UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of)

Philadelphia Electric Company) Docket Nos. 50-352
50-353

(Limerick Generating Station,)
Units 1 and 2)

TESTIMONY OF VINCENT S. BOYER, JAMES M. CORCORAN, JR., DAVID T. CLOHECY, FRANK J. COYLE, ROBERT H. ZONG, H. WILLIAM VOLLMER, JOHN W. BENKERT, VINOD AGGARWAL, DR. JOHN W. FISHER, RICHARD A. SIMANEK, AND DALE B. HACKNEY RELATING TO CONTENTION VI-1.

INTRODUCTION

V. S. Boyer
J. M. Corcoran
D. T. Clohecy

1. On October 28, 1983 the Atomic Safety and Licensing Board Issued its Memorandum and Order Confirming Rulings Made at Prehearing Conference which partially admitted Air and Water Pollution Patrol's (AWPP) Contention VI-1. This Contention was reworded by the Licensing Board as follows:

> "Applicant has failed to control performance of welding and inspection thereof in accordance with quality control and quality assurance procedures and requirements, and has failed to take proper and effective corrective and preventive actions when improper welding has been discovered."

AWPP also filed a pleading containing a number of specific welding deficiencies in addition to one the described in NRC Inspection Report 50-353/76-06 which AWPP asserted supported this contention. The Licensing Board eliminated a number of these specific examples from litigation in its

Memorandum and Order ruling on Applicant's Motion to Strike specific Instances Advanced by AWPP in Support of Contention VI-1 (April 2, 1984).

This testimony includes the following:

° A description of the Quality Assurance Program for the Limerick Generating Station ("Limerick" or "LGS") as it relates to welding.

° Experience with implementation of the welding Quality Assurance Program at LGS.

o A description of the welding program including industry and project programmatic improvements to the welding program at Limerick.

o A description of the NRC IE Item 353/76-06-01 and an analysis of its resolution.

o An evaluation of the lack of safety significance of the relatively few welding deficiencies advanced by AWPP which were identified by the NRC IE.

o A discussion of the specific examples advanced by AWPP.

SUMMARY

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D.T. Clohecy
F.J. Coyle

2. The quality of welding at the Limerick Generating Station is achieved through the use of skilled personnel, advanced planning, procedures, proper definition of job requirements, and appropriate supervision and technical direction. Quality is verified through surveillance, inspection, testing, checking and review work activities and documentation. Quality verification is performed by individuals who are not directly responsible for performing the work activity.

J.M. Corcoran
D.T. Clohecy
F.J. Coyle

3. The Limerick Quality Assurance Program, which meets the requirements of 10CFR, Part 50, Appendix B, encompasses all phases of welding from design to final verification. This program is effective in assuring that the welding meets the quality requirements and satisfies the design criteria required for the safe operation of the plant.

J.M. Corcoran
D.T. Clohecy
F.J. Coyle

4. Throughout the course of construction of the Station, Philadelphia Electric Company has monitored, through audits, all welding related activities involved in the construction of the Limerick Generating Station. The results of these audits have confirmed that the Quality Assurance Program, as it pertains to welding, is effectively assuring that Limerick Generating Station will be a safe and reliable plant.

J.M. Corcoran
D.T. Clohecy
F.J. Coyle

5. While the Quality Assurance Program and its implementation as it pertains to welding has always been adequate to assure that welding at Limerick meets or exceeds the quality standards required to meet the safe operational needs of the plant, a

number of changes and improvements in the implementing procedures have been made to provide for clarification and uniform interpretation and implementation of the applicable requirements.

J.M. Corcoran
D.T. Clohecy
F.J. Coyle

6. A description of the NRC Inspector's findings, as documented in IE Item 353/76-06-01, relative to two structural weld deficiencies which were accepted by a particular quality control inspector, is included. The Company's corrective actions taken in 1976 and 1977 are also discussed as is the Companyt's 1983 review of the original Quality Assurance Records to assure that welds for which the subject Quality Control Inspector had final inspection responsibility were satisfactorily reinspected or otherwise properly dispositioned. The small number of minor structural weld deficiencies identified, including those four welds dispositioned "repair" or "rework" in 1976, together with the welds inaccessible for reinspection due to coverage by concrete have all been evaluated and found to have no effect on safety.

V.S.Boyer
J.M.Corcoran
F.J.Coyle
J. Benkert

7. AWPP has cited several NRC inspection items which it describes as a chronology of pertinent examples evidencing improper control of welding and failure to take proper corrective action when welding infractions have been discovered. A full discussion of the circumstances surrounding each item is included . A complete definition of the instances cited by AWPP, the action taken to resolve the matters and a discussion of the NRC's follow-up inspection activities which verified and evaluated the resolution of each is also provided. This discussion demonstrates that AWPP's examples are isolated, nonprogrammatic in nature, and in fact, indicative of the effective quality assurance program at Limerick Generating Station.

DEFINITION OF TERMS

R. H. Zong
D.B.Hackney

9. The following definitions of technical terms from AWS D1.1-1972 Sect. 3.6 and Appendix I, Terms and Definitions, are provided.

- o Weld Profile - the cross sectional view of the weld, as related to surface contour with respect to convexity, concavity, undercut, or overlap, and aspects affecting size.
- o Fillet Weld - A weld of approximately triangular cross-sections joining two surfaces at approximately right angles.
- o Undercut - A groove melted into the base metal adjacent to the toe or root of a weld and left unfilled by weld metal.
- o Toe of Weld - The junction between the face of a weld and the base metal
- o Root of Weld - The points, as shown in cross-section at which the back of the weld intersects the base metal surfaces.
- o Overlap - Protrusion of weld metal beyond the toe or root of the weld.
- o Size of Weld - For equal leg fillet welds, the leg length of the largest isosceles right-triangle which can be inscribed within the fillet-weld cross-section.

Description of the Quality Assurance Program as it Relates to Welding

10. The Philadelphia Electric Company is implementing a Quality Assurance Program for its Limerick Generating Station which meets the requirements of 10CFR Part 50 Appendix B.

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J.M.Corcoran

The Quality Assurance Program has three levels of verification. Philadelphia Electric Company provides the third level of review and verifies that Bechtel's design work results in clear instructions to the construction force. The construction force's application of these instructions in the actual welding program is also subject to a three level verification program. Philadelphia Electric Company is again the third level to ensure that the welding is being performed and inspected in accordance with the requirements of the welding program. These levels and how they interact are discussed below. This program is most recently described in the June 10, 1983 (Ref. 1, Appl. Exh.___) and the September 15, 1983 (Ref. 2, Appl. Exh.___) letters submitted to the NRC.

From a management perspective, design verification, inspection, surveillance, auditing and evaluation has enabled Philadelphia Electric Company to maintain control over the welding activities and assure a high-quality end-product.

11. Philadelphia Electric Company's experience with nuclear power at Peach Bottom Atomic Station is the basis upon which the Company has established and implemented its quality assurance program for Limerick Generating Station. The Company realizes that the high reliability which is being achieved at Peach Bottom is the result of the high quality standards that the plant was required to meet during construction.

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12. Because of Peach Bottom and Limerick, Philadelphia Electric Company has been involved in the maturation of quality assurