OD surface. STATUS: Requires evaluation
1105	FW0014	Two Weld Data Repair Cards were issued for this joint. WDRC referenced WMR No. 25961. Each

Line No.	Weld No.	Discrepancy
1105	FW0014	(Continued) repair card has a different date for the WMR. STATUS: Corrected
1205	FW0036	Incorrect designation of weld filler material on WDC. Entry on WDC is RCuA1A2 which is for manual GTAW welding. Actual material used is ECuA1A2 which is automatic GTAW welding. STATUS: Corrected
1302	FW0013	Weld filler material log indicates welding performed after the QC final visual inspection hold point was signed off. STATUS: Requires evaluation
1302	FW0034	Liquid penetrant inspection point for repair not signed by QC Inspector. Reference to the inspection report indicated that inspection had been performed. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1305	FW0009	QA/QC acceptance block for WDRC No. 3 not signed off. STATUS: Corrected
1306	FW0001	WDC indicates welder AHV made entire original joint. The base material thickness is listed as 0.365 inches. Welder AHV was only qualified to 0.309 inches maximum thickness of weld deposit at the time of this weld joint. STATUS: Requires evaluation
1307	FW0001B	Incorrect heat/lot code for weld filler material listed on weld filler material log of WDC. Heat/lot code referenced (0084) is for ER316 filler material. STATUS: Corrected
1307	FW0004	Final documentation package does not have the radiography report referenced on the WDRC. STATUS: Corrected

Line No.	Weld No.	Discrepancy
2105	FW0027	WDC indicates fit-up repair. Date of entry is after final welding was completed. STATUS: Corrected
2205	FW0045	Heat number listed on WDC for spool BA is incorrect. STATUS: Requires evaluation
2205	FW0049	Liquid penetrant inspection sign-off appears to be incorrect. STATUS: Corrected
2206	FW0001	QC preheat hold point not signed. STATUS: Requires evaluation
2206	FW0011	QC preheat hold point not signed. STATUS: Requires evaluation
2207	FW0006	Incorrect heat/lot code for weld filler material listed on weld filler material log of WDC. Heat/lot code referenced for WMR 86641 (0096) is for ER-309 filler material.

Line No.	Weld No.	Discrepancy
2305	FW0028	Liquid penetrant examination hold point signed on 4-18-79, indicating acceptable examination. Resolution of defects Serial No. 0024 was issued to repair unacceptable defects indicated by liquid penetrant examination of 4-18-79. STATUS: Corrected

Weld Data Cards were written to document additional inspection and repairs performed to 166 welds made by Southwest Fabricating and Welding Co. The Weld Data Card for each joint was used to record the results of liquid penetrant inspection. A WDRC was used to document grinding of the weld to remove unacceptable indications. If welding was required to restore the wall thickness a second repair card was written. For these vendor welds, the weld numbers are identified as FS. The technical review of the repaired vendor welds indicated only one WDRC with a discrepancy.

Line No.	Weld No.	Discrepancys
1205	FS0003	The heat/lot code for the weld filler material issued by WMR 42862 was not recorded on the WDC. STATUS: Requires evaluation

Spent Fuel Cooling and Cleaning System (FC) - Sixteen welds have been started or completed. Five Weld Data Cards have conditions requiring correction or evaluation:

Line No.	Weld No.	Discrepancy
1010	FW0002	Incorrect heat number referenced on WDC for Spool A STATUS: Corrected
1015	FW0003	Incorrect heat number referenced on WDC for Spool B. STATUS: Corrected
1016	FW0002	Incorrect heat number referenced on WDC for Spool B. STATUS: Corrected

Line No.	Weld No.	Discrepancy
2213	FW0003	Incorrect heat number referenced on WDC for Spool C. STATUS: Requires evaluation
2213	FW0004	Incorrect heat number referenced on WDC for Spool C. STATUS: Corrected

Reactor Coolant System (Main Loop) (RC) - A total of nineteen reactor coolant main loop welds have been completed or are in process. A review of the Weld Data Cards for these welds indicates the two problems discussed below. Neithe of the problems are expected to require rework because the welds in question have already been examined radiographically and found to be acceptable.

a. The Welding Procedure Specification used for welding of the reactor coolant main loop was for single-welded joints and therefore specified no backgouging. All ninteen weld joints were welded using a double-weld, consumable insert technique. The insert was consumed and two layers of weld metal were deposited from the inside with the outside of the groove purged with inert gas. The

balance of the welding was done from the outside. The WDC does not indicate that backgouging was performed prior to welding from the second side. The Procedure Qualification Record for the welding procedure does not indicate that the qualification test coupon was welded in a similar manner so as to demonstrate that proper fusion and penetration can be obtained, as required by NB-4423.

b. During the initial pass to melt the consumable insert on joint FW0020, a hole was melted through the insert. The open hole was repaired from the ID as a "minor defect" using the automatic welding equipment with an open butt technique and the parameters of the WPS specified for the fill passes. This welding procedure is not applicable to open-butt welding.

During the review, it was noted that eight Weld Data Cards did not have entries to indicate which welder/welding operator melted the consumable insert. For these joints, it cannot be clearly established by the information available on the WDC if the melting of the insert was done manually or with the automatic equipment. This condition exists for the following Weld Data Cards:

Line No.	Weld No.	Line No.	Weld No.
1102	FW0005	1203	FW000[illegible]
1103	FW0003	1303	FW0019
1201	FW0011	1401	FW0027
1201	FW0012	1401	FW0028

Five Weld Data Cards have other conditions requiring correction or evaluation. A detailed tabulation is provided below:

Line No.	Weld No.	Discrepancy
1103	FW0004	WDC indicates open-butt repair of "blow hole" in root pass. No indication as to which welder performed open-butt repair. STATUS: Requires evaluation
1202	FW00[illegible]3	No indication on WDC of NDE performed for temporary attachment (spacer block) removal. Card has QC signature, but not date or indication of type NDE performed. STATUS: Requires evaluation

Line No.	Weld No.	Discrepancy
1301	FW0017	WDC indicates "minor repair" performed on 4-10-80. Straight length filler material issued on 4-10-80 indicating manual welding performed during repair. Last previous issue of weld filler material was on 3-21-80. No description of defect or NDE performed to verify removal of defect was provided. STATUS: Requires evaluation
1303	FW0019	The heat number recorded on the WDC for the pump nozzle is apparently the drawing number. STATUS: Requires evaluation
1402	FW0029	Incorrect heat/lot traceability code specified on weld filler material log for last filler material entry. Process used was GTAW; traceability code entered for SMAW filler material. STATUS: Requires evaluation

Reactor Coolant System - Other Than Main Loop (RC) - Ten welds have been started or completed. No discrepancies were noted.

Residual Heat Removal System (RH) - Four welds have been started or completed. No discrepancies were noted.

Reactor Makeup Water System (RM) - Eight welds have been started or completed. Four weld data cards have conditions requiring correction or evaluation:

Line No	Weld No.	Discrepancy
1015	FW0004	Incorrect heat number specified on WDC for Spool C. Incorrect status of weld filler material indicated on filler material log. Log indicates GTAW bare wire used, but fit-up inspection was not signed. Corrective Action Report issued 7-15-80. STATUS: Requires evlaution
1015	FW0005	Pipe spool serial number recorded on WDC as base material specification entry. STATUS: Corrected

Line No.	Weld No.	Discrepancy
1015	FW0006	Incorrect status of weld filler material indicated on filler material log. Log indicates GTAW bare wire used but fit-up inspection was not signed. STATUS: Corrected
1015	FW0012	Incorrect base material specification indicated on WDC for Spool K. STATUS: Requires evaluation

Safety Injection System (SI) - A potential generic problem exists for all six-inch NPS groove welds of line number 1206 for this system. The six inch pipe has a nominal wall thickness of 0.432 inch. Most of the groove welds started or completed on this line have been made by welders who are qualified to a thickness of 0.436 inches (based on 2 inch Sch. 80 pipe, 0.218 wall). The normal wall thickness tolerance of ± 12 1/2 percent would extend the thickness of the groove welds to beyond the welder's qualified limits. Most of these groove welds are pipe to fitting welds, which increases the possibility of a welder depositing weld metal thickness beyond the qualified range. There is no indication, however, that the welds themselves were defective.

Line No.	Weld No.	Discrepancy
1101	FW0002	Incorrect base material heat number indicated on WDC for Spool E. STATUS: Corrected
1101	FW0007	Incorrect base material specification and heat number indicated on WDC for Spool K. STATUS: Corrected
1102	FW0004	Incorrect base material specification used. WDC and CMTR indicate material to be SA182. TRD requires SA403 material for this application. STATUS: Requires evaluation
1105	FW0018	Incorrect type of weld filler material. ER308 filler material used for type 316 base materials. STATUS: Pending resolution of nonconformance report.
1118	FW0004	Incorrect weld filler material type entered on filler material log of WDC. STATUS: Corrected.

Line No.	Weld No.	Discrepancy
1201	FW0001	Incorrect base material specification used. Vendor documentation indicates material as SA182. TRD and WDC specify material as SA403. STATUS: Requires evaluation
1201	FW0005A	Incomplete heat number specified on WDC for both spools. STATUS: Corrected
1206	FW0042	Incorrect base material heat number indicated on WDC for Spool R. STATUS: Corrected
1234	FW0013	Incorrect base material heat number indicated on WDC for fitting (bulk material item). STATUS: Corrected

Penetrations - Sixteen welds have been started or completed. Seven weld data cards have conditions requiring correction or evaluation.

Penetration No.	Line No.	Weld No.	Discrepancy
M-11	SI 1305	FW0011	Weld filler material log does not indicate type/class of material for welder AAK. STATUS: Corrected
M-15	SI 1205	FW0015	Incorrect heat number for sleeve and penetration assembly. No revision indicated for WPS used. STATUS: Requires evaluation
M-17	CS 1102	FW0017	No revision indicated for WPS used. STATUS: Corrected
M-18	SI 1106	FW0018	Heat numbers reversed for sleeve and penetration assembly. No revision number for WPS used. Filler material log indicates GTAW wire used but fit-up not signed by QC (CI joint design). STATUS: Corrected

Penetration No.	Line No.	Weld No.	Discrepancy
M-25	CC 1112	FW0022	Incorrect heat/lot code recorded for WMR 130008. STATUS: Corrected
M-33	CC 1104	FW0030	WDC does not clearly indicate which welder performed the open butt repair. STATUS: Corrected
M-34	CC 1108	FW0031	Incorrect heat number for penetration assembly. STATUS: Requires evaluation

Fuel Transfer Tube - Spacer Blocks - Six welds have been completed. No discrepancies were noted.

Control Rod Drive Mechanicsm - Seal Welds - Seventy-four seal welds have been completed. Five Weld Data Cards have conditions requiring correction or evaluation.

Weld No	Discrepancy
FW0003	Fit-up inspection hold point not signed by QC Inspector. STATUS: Corrected
FW0004	Fit-up inspection hold point signature not dated. STATUS: Corrected
FW0040	WDC does not clearly indicate if welder AOR participated in welding of joint. STATUS: Corrected
FW0052	Fit-up inspection hold point not signed by QC Inspector. STATUS: Corrected
FW0070	Incorrect filler material traceability code referenced on filler material log. STATUS: Corrected
FW0076	WDC missing STATUS: Under evaluation

APPENDIX C

DISCREPANCIES IN ASME PIPE SUPPORT WELD DOCUMENTATION

Pipe Support	Discrepancy
1. CS 1002RR29	QC signature for fit-up inspection not dated.
2. CS 1004 RR02	QC signature for fit-up inspection signed in ANI signature block.
3. CS 1012 RR33	"S" (for satisfactory) entered in block for final visual inspection results without QC inspector's signature or date.
4. CS 1114 RH22	Incorrect date for final visual inspection or signature (1979 instead of 1980).
5. CS 1115 RR20	QC signature for fit-up inpsection not dated.
6. CS 1214 RR20	Incorrect date for final visual inspection signature (1979 instead of 1980).

Pipe Support	Discrepancy
7. CS 1215 RR03	QC signature for final visual inspection not dated.
8. CS 1303 SS01	Welder symbol and WMR number not transferred from back of WDC to front.
9. CS 1528 RR01	Welder symbol and WMR number not transferred from back of WDC to front.
10. CS 1530 RH01	Illegible date for fit-up inspection.
11. CS 1530 RH05	Welder symbol and WMR number not transferred from back of WDC to front.
12. CV 1011 SS04	Welder symbol and WMR number not transferred from back of WDC to front.
13. CV 1088 RH07	Minor repair notation made on WDC without QC or Welding Technician initials or date.
14. CV 1099 RH05	Welder symbol and WMR number not transferred from back of WDC to front.

Pipe Support	Discrepancy
15. CV 1116 RH17	QC signature for fit-up inspection signed in ANI signature block.
16. CV 1162 RH04	Welder sumbol and WMR number not transferred from back of WDC to front.
17. CV 1163 RR13	QC signature for final visual inspection not dated.
18. CV 1172 SH01	Welder symbol and WMR number not transferred from back of WDC to front.
19. CV 1214 RH03	Two WMRs listed on front of WDC. One of them listed on filler material log as no material used. Actual WMRs show no material used for one WMR and the other was voided prior to material issue. Actual WMR(s) used is unknown.
20. SI 1101 SS12	QC signature for fit-up inspection not dated.
21. SI 1102 RH05	Three WMR numbers not transferred from back of WDC to front.

Pipe Support	Discrepancy
22. SI 1102 RR04	QC signature for fit-up inspection not dated.
23. SI 1102 RR08	FW03 - WDC does not identify material used for tack welding. FW04 and FW05 - Weld data card/weld filler material log indicates no filler material used between fit-up inspection and final inspection.
24. SI 1201 RR10	Welder symbol not transferred from back of WDC to front.
25. SI 1302 RH02	WDC indicates that material was used but WMR was voided.

APPENDIX D

REVIEW TEAM COMMENTS ON ASME PIPING CONSTRUCTION PROCEDURES

All of the comments made during the review are included herein, mainly for completeness. Each comment refers to a specific paragraph in the procedure and is understandable when read in conjunction with the referenced paragraph.

A. A040KPMECP-1, Revision 14, Dated July 3, 1980, "Qualification of Welders and Welding Operators".

1. Reference paragraph 3.3.4(6)

References horizontal and vertical planes are confusing. State that pipe shall not be rotated during welding.

2. Reference paragraph 3.4.1

Weld process is not specified as an essential variable. Suggest revising sentence, "...welder performance tests for each process to be used..."

*3. Reference paragraph 3.5.2(1)(2)

Root and face bends required for plate material thickness ≤ 3/8 in. thick. MECP-1 specifies side bends for 3/8 in. thick material. These two subparagraphs must be made consistent with Tables 5.26.1 (Plate and Pipe) of D1.1-80. Note that Illustration A5 (Plate) is not consistent with the 1980 Addenda.

4. Reference paragraph 3.5.2(3)

Include acceptance criteria for the referenced fillet break and macroetch tests.

5. Reference paragraph 3.5.3

Specify the acceptance criteria for radiographic examination of welder performance qualification tests instead of referring to applicable NDEP which should be used for technique.

6. Reference paragraph 3.9

It is suggested that all the requirements for AWS D1.1 qualification should be consolidated in this section. This should include materials, number and types of specimens and tests, and acceptance criteria.

7. Reference paragraph 3.9.2.3.1 (Pipe)

These acceptance criteria are as specified in AWS D1.1. It is suggested that the porosity acceptance criteria specified in 9.25.1.8 of AWS D1.1 which apply to plate specimens be adopted for pipe.

*8. Reference paragraph 3.9.2.3.1(2) (Plate)

AWS D1.1 specifies that complete fusion shall exist between adjacent weld metal layers. MECP-1 does not address this requirement. It is understood that this should be verified during welding.

9. Reference paragraph 3.9.2.3.1(4) (Plate)

Specify the contour requirements of MECP-2.

10. Reference Appendix A

Delete paragraphs 5.1 through 5.4 because they are not relevant to the Standard Tests.

11. Reference Illustration 1

Include the welding process in the schedule of standard tests, e.g., GTAW, WPS#.

12. Reference Illustration A5

This illustration should be from the latest edition of AWS D1.1 (1980).

B. A040KPMECP-4, Revision 9, Dated March 26, 1980 (Including Interim Change Notice No. 1) "Field Fabrication and Welding of Piping Systems and Component Supports for Nuclear Systems".

1. Reference paragraphs 1.1.1 and 2.1.4

Clarify the difference between "pipe hangers and supplementary steel supports" fabricated and installed per reference 8 and "component supports" fabricated and installed per this document. Component supports, as defined in ASME Section III, Subsection NF, would include pipe hangers.

2. Reference paragraph 2.1.1

State edition and addenda of ASME Section III which is applicable.

3. Reference paragraph 3.2.4(b5)

Grinding should be avoided or be minimized on the inside surface of stainless steel pipe and components.

4. Reference paragraph 3.2.6.1

Specify maximum length of the window.

5. Reference paragraph 3.4.1

In some instances preheat may be necessary in making tack welds using the GTAW process.

6. Reference paragraph 3.6.1(5)

The minimum purge gas flow rates should be as stated on the WPS.

7. Reference paragraph 3.6.1(6)

A minimum oxygen content of 1% would be more appropriate for stainless steel base metals. Approved procedures for checking purge quality are required, but reference to a specific procedure is not specified.

8. Reference paragraph 3.6.9

This paragraph may be inconsistent with WPSs which allow weave beads.

9. Reference paragraph 3.8.7

The minimum preheats specified in the WPS should take preference.

10. Reference paragraph 3.8.11

Specify the base metal examination requirements after removal of spacer blocks (temporary attachments).

11. Reference paragraph 3.10.2

The requirement to remove all tungsten inclusions may be unnecessarily restrictive. The acceptance criteria of the

appropriate NDE method should be used as an accept/reject criteria for tungsten inclusions.

*12. Reference paragraph 3.14.3.3

NB-4452 and NB-4453 require that MT or PT be used to examine the defect excavation before repair regardless of the original NDE method.

13. Reference Illustration 4

Does not conform with Figure NB-4233-1, W75

C. A040KPMECP-8, Revision 4, Dated July 7, 1980, "Control of Welding Materials".

1. Reference paragraph 1.3.1

It is not clear whether brazing materials are covered by this procedure.

2. Reference paragraph 2.1(4)

The distinction between nonsafety-related weld filler material (NSWFM) and non-Q material is not clear. It is suggested that the designation "Q" and "non-Q" be dropped.

3. Reference paragraph 3.1.2

Paragraph 3.8 applies to NSWFM not to non-Q material.

4. Reference paragraph 3.3.2(3)

Specify that the Material Distribution Station (MDS) attendant shall examine the hermetrically sealed containers for damage before issuing the electrodes.

5. Reference paragraph 3.3.3(5)

It is suggested that the practice of cleaning contaminated spooled wire and cutting into straight lengths be discontinued unless the individual lengths are flag tagged and the tagging is witnessed by QC.

6. Reference paragraph 3.4.1(2)

A current list of all craft superintendents and weld technicians authorized to initiate and approve a WMR should be posted at each MDS. The attendant should verify that the signatures on the WMR are on the authorized list.

7. Reference paragraph 3.4.1(3)

It is suggested that in order for filler metal for multiple welds to be issued on one WMR, the welds should all require the same WPS.

8. Reference paragraph 3.4.1(14)

The identification tags (other than flag tags) for consumable inserts should be returned to the MDS. This will prevent the welder from inadvertently putting the wrong tag on the returned insert.

9. Reference paragraph 3.4.1(15)

Verification that the correct insert was installed should be done by checking the marking on the insert itself, not by reviewing the WMR. The weld technicians and Q.C. inspectors should check

the markings on all other filler materials before they are consumed.

10. Reference paragraph 3.5

The MDS attendant should be provided with a precise, written definition of "repeated shortages". Specify the document to be used to record shortages and the action to be taken when repeated shortages occur.

11. Reference paragraph 3.6(6)

The method of identifying brazing material should be specified.

12. Reference paragraph 3.10.5(g)

Documentation of the inspections of the MDS by the QC inspector should be done on preprinted Examination Check Forms. The items to be surveilled or inspected should be printed on the form.

13. Reference Illustration 3

A separate flow diagram should be created to show all the steps specified in this procedure for controlling filler metal.

APPENDIX E1

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (5) Compliance	Noncomplying Conditions: Undersize	Weld Contour	Overlap	Undercut	Toe Contour	Porosity	Arc Strikes	Spatter/Slag	Edge Melting
				Reactor Containment Building 1								
1	K7024 E2 457 C-1	44	No (2)						X(1)			
2	K7024 E2 459 C-3	45	Yes (2)									
3	K7024 E3 44	33	No		X	X			X(1)	X		X
4	K7024 E3 149 B-4	14	Yes									
5	K7024 E3 150 B-2	16	No	X						X		
6	K7024 E3 288 PH4	21	Yes									
7	K7024 E4 125 B-6	23	Yes									
8	K7024 E4 125 B-7	24	No		X	X				X		
9	K7024 E4 298 PH3	32	Yes									
10	K7024 E6 C-7	20	No		X	X	X	X	X(1)	X	X	
11	K7024 E6 170 B-4	19	No	X		X				X	X	
12	K7024 E6 170 B-5	18	No	X		X			X(1)	X		
13	K7024 E6 170 B-6	17	No	X		X			X(1)			

APPENDIX E1 (Continued)

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (5) Compliance	Noncomplying Conditions: Under size	Weld Contour	Overlap	Undercut	Toe Contour	Porosity	Arc Strikes	Spatter/Slag	Edge Melting
14	K7024 E6 194 B-1	43	No		X	X				X	X	
15	K7024 E6 A216 PH3	25	No		X	X	X	X	X(1)	X		
16	K7024 E7 203 B-9	27	No			X					X	
17	K7024 E7 217 B-1	28	No	X	X				X(1)	X		X
18	K7024 E7 222 B-3	22	No							X		
19	K7024 E7 235 B-3	29	Yes									
20	K7024 E7 235 B-4	30	Yes							X		
21	K7024 E7 235 B-5	31	No						X(1)			X
22	K7024 E10 A203 B-2	15	No									
23	K7024 E10 A216 PH3	26	Yes			X			X(1)	X		
24	K7024 E15 407 B-6	46	No	X	X	X		X	X		X	X
25	K7024 E17 410 B-3	50	No	X	X	X				X		
26	K7024 E18 433 B-1	49	No									

APPENDIX E1 (Continued)

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (5) Compliance	Noncomplying Conditions: Under size	Weld Contour	Overlap	Undercut	Toe Contour	Porosity	Arc Strikes	Spatter/Slag	Edge Melting
27	K7024 E23 48 521 B-1		No			X			X	X		X
28	K7024 E23 47 534 B-7A		No	X					X(1)			X
29	K7024 E302 51 319 B-5		No	X						X	X	
30	K7024 E303 69 3225 (B)		No	X	X				X(1)	X		X
31	K7024 E303 70 321 B-1		No (2)	X	X							X
32	K7024 E303 71 322 B-7		No		X				X(1)			
33	K7024 E303 72 322 B-6		No (2)	X	X					X		X
34	K7024 E303 73 322 B-3		No (4)	X	X							
35	K7024 E303 74 322 B-5(A)		Yes					X	X	X		X
36	K7024 E303 75 322 B-4		No(4)	X	X	X						X
37	K7024 76 303 B-4		No	X		X			X(1)			X
38	K7024 E303 77 303 B-5		No	X	X	X	X	X	X(1)			X
39	K7024 E303 78 303 B-3		No	X	X							

APPENDIX E1 (Continued)

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (5) Compliance	Noncomplying Conditions: Under size	Weld Contour	Overlap	Undercut	Toe Contour	Porosity	Arc Strikes	Spatter/Slag	Edge Melting
					Reactor Containment Building 2							
40	K7029 E5 151 B-6	59	No(2)									X
41	K7029 E5 170 B-2	60	No(2)		X							X
					Fuel Handling Building 1							
42	K7023 E2 A12	10	Yes								X	
43	K7023 E2 B25	9	No					X(1)			X	
44	K7023 E2 D2	6	No	X								
45	K7023 E2 D4	7	Yes						X	X		
46	K7023 E2 D19	3	No	X	X							
47	K7023 E2 D20	1	Yes								X	
48	K7023 E2 D24	2	No						X		X	
49	K7023 E2 E15	5	No		X			X(1)				
50	K7023 E2 E21	4	No		X							
51	K7023 E2 E28	8	No	X								
52	2424 E4 174	12	No(2)		X							

APPENDIX E1 (Continued)

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (S) Compliance	Noncomplying Conditions: Under size	Weld Contour	Over-lap	Under-cut	Toe Contour	Poro-sity	Arc Strikes	Spatter/ Slag	Edge Melting
53	2424 E4 177	11	No						X(1)	X	X	
54	2424 E4 202	13	No						X(1)			
			Fuel Handling Building 2									
55	K7028 E3 A4	68	Yes									X
56	K7028 E3 A5	66	No	X								X
57	K7028 E3 B16	67	No		X	X			X	X		X
58	K7028 E2 A19	64	No(2)		X	X	X			X		X
59	K7028 E2 A8	65	No						X			X
60	K7028 E2 F10	61	No						X(1)	X	X	X
61	K7028 E2 F25	63	No	X					X(1)			X
62	K7028 E2 F31	62	No									
			Mechanical Electrical Auxiliary Building 1									
63	K7025 E4 4	36	Yes									X
64	K7025 E8 5	54	No									
65	K7025 E6 7	38A	Yes(2)									

APPENDIX E1 (Continued)

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (5) Compliance	Nonconforming Conditions: Under size	Weld Contour	Over-lap	Under-cut	Toe Contour	Poro-sity	Arc Strikes	Spatter/ Slag	Edge Melting
66	K7025 E2 11	35	No									X
67	K7025 E12 11	42	No									X
68	K7025 E3 12	52	No	X	X							
69	K7025 E5 20	38	Yes									
70	K7025 E7 26	39	No(3)	X								
71	K7025 E9 25	40	No									X
72	K7025 E10 34	41	No									X
73	K7025 E1 53	34	Yes									
74	K7025 E12 63	55	No		X							X
75	K7025 E6 98	37	No	X								
76	K7025 E13 2	56	No			X						X
77	K7025 E7 2	53	Yes									

APPENDIX E1 (Concluded)

RESULTS OF VISUAL EXAMINATION OF SAFETY-RELATED STRUCTURAL WELDS

Number	Weld Identification	Report No.	Full (5) Compliance	Noncomplying Conditions: Under size	Weld Contour	Overlap	Undercut	Toe Contour	Porosity	Arc Strikes	Spatter/Slag	Edge Melting
				Mechanical Electrical Auxiliary Building 2								
78	K7030 E1 32	58	No							X		X
79	K7030 E2 9	57	No									X

(1) Compliance with AWS D1.1 (1975) criteria; noncompliance with MECP-2 criteria
(2) Access for examination limited by obstruction
(3) Bottom of clip not welded
(4) Crater not filled to full cross-section
(5) Full compliance with AWS D1.1 (1975), and construction procedure MECP-2

APPENDIX E2

DESCRIPTION OF NONCOMPLIANCES WITH AWS D1.1 "STRUCTURAL WELDING CODE"

Undersize Weld

The designer specifies the required weld size on the drawing. The noncompliance occurs when the weld size is less than specified on the drawing. This noncompliance may be significant because it represents a potential impairment in the capacity of the weld to support the design load.

Weld Contour

The Code specifies the shape of the fillet weld face, particularly convexity, within narrow limits. This noncompliance usually meant that the weld exceeded the convexity limits. Although not in compliance with the Code, this condition is not generally considered to impair weld integrity in statically loaded structures.

Overlap

This is the condition when the weld metal at the weld toe lays on top of the adjacent base metal but is not fused to it. It is undesirable because it forms a mechanical notch at the weld toe.

Porosity

Porosity is a cavity-type discontinuity in the weld metal caused by gas entrapment during solidification. The Code recognizes porosity as being relatively harmless in statically loaded structures by allowing a certain amount of porosity in the weld. The construction procedure, MECP-2, is far more strict than the Code in that it does not allow any porosity. Such a criteria is unrealistic for structural welding using the shielded metal-arc welding process under field conditions. Of the 25 cases of recorded porosity, 20 of those conditions are acceptable by AWS D1.1 criteria.

Arc Stikes

Arc strikes are disturbances of the base metal surface caused by a momentary contact of the welding electrode with the base metal. The Code and the construction procedure, MECP-2, require that the surface disturbance be removed and the new surface below the disturbance be examined for small cracks. Such removal is

usually accomplished by grinding and no additional welding is normally required.

Edge Melting

This condition occurs when the fillet weld made along the edge of a plate, as in the lap joint, melts the corner of the plate. It is considered undesirable by the Code because it makes measuring the leg length more difficult.

Toe Contour

The construction procedure requires that any blending of the weld toe and adjacent base metal by grinding does not reduce the thickness of the base metal by more then 1/32 inch or 5% of the thickness, whichever is smaller. The Code only places this restriction on butt welds which are required to be flush with the base metal surface.

Spatter/Slag

Spatter is the metal particles expelled during welding which do not form part of the weld. The particles adhere, either loosely or tightly, to the adjacent weld metal or base metal. Slag is the nonmetallic protective material which forms on the surface of shielded metal-arc welds. The Code requires that all slag be

removed after welding so that the weld may be properly inspected. Spatter is to be removed if the weld is to be painted. Neither of these conditions affect the integrity of the weld, but do not facilitate inspection and painting.

Undercut

Undercut is a groove melted into the base metal adjacent to the weld toe and left unfilled by the weld metal. The Code specifies two depths of undercut, depending on the orientation of the undercut with respect to the direction of applied tensile stress. When the undercut is oriented transverse to the direction of tensile stress, a depth of 0.010 inches is allowed. For all other cases, 1/32 inch is permitted. In the 1980 edition of the Code, up to 1/16 inch undercut is permitted for short lengths under certain conditions.

Underfilled Crater

A crater is the depression in the weld metal at the termination of the weld. The Code requires that it be filled out to full section thickness. This condition is equivalent to a short length of undersize weld.

APPENDIX F

REVIEW TEAM COMMENTS ON THE STRUCTURAL STEEL CONSTRUCTION PROCEDURES

A. A040KPMECP-2, Revision 7, Dated March 5, 1980. Field Fabrication and Welding of Structural Steel to the Requirements of AWS D1.1.

1. Reference Paragraph 1.2.1

Substitute "AWS D1.1, Structural Welding Code" for "Code".

2. Reference Paragraph 1.3.1

MECP-2 requires that an Examination Check (form is not numbered) be completed for documenting the welding. CCP-17 also requires that a different inspection report form be completed (Form STQACCP172A). It is recommended that all weld inspection documentation be made on one form.

3. <u>Reference Paragraph 1.3.1</u>

The referenced Site QC Schedule, Appendix B (Form STQA0600) requires fourteen items to be inspected, surveyed, or reviewed at least twice each week. These items are substantially the same as referenced in AWS D1.1. Paragraphs 6.4.1, 6.5.1, 6.5.2, 6.5.3, 6.5.5 of AWS D1.1 require the inspector to inspect, examine, or make certain that all the requirements are met for all welds. AWS D1.1 does not allow the above mentioned items to be surveyed only twice each week. The Site QC Schedule allows a possible deviation from the intent of AWS D1.1.

*In Revisions 2 through 5 of MECP-2, the Site QC Schedule required final visual inspection at least twice per week. This could result in a deviation from the minimum requirements of AWS D1.1.

CCP-17, "Erection of Category I Structural and Miscellaneous Structural Steel," Paragraph 3.5.3, requires that at least 25 percent of the fitups be inspected by the QC inspector. AWS D1.1 requires the inspector "...to examine the work to make certain that it meets the requirements of Section 3..." It should be made clear that the inspector's obligation is to assure that all fitups meet the requirements of Section 3.

4. Reference Paragraph 3.1.1

*The gas tungsten arc welding (GTAW) process is not recognized by AWS D1.1 as an acceptable welding process for a prequalified welding procedure specification (WPS). If the GTAW process is to be used for welding under AWS D1.1, it must be qualified by tests as described in Section 5 of AWS D1.1

Paragraph 3.1.1 should be revised to specify the approved welding processes for prequalified procedures.

5. Reference Paragraph 3.1.2

Add a statement that processes other than those designated as being prequalified can be used provided the WPS is qualified in accordance with paragraph 5.2 of AWS D1.1.

6. Reference Paragraphs 3.2.1 and 3.3.2

Base metals and filler metals must meet the requirements of Paragraph 8.2 of AWS D1.1.

7. Reference Paragraph 3.2.3

A reference to AWS D1.1, Paragraph 5.2 should be given.

8. Reference Paragraph 3.4.2(c)

Specify that the WPS shall be qualified in accordance with Paragraph 5.2 of AWS D1.1.

9. Reference Paragraph 3.7

Assembly weld joint and fitup tolerances should be included for full penetration and partial penetration groove welds.

10. Reference Paragraph 3.8.1

*AWS D1.1, Paragraph 8.2.4 requires that backing bars, runoff plates, and extension bars be of one of the steels listed in Paragraph 8.2.1. MECP-2 allows backing material to be of the same nominal composition. This is a deviation from the requirements of AWS D1.1. MECP-2 does not address the material requirements of spacers.

11. Reference Paragraph 3.8.1

AWS D1.1, Paragraph 4.7.3 requires that the backing material be continuous and that all joints in the backing be full penetration butt welds. Paragraph 3.8.1 does not address this requirement.

12. Reference Paragraph 3.10.4

This requirement may be impossible to comply with depending on length of deposited weld per electrode (i.e., high heat inputs may limit total length of weld pass per electrode).

13. Reference Paragraph 3.11

*AWS D1.1, paragraph 4.2 requires that the preheated area extend for a minimum of 3 inches in all directions from the point of welding. MECP-2 Paragraph 3.11 does not address this requirement.

14. Reference Paragraph 3.12.3(a)

*AWS D1.1, Paragraph 3.9.1.1(2) requires that the maximum temperature difference within any 15 feet interval of the part being heated be no greater than 250°F. The placement of thermo couples and the maximum temperature difference specified by Paragraph 3.12.3(a) could result in a deviation from the minimum requirements.

15. Reference Paragraph 3.12.3(b)

*AWS D1.1, Paragraph 3.9.1.1(3) requires that the maximum temperature difference between any portions of the heated

assembly during the holding period be no greater than 150°F. The placement of thermocouples and the maximum temperature difference specified in Paragraph 3.12.3(b) could result in a deviation from the minimum requirements of AWS D1.1.

16. Reference Paragraph 3.13.1

AWS D1.1 specifies the use of "welding grade" shielding gas with a dew point of lower than -40°F.

17. Reference Paragraph 3.17

*AWS D1.1, Paragraph 3.7.2.4 requires that when cracks are detected in the weld or base metal, the extent of cracking be determined by magnetic particle testing or other equally positive means and that both the crack and sound metal for 2 inches beyond both ends of the crack be removed before rewelding. This requirement is not addressed by MECP-2. Although it is not a code requirement, it is recommended that the defect excavation be inspected by MT or liquid penetration testing before it is rewelded.

18. Reference Paragraph 3.17.4

It is recommended that the types of weld repairs requiring documentation be clearly specified. Those "in-process" repairs

to correct such defects as undercut, overlap, etc., which may not require documentation of repair, should be clearly identified.

19. Reference Paragraph 3.19.2(1)

This paragraph requires that the weld technicians perform the final visual inspection on certain AWS D1.1 welds. It is not clear who performs the other surveillance activities required by AWS D1.1. This could result in a deviation from the minimum requirements of AWS D1.1.

20. Reference Paragraph 3.19.3

*The visual acceptance criteria of this paragraph are directed at weld metal defects and as such do not fully comply with Paragraph 8.15.1 of AWS D1.1.

Specifically, Paragraphs 8.15.1.2, 8.15.1.4 and 8.15.1.6 are not adequately covered. Additionally, the requirement that all surface porosity is unacceptable exceeds AWS D1.1 criteria.

21. Reference Paragraph 3.23

It is not clear from this paragraph who has the responsibility for inspection and surveillance of seal welding.

22. <u>Reference Table 1 (Base Material Group Number)</u>

The table requires the following modifications:

1. Group 1

(a) Include Grade A and Grade B after ASTM A500.

(b) Include Grade I and II after ASTM A524.

(c) API 2B only may be included depending on base metal used for manufacture.

(d) ABS Grade A, B, D, CS, DS and E only may be included in Group 1.

(e) See comment b.3.

2. Group 2

(a) Include Grade 65 and Grade 70 after ASTM A516.

(b) ASTM A572, Grade 60 is a Group 3 material.

(c) API 5LX, Grade 42 is a Group 1 material.

(d) ABS AH, DH or EH must be AH 32 or AH 36, etc.

(e) The Note 6 to Table 4.1.1 of AWS D1.1 must be considered with ASTM A606 material.

3. Group 3

See comment 2(b).

4. Group 4

ASTM 4514 is included in Group 4 in sizes 2-1/2 inches and less only.

23. Reference Illustration 1A, Quality Assurance Examination Check

*This form does not adequately document visual inspection and the surveillances as required by AWS D1.1 There is no provision on the form for identifying which weld has been inspected. MECP-2 does not identify any other form or method for the inspector to document his inspections. This deficiency must be reviewed in conjunction with the requirements of AWS D1.1, Paragraph 6.5.6, which requires that the inspector "identify with a distinguishing mark all parts or joints that he has inspected and accepted."

B. A040KSWES-1, Revision 4, Dated 9/17/79, "Stud Welding"

1. Reference Paragraph 1.2.1

Delete reference to pressure vessel components. AWS D1.1 is not applicable to these items.

2. Reference Paragraph 1.3

AWS D1.1, Paragraphs 4.26, 4.27, and 4.31 specify material and testing requirements for studs. WES-1 does not address these requirements.

3. Reference Paragraph 1.3.2.4

*AWS D1-1, Paragraph 4.28.11.2 specifies that SMAW electrodes shall be either 5/32" diameter or 3/16" diameter. WES-1 specifies a maximum electrode diameter of 5/32". This statement implies that electrodes less than 5/32" may be used. However, such electrodes are not permitted by AWS D1.1.

4. Reference Paragraph 1.3.2.7

Incorporate the AWS D1.1 requirements for preheat, Table 4.2, into this procedure.

5. Reference Paragraph 1.3.4

*AWS D1.1 Paragraph 4.28.7 requires that when the base metal temperature is below 32 F, one stud per 100 shall be tested per Paragraphs 4.30.1 and 4.30.2. WES-1 does not address this requirement.

6. Reference Paragraph 3.2.2

P-numbers are not referenced in AWS D1.1.

*It is not clear from this paragraph that the qualification tests must be repeated after any change in the welding parameters, stud diameter, position, operator, or welding unit. The referenced paragraph only states that a new welding procedure shall be prepared prior to starting welding after the above-mentioned changes have been made.

7. Reference Paragraph 3.2.4

*AWS D1.1 Paragraph 4.29.1.1 requires that the first two studs welded to shear connectors with 20 or more studs be bent to an angle of 30 degrees after welding. WES-1 does not address this requirement. Paragraph 4.29.4 of AWS D1.1 specifies a tolerance on the length of the stud after welding. When the as-welded stud length exceeds the maximum allowable length, welding shall be stopped until the condition has been corrected. WES-1 does not address this requirement.

8. Reference Paragraph 3.2.5

AWS D1.1, Paragraph 4.29.1.4 requires that failures in the stud shank which occur during qualification be investigated to

determine and correct the cause before any more studs are welded. WES-1 does not address this requirement.

9. Reference Paragraph 3.5.1.1

*AWS D1.1 does not allow this exception to the requirement for a full 360-degree fillet.

10. Reference Paragraph 3.5.1.2

The maximum acceptable amount of undercut should be specified.

11. Reference Paragraph 3.6.2

*AWS D1.1, Paragraph 4.30.1 requires that stud shear connectors which do not show a 360-degree weld fillet or have been repaired by welding, or exhibit less than the specified reduction in length, be bent to an angle of at least 15 degrees as a test of the soundness of the weld. WES-1 specifies that only the first two SMAW repaired studs done each day by each welder be bent. Studs not meeting the length requirements are not required to be bent by WES-1.

12. Reference Paragraph 3.8.1

Specify in WES-1 the requirements of AWS D1.1, Paragraph 4.29.5 regarding repair of base metal after a stud has been removed.

13. Reference Paragraph 3.9.2

See comment "12" above.

14. Reference Appendix B, Site QC Schedule

*The frequency of inspection specified is less than required by AWS D1.1.

C. A040KPCCP-15, Revision 10, "Fabrication and Erection of Miscellaneous and Structural Steel"

Revision 10 of CCP-15 is a combination of the previous revisions of CCP-15 and A040KPCCP-17, "Erection of Category I Structural and Miscellaneous Structural Steel".

CCP-17 is no longer in use. Past revisions of this procedure were not reviewed. This procedure was reviewed only for welding content. Details of the erection of structural steel not related to welding were not reviewed.

1. Reference Paragraph 6.1

This paragraph is not required because Paragraph 8.1.3.2 specifies that all welding will be done in accordance with MECP-2 and MECP-12.

2. Reference Paragraph 8.1.2

Use consistent terminology, e.g., detail drawings, fabrication drawings (paragraph 8.1.2.5), Construction Structural Engineering, Structural Engineering (paragraph 8.1.2.5), fabrication superintendent, craft superintendent (Paragraph 8.1.3.14).

3. Reference Paragraph 8.1.3.4

Transferring of heat codes prior to cutting should be witnessed by QC inspector.

4. Reference Paragraph 8.1.3.6

Clarify the meaning of "shop fabricators."

5. Reference Paragraph 8.1.3.8

Reference to "low-stress steel stenciled" is unclear. Is this a steel stamp or paint stencil? Clarify meaning of "metal marker."

6. Reference Paragraph 8.1.3.9

Work piece shall be air-cooled to room temperature after straightening; quenching is not allowed. The Project Welding Engineer (with Design Engineering's concurrence) shall approve straightening of all high-strength, low-alloy materials. Heat should not be applied to high-strength bolting material or to torqued connections.

7. Reference Paragraph 8.1.3.15 and 8.1.3.17

Requirements of AWS D1.1, paragraphs 4.28.8 and 4.30.4 must be met.

8. Reference Paragraph 8.2.2.10.4

Calibration of torque wrenches should be witnessed and documented by the QC inspector.

9. Reference Paragraph 8.2.3.1

Clarify the meaning of "the constructor."

10. Reference Paragraph 8.2.3.5

Construction Structural Engineering (with Design Engineering concurrence) should approve any modifications of members not specified on the drawings.

11. Reference Paragraph 8.2.4.2

It is not clear from the wording of this paragraph that mark number or heat code should be readily identifiable after welding and erection. This paragraph also applies to members other than embeds.

12. Table 1

Incorrect references are given for Items 2.1.2, 2.1.4 and 3.1.1. Suggest that all references be carefully checked.

13. Illustration 1

Documentation of the required inspections for multiple piece marks may be difficult on the present form without a set of

written instructions explaining how to complete the form. Explain how the following situations will be handled:

a. More than one welder or WPS.

b. Multiple piece marks.

c. More than one piece for each piece mark.

d. Pieces erected in different buildings, rooms or elevation. The detailed instructions can be used during training of weld technicians.

APPENDIX G

REVIEW TEAM COMMENTS ON THE NONDESTRUCTIVE EXAMINATION PROCEDURES

A. ST-NDEP 2.1, Radiographic Examinations, Revisions 1 through 9

1. Reference paragraph 4.2b, Revisions 6 through 9

This procedure allows the use of two exposures for double wall exposures, double wall viewing or three exposures for superimposed images. Although this is allowed by the ASME Section V, adequate coverage is usually not obtained and/or adequate film density obtained on small diameter heavy wall pipe.

2. General, Revisions 1 through 9

The procedure does not specify the minimum source to film distance or the maximum focal spot size which are recorded on the radiographic review form. These parameters are only indirectly controlled by the geometric unsharpness and, therefore, should be stated to control these parameters directly.

3. General, Revisions 1 through 9

This procedure or other applicable referenced procedures do not require that a standard convention be used for the location of radiographic station markers, i.e., "zero" at 12 o'clock, station markers placed at two inch intervals, clockwise down stream.

4. General, Revisions 1 through 9

This procedure does not adequately describe the control of repair radiographs, such as identifying the repair radiograph as R-1, R-2. Also, there is a distinct advantage in storing the repair film in the same package as previous repair and original films.

5. General, Revisions 1 through 9

The procedure does not contain a reference to the placement of source side or film side location markers in accordance with the code reference.

6. General, Revisions 5 through 9

This procedure does not require that the geometric unsharpness (U_g) be calculated or that the density be monitored. Both these items are highly recommended.

B. ST-NDEP 3.1, "Visual Examination, Revisions 1 through 6.

1. Reference paragraph 4.4.2, Revisions 1 through 6

This procedure contains an indirect lighting requirement, but does not state the minimum lighting requirements of 15 foot candles for general examination and 50 foot-candles for study of small anomalies, as specified in ASME Section V, T-923(a).

2. Reference paragraph 5.5, Revisions 1, 2, 3

The procedure does not contain or reference any acceptance criteria as required in ASME Section V, T-670.

3. Refernce paragraph 1.0, Revision 6

The procedure exempts the requirements for procedure qualification. Assurance by the inspector that NDE procedure qualification was performed is a requirement of the code references. A report of demonstration that the procedure was adequate is also required by ASME Section III, NA 5254 and Section V, T-930(c).

4. Reference paragraph 4.4, Revisions 2 through 6

The procedure requires dimensional control of various weld bead contours such as maximum reinforcement, fillet size, undercut, etc., with no provision for a uniform method of measurement of these characteristics.

5. General Comment, Revisions 2 through 4

The actual acceptance criteria for a given weld is sometimes difficult for an inspector to determine. An example is that the acceptance criteria for the Essential Cooling Water System must be extracted from the text of three documents, ST-NDEP 3.1, A040KPMECP-4, and A040KSWES-4.

C. ST-NDEP 4.1, "Liquid Penetrant Examination", Revisions 1 through 7.

1. Reference paragraph 4.2, Revision 1

The record of procedure qualification was not attached to this procedure as stipulated in paragraph 4.2 of this procedure.

2. Reference paragraph 4.3.2, Revisions 1,2,3,5,6, and 7

This procedure does not identify all the penetrant materials allowed for use as required by ASME Section V, T-681(a).

3. Reference paragraph 5.1.1, Revisions 1,3,5,6, and 7

Cleaning agents such as acetone and alcohol are exempt from batch analysis for sulfur and halogens. This analysis is required by ASME Section V, T641(d).

4. Reference paragraph 5.1.2, Revisions 1 through 7

The ASME Section V, T-643, requires that surfaces for examination shall not be below 60°F nor above 125°F. The procedure does not make provision for assuring the temperature limits are met.

5. Reference paragraph 5.1.5, Revision 1

The procedure does not identify a minimum drying time as required by ASME Section V, T-645.

6. Reference paragraph 5.1.5, Revisions 1, 2, 3 and 5

The procedure specifies "blotting" and "wiping" for the purpose of drying, which is not allowed by ASME Section V, T-645.

7. Reference paragraphs 5.2 and 5.4, Revision 1

This procedure does not contain acceptance criteria as required by ASME Section V.

D. ST-NDEP 5.1, "Magnetic Particle Examination", Revisions 1 through 7

1. Reference paragraph 5.2, Revisions 1 through 6

The procedure does not adequately define the materials, shapes, or sizes to be examined, as required.

2. Reference paragraphs 5.2 and 5.3, Revisions 1 through 6

The procedure does not specify the ferromagnetic particles to be used, i.e., manufacturer, color, wet or dry, as required by ASME Section V, T-726.

3. General Comments, Revision 3

The procedure does not address the direction(s) of magnetization relative to geometric shape; this is not a code requirement.

APPENDIX H1

LIST OF INSPECTORS AND CERTIFICATIONS REVIEWED

INSPECTOR IDENTIFICATION NUMBER	VT-II	PT-II	RT-II	AWS VT-II	PQT RT-II	PQT VT-II
1.	X	X		X		
2.	X	X	X	X	X	
3.						X
4.	X	X				
5.		X	X		X	
6.	X	X		X		
7.				X		
8.	X		X		X	
9.					X	
10.				X		
11.			X		X	
12.		X	X	X	X	
13.				X		X
14.	X	X				
15.			X		X	
16.	X	X				
17.			X		X	
18.	X	X				

APPENDIX H1

LIST OF INSPECTORS AND CERTIFICATIONS REVIEWED

INSPECTOR IDENTIFICATION NUMBER	VT-II	PT-II	RT-II	AWS VT-II	PQT RT-II	PQT VT-II
19.	X	X	X		X	
20.	X	X				
21.	X	X		X		
22.	X	X		X		
23.				X		
24.	X			X		
25.	X	X				
26.	X			X		
27.	X	X		X		
28.	X	X		X		
29.						X
30.				X		
31.					X	
32.	X		X	X		
33.				X		
34.			X	X		
35.	X	X		X		X
36.	X	X				

APPENDIX H1

LIST OF INSPECTORS AND CERTIFICATIONS REVIEWED

INSPECTOR IDENTIFICATION NUMBER	VT-II	PT-II	RT-II	AWS VT-II	PQT RT-II	PQT VT-II
37.	X	X		X		X
38.			X		X	X
39.				X		
40.				X		
41.	X	X				
42.	X					
43.	X		X	X	X	
44.		X				
45.	X	X		X		
46.	X			X	X	X
47.	X	X		X		
48.	X	X				
49.	X			X		
50.	X	X				
51.		X				
52.					X	
53.						X
54.	X	X				

APPENDIX H1

LIST OF INSPECTORS AND CERTIFICATIONS REVIEWED

INSPECTOR IDENTIFICATION NUMBER	VT-II	PT-II	RT-II	AWS VT-II	PQT RT-II	PQT VT-II
55.			X		X	
56.			X			
57.			X		X	
58.				X		
59.	X	X				
60.			X		X	
61.	X	X				
62.	X	X				
63.	X	X				X
64.	X	X		X		X
65.	X					
66.				X		
67.				X		
68.						X
69.	X			X		
70.	X	X				

APPENDIX H2

NDE INSPECTOR

QUALIFICATION AND CERTIFICATION DISCREPANCIES

INSPECTOR IDENTIFICATION NUMBER	DISCREPANCIES
4.	Inadequate experience and training.
7.	Not certified during examination.
9.	Signed as higher level.
11.	Signed as higher level. Not certified during examination.
12.	Not recertified after rehire.
14.	Inadequate experience. Not certified during examination.

APPENDIX H2

NDE INSPECTOR

QUALIFICATION AND CERTIFICATION DISCREPANCIES

INSPECTOR IDENTIFICATION NUMBER	DISCREPANCIES
16.	Eye exam lapsed (one month).
20.	Inadequate training.
24.	Inadequate experience.
25.	Inadequate experience. No eye exam during examination. Not certified during examination.
30.	Not certified during examination.
32.	Signed as higher level (possible).

APPENDIX H2

NDE INSPECTOR

QUALIFICATION AND CERTIFICATION DISCREPANCIES

INSPECTOR IDENTIFICATION NUMBER	DISCREPANCIES
43.	Inadequate training.
44.	Signed as higher level.
54.	Not recertified after rehire.
55.	Inadequate experience and training.
56.	Signed as higher level (possible).
61.	Inadequate experience.
65.	Not recertified after rehire.

APPENDIX H2

NDE INSPECTOR

QUALIFICATION AND CERTIFICATION DISCREPANCIES

INSPECTOR IDENTIFICATION NUMBER	DISCREPANCIES
67.	Not certified during examination
70.	Not certified during examination. Inadequate training.

APPENDIX J1

PROJECT DOCUMENTS REVIEWED

A. CONSTRUCTION AND QUALITY CONTROL PROCEDURES

WELDING CONSTRUCTION PROCEDURES

A040KPWCP-1 Control of Welding Materials (Superseded by A040KPMECP-8)

A040KPWCP-2 Administration and Organization of Welding Engineering Department

A040KPWCP-3 Administration and Organization of Welder Qualification and Training Center

A040KPWCP-4 Administration and Operation of the Weld Data Control Center

A040KPWCP-5 Administration and Organization of Field Weld Technical Center

MATERIAL ENGINEERING AND QUALITY CONSTRUCTION PROCEDURES

A040KPMECP-1 Qualification of Welders and Welding Operators A40KPMECP02 Field Fabrication and Welding of Structural Steel to the Requirements of AWS D1.1

A040KPMECP-4 Field Fabrication and Welding of Piping Systems and Component Supports - Nuclear Systems

A040KPMECP-8 Control of Welding Materials

CIVIL CONSTRUCTION PROCEDURES

A040KPCCP-15 Fabrication of Miscellaneous Steel

A040KPCCP-17 Erection of Category I Structural and Miscellaneous Structural Steel

MECHANICAL CONSTRUCTION PROCEDURES

A040KPMCP-2 Fabrication and Installation of Safety Related Piping Systems

A040KPMCP-7 Field Fabrication and Installation of Pipe Hangers and Supplementary Steel Supports

APPENDIX J1

PROJECT DOCUMENTS REVIEWED

WELDING ENGINEERING STANDARDS (Site)

A040KSWES-1	Stud Welding
A040KSWES-4	Field Welding of Aluminum-Bronze Pipes (Inspection Plan)
A040KSWES-11	Electronic Alignment, Performance Verification and Maintenance of the Dimetrics Gold Track II Automatic Welding System
A040KSWES-12	Main Coolant Loop Pipe Welding

B. ENGINEERING DOCUMENTS

ENGINEERING TECHNICAL REFERENCE DOCUMENTS

1A890WQ002	Weld Joint Design Specification
1A47WQ003	Pipe Weld Numbering
1L019PD002	Criteria for Piping Design
A010PQ002	Piping Erection and Field Fabrication Criteria
5L019PQ004	Criteria for Piping Design
1L369RQ006	Criteria for the Design of Pipe Supports
1L379RQ012	Simplified Procedure for Supporting Hot or Cold ASME Piping of Dimensions 6" and Below
3L369RQ014	Typical Pipe Supports for 6" Nominal Diameter Pipe and Under
Z019ZQ003	Instrument Piping and Installation Design Criteria Document
3E204SQ013	Electrical Cable Tray Hangers (Class 1E) Design Process

APPENDIX J1

PROJECT DOCUMENTS REVIEWED

ENGINEERING SPECIFICATIONS

1U020WS001	Weld Filler Material
1L020PS100	Fabrication Specification for ASME Section III Piping 2 1/2 Inches and Larger
1L060PS101	Bulk Piping Material Specification
1L360PS102	ASME III Pipe Hangers and Supports
3A010SS012	Category I Structural Steel Specification
3A010SS026	Category I Miscellaneous Steel Specification
3A010SS030	Erection of Category I Structural Steel Specification

APPENDIX J2

SUMMARY OF PSAR/FSAR BASE CODES

	CODES AND STANDARDS REQUIREMENTS	
	PSAR	FSAR
A. Concrete and Category I Structural Steel Internal Structures of Concrete Containment (3.8.3)	AISC-69 Spec. for Design, Fabrication and Erection of Structural Steel for Buildings (3.8.3.2.1) AISC-69 Manual of Steel Construction (3.8.3.2.3) NRC Regulatory Guides 1.28, 1.38, 1.50, 1.71, 1.74, 1.80 (3.8.3.2.2).	AISC-69 Spec. for Design Fabrication and Erection of Structural Steel for Buildings with Supplements 1.2,3, (3.8.3.2.1) 1971 edition is referenced as applicable in 3.8.3.4.5, 3.8.3.6.4, and 3.8.3.6.4.3. Examination and testing of material is per 1969 edition (3.8.3.6.4.3) AISC-71 Code of Standard Practice for Steel Building and Bridges (3.8.-3.2.1). AWS D1.1-1974 Structural Welding Code and Addenda (3.8.3.2.1). NRC Regulatory Guide 1.94, Rev. 0 (3.8.3.2.2.) Table 3.12-1, however, takes partial exception.
B. Other Category I Structures (MEAB, DGB, FHB, Intake, ECW Intake, ECW Discharge, Class IE Underground Electrical Raceway, Condensate Storage Tank) 3.8.4.	AISC-69 Spec. for Design, Fabrication and Erection of Structural Steel for Buildings. AISC-69 Manual of Steel Construction	AISC-69 Spec. for Design, Fabrication, Erection of Structural Steel for Building with Supplements 1, 2 & 3. AWS D1.1-72 Structural Welding Code. AISC-70 Manual of Steel Construction

APPENDIX J2

SUMMARY OF PSAR/FSAR BASE CODES

		NRC Regulatory Guide 1.94, Rev. 0, Partial Exception taken in Table 3.12-1 and 3.8.4.2.3
C. ASME Section III Piping and Supports	ASME III (1) ASME XI	ASME III (1) ASME XI, 1974 through Summer 1975 (6.6.1) R.G.1.44, Rev. 0 (2) R.G.1.50, Rev. 0 R.G.1.84, Rev. 11 (17 Code Cases on welding NDE) R.G.1.85, Rev. 11 (6 Code cases on welding NDE)
D. Quality Assurance Requirements Pertaining to Welding/NDE	ANSI N45.2-1971 (R.G.1.28, Rev. 0) ANSI N45.2.1973 (R.G. 1.37, Rev. 0) ANSI N45.2.2-1972 (R.G. 1.38, Rev. 0) ANSI N45.2.3-1973 (R.G.1.39, Rev. 0) ANSI N45.2.4-1972 (R.G.1.30, Rev. 0) ANSI N45.2.5-Draft 3 Rev. 3 (WASH-1309) ANSI N45.2.6-1073 (R.G.1.58, Rev.0) ANSI N45.2.8-Draft 3 Rev. 3 (WASH-1309) ANSI N45.2.9-1974 (R.G.1.88, Rev. 0) ANSI N45.2.10-1973 (R.G.1.74, Rev. 0) ANSI N45.2.11-Draft 3, Rev. 1 (R.G.1.64, Rev. 0) ANSI N45.2.12-Draft 3, Rev. 4 (WASH-1283) ANSI N45.2.13-Draft 4, Rev. 4 (WASH-1283)	ANSI N45.1-1971 (RG.1.28, Rev. 0) ANSI N45.2.1-1973 (R.G. 1.37, Rev. 0) ANSI N45.2.2-1972 (R.G. 1.38, Rev. 2) ANSI N45.2.3-1973 (R.G.1.39, Rev. 2) ANSI N45.2.4-1972 (R.G.1.30, Rev. 0) ANSI N45.2.5-1974 (R.G.1.94, Rev. 1) (3) ANSI N45.2.6-1973 (R.G.1.58, Rev. 0) ANSI N45.2.8-1975 (R.G.1.116, Rev. 0) ANSI N45.2.9.1974 (R.G.1.88, Rev. 2) ANSI N45.2.10-1973 (R.G.1.74, Rev. 0) ANSI N45.2.11-1974 (R.G.1.64, Rev. 2) ANSI N45.2.13-1976 (R.G.1.123, Rev. 1)

APPENDIX J2

SUMMARY OF PSAR/FSAR BASE CODES

NOTES

(1) Per 10 CFR 50.55 (a), the applicable code edition and addenda are established by date of purchase order for piping and support material. Field welding and NDE code of reference was based on the commitment made in the first purchase order issued for material, which was 1974 through Winter 1975.

(2) Conforms to the intent of the Regulatory Guide.

(3) Partial exception taken to sampling point of concrete and testing frequency of cadweld splices.

APPENDIX J3

SUMMARY OF PROJECT DOCUMENT REFERENCES TO CODES/STANDARDS

CODE		CODE EDITION REFERENCED		
AWS D1.1		1974 3A010SS030	1975 A040KPMECP-2 A040KSWES-1 3A010SS026(1)* 3A010SS012(1) A40KPCCP-15	No Date A040KPMECP-1 A040KPCCP-17
AISC Code	7th Edition A040KPMECP-2	1970 3A010SS026	1972 3A010SS012 3A010SS030	Latest Edition A040KPCCP-17
AISC Specification	7th Edition A040KPMECP-2 3A010SS026(2)	1971 3A010SS012 3A010SS030		No Date A040KPCCP-17
ASME II		1974-W75 1U020WS001 1L060PS101 1L020PS100		
ASME III		1974-W75 1L360PS102 1L020PS100 1L369RQ006 1U020WS001 5L019PQ004 A010PQ002	1977-W77 1L060PS101	No Date A040KPMECP-1 A040KPMECP-4 A040KPCCP-17 A040KPMCP-2 A040KPMCP-7 1L019PD002 A010PQ002 1A890WQ002
ASME V				No Date A040KPMECP-4
ASME IX	1974-W75 1L020PS100	Latest Edition A040KPMECP-4		No Date A040KPMECP-1
ASME XI	1974-S75 A010PQ002			

APPENDIX J3

SUMMARY OF PROJECT DOCUMENT REFERENCES TO CODES/STANDARDS

CODE	CODE EDITION REFERENCED		
ANSI N45.2	1971	1972	No Date
	A040KPWCP-4	3A010SS030	A040KPWCP-3
	11060PS101		A040KPWCP-5
	1U020WS001		A040KPMECP-2
	A010PQ002		
ANSI N45. 2.1	1973		
	1L060PS102		
	A010PQ002		
ANSI N45. 2.2	1972		No Date
	1L360PS102		A040KPCCP-17
	1L060PS101		
	3A010SS030		
	3A010SS026		
	1U020WS001		
	A010PQ002		
	1L020PS100		
ANSI N45. 2.3	1973		No Date
	3A010SS030		A040KPCCP-17
ANSI N45. 2.5	1974		
	3A010SS030		
ANSI N45. 2.9	1974		
	3A010SS030		
	A010PQ002		
ANSI N45. 2.11	1974		
	3A010SS026		
ANSI N45. 2.13	1975		
	3A010SS030		

APPENDIX J3

SUMMARY OF PROJECT DOCUMENT REFERENCES TO CODES/STANDARDS

NOTES

(1) Code effective date is identified "1975 or later editions"

(2) Code effective date was changed to the Seventh Edition on 3/20/80 via Revision G. Previously, the 1971 supplement had been referenced.

*Numbers in parenthesis refer to notes at the end of table.

APPENDIX K

INVESTIGATION OF UNRESOLVED ITEMS IN NRC INVESTIGATION REPORT, 79-19

1. NRC Tracking No. 79-19-31, Questionable Practices During Welder Qualifications - Qualification Position.

The NRC inspector observed that welder qualifications in the 2G position (pipe axis vertical) were done in two parts. After approximately half of the weld was completed, the arc was terminated, and the test coupon was rotated so that the unfinished portion of the weld was accessible to the welder. Only approximately half of the weld was accessible to the welder because of the layout of the qualification booth. After rotating the pipe the weld was completed.

In paragraph QW-122.2 of ASME Section IX describing the 2G pipe position it is stated that the pipe "shall not be rotated during welding". The NRC inspector interpreted the requirements to mean that the entire weld had to be made as one continuous 360 degree weld.

The Review Team concluded that the intent of the Code was to simulate the condition of joining two fixed vertical runs of pipe. Under these conditions, it is normal for the welder to partially complete the weld, terminate the arc, move around the pipe to a position which affords better access to the remaining weld, and complete the weld. In 2G position qualification, it is normal to terminate the arc one or more times during the test and move to a position which affords better access.

The only unusual condition noted by the Review Team was that the test coupon was moved, rather than the welder. This was necessary in this situation because there was not enough room for the welder to move around the fixed pipe coupon.

The Review Team concluded that there was no difference between moving the coupon after the arc was terminated and moving the welder after the arc was terminated. Of importance was that the coupon was not moved during the time when metal was being deposited. In the opinion of the Review Team, no Code violation occurred.

2. NRC Tracking No. 79-19-31, Questionable Practices During Welder Qualifications - Root Spacing and Backing Ring.

The NRC inspector observed that the root spacing in a backing-ring weld for welder qualification had been increased to 3/8 -

1/2 in. instead of 1/16 - 1/8 in. The NRC report did not report where this spacing requirement was specified, but it is assumed that the root spacing was specified in the weld procedure specification used to qualify the welder.

ASME Section IX specifies root spacing as a nonessential variable for qualification of weld procedure specifications (WPS) but does not address it as a variable for welder performance qualification.

The Review Team concluded that the noncompliance occurred because the welder did not follow the WPS. However, since root spacing is not essential for welder qualification, the tests should not be considered invalid. To remedy the Code noncompliance, the should be revised to show the wider root gap. No requalification of the WPS is required because root spacing is a nonessential variable.

The NRC inspector also considered that leaving the backing ring attached to the weld coupon during radiography was improper because the silhouette of the backing ring may interfere with interpretation. The Review Team concluded that the ASME Section IX allowed radiography to be performed with or without a backing ring.

3. NRC Tracking No. 79-19-35, Declassification of Lower Steam Generator Support Columns.

The NRC inspector expressed concern about the removal of the ASME Section III NPT Stamp from the lower steam generator support columns.

The Review Team found that Brown and Root had responded to this concern on February 15, 1980 in a memo(1) from the Engineering Project Manager to the Project General Manager. This memo was reviewed and in the opinion of the Review Team adequately addressed the concerns of the NRC inspector. Exerpts from the memo are provided below:

> The steam Generator and Reactor Coolant Pump Support Columns are designed to be a part of the system that transfers the loads from those components to the Reactor Containment Building Structure. The upper columns are part of the NSSS, which is furnished by Westinghouse. The lower column supports were furnished by Brown & Root and were fabricated by Lamco Industries for Unit 1 and by the Pittsburgh Des-Moines Steel Company for Unit 2. During normal operations, these

(1) J. R. Geurts from J. L. Hawks, "NRC Open Item Concerning Code Classification," Correspondence No. GM-61219, February 15, 1980.

columns carry compression loads from the components to the containment mat. During a seismic or LOCA event, these columns must resist both tension and compression loads. The tensile load between these columns is carried through the concrete slab at Elev. 19'-0" anchor bolts.

The specification for the lower column supports required these items to be designed, fabricated, and erected in accordance with the ASME Boiler and Pressure Vessel Code, Section III, Div. 1, Subsections NA and NF; including Code Case 1644-5, 1974 Edition, Addenda through Winter 1975.

Defects were discovered in the material that welded the baseplates of these supports to the columns. At the time of this discovery, a majority of the Unit 1 assemblies had been shipped to the STPEGS Site. This deficiency was reported to the NRC under the terms of 10CFR50.55(e). The corrective action for this deficiency was to gouge out the defective welds and reweld the material. For those column assemblies which had been shipped to the STPEGS Site, it was necessary that the repair work be performed at the location. A search of the ASME Code failed to reveal any requirements for this type of repair; i.e, major repair work

conducted on this type of part which had previously been accepted by an Authorized Nuclear Inspector and shipped to the construction site. An inquiry was made to the ASME. To satisfy the requirements of the ASME Code, therefore, it would have been necessary for the fabricator to have had a survey of his site facilities. It would have taken from 6 to 8 months to obtain such a survey. The impact on the Project in terms of cost and schedule would have been significant.

In reviewing the design requirements for these column supports, it became apparent that the commitment to follow the letter of the ASME Code was done more in the interest of quality than of necessity. The Code Boundary for the ASME classified material ends at the slab at Elev. 19'-0". Thus, it was mandatory that the upper column supports and the through anchor bolts be classified as ASME Code item, but this requirement did not extend to the lower column supports. The design specification (TRD 1C119S0002) and the fabrication specification (1C119SS035) were then revised to show the lower columns being classified as Category I structural steel members under the AISC Code. This revision of Code classification effectively deleted the necessity for Code stamping and for any Certificate of Authorization for Site work. The revision to the

design specification and the fabrication specification is completed. The FSAR Change Notice has been submitted in accordance with Project Procedures and is currently in work.

The Code stamps were removed by B&R and the repair work was done at the STPEGS Site by the Pittsburg-Des Moines Steel Company. All repair work was done in accordance with ASME Code requirements and the repair work was witnessed by the Pittsburg-Des Moines Steel Company's Authorized Nuclear Inspector. The original intent to maintain ASME type quality on these columns was therefore maintained, even though there was no Regulatory, ASME, or State requirements to do so.

The NRC inspector questioned the alignment practice used to install the steam generators. The Review Team did not investigate this unresolved item.

4. <u>NRC Tracking No. 79-19-36</u>, <u>Declassification of the Fuel Transfer Tube</u>.

The NRC inspector expressed concern about the removal of the ASME Section III NPT stamp from the Fuel Transfer Tube.

The Review Team found that Brown and Root had responded to this concern on February 15, 1980 in a memo[2] from the Engineering Project Manager to the Project General Manager. This memo was reviewed and in the opinion of the Review Team adaquately addressed the concerns of the NRC inspector. Excerpts from the memo are provided below:

> In the PSAR, we stated that the Containment structure, including the liner, would be designed, fabricated, and erected in accordance with the proposed ACI 359/ASME Section III, Div. 2, Code 1973; including Addendas 1 through 6. The following exceptions to this commitment were taken.
>
> 1. Authorization & Code Stamping Requirements
> 2. Personnel Qualifications for Level III Inspections
>
> In this commitment, however, we were inconsistent because we committed to the classification of the Containment penetrations to a different Code. Historically, the Containment penetrations, which are part of the Containment pressure boundary, fall under

(2) J. R. Geurts from J. L. Hawks, "NRC Item Concerning Code Classification," Correspondence No. GM-61219, February 15, 1980.

the jurisdiction of the ASME Boiler and Pressure Vessel Code, Section III, Div. 1, Class MC (which requires stamping and authorized inspections) since these penetrations had historically been part of a stamped Containment liner. On STP, however, the penetrations are an ample part of an unstamped Containment vessel and thus, therefore, have equal Code treatment as the liner itself. This fact was brought to our attention when the Authorized Nuclear Inspector for one of our suppliers refused to allow the penetrations to be stamped for the reasons stated previously. The Fuel Transfer Tube Sleeve fits into this category; i.e., requiring the same Code classification as the Containment vessel. Originally, however, the Fuel Transfer Tube Liner was classified as an ASME Section III, MC component.

The Fuel Transfer Tube System consists of the following three separate assemblies:

1. The sleeve and bellows inside the Containment.
2. The penetration sleeve through the Containment.
3. The sleeve and bellows inside the Fuel Handling Building.

Each individual sleeve and bellows was hydro tested in the shop, but none of the three assemblies listed above were hydro tested as a unit.

During the erection of the three assemblies listed above at the STPEGS Site, several problems were encountered regarding Authorized Nuclear Inspector witnessing of hydro testing. Since B&R Engineering was in the process of revising the Code classification of this component, these problems were automatically dispositioned since the requirement for the Authorized inspections were no longer valid. We did, however, attempt to follow Code requirements in every respect possible to ensure that our commitments toward quality assurance were honored. For example, a separate Design Specification was created for the Fuel Transfer Tube Sleeve (TRD 2F269S0004), even though a design specification was no longer required. All welds were hydro tested and hydro test records maintained in a manner similar to that which would be required by the ASME Code. At one time, all components and welds were hydro tested, but the entire unit was not hydro tested after it was completely assembled due to accessibility problems. The unit will be totally tested during the Containment Integrity Pressure Test. The unit met all of the Code requirements from the point of view of

design, fabrication, examination, and erection, but not all of the hydro tests were witnessed by an Authorized Nuclear Inspector.

At the present time, an FSAR Change Notice has been submitted and processed to the Client in accordance with applicable Project Procedures. This change clearly identifies the fuel transfer tube sleeve as an integral part of the Containment liner but not requiring stamping or authorized nuclear inspections, but being designed, fabricated, and erected in accordance with the requirements of the ASME Code. This change will be included in the next scheduled published revision of the FSAR.

In summary, it is our opinion that the Fuel Transfer Tube was designed, manufactured, and erected in accordance with Quality Assurance requirements that are in excess of those required by the Code in affect.

5. <u>NRC Tracking No. 79-19-37, Control of Attachment Welds to Heat Treated Equipment Supports</u>

The NRC inspector expressed concern about the apparent lack of control and lack of documentation of attachment welds to the lower steam generator support columns and other similiar supports.

The Review Team did not investigate this unresolved item.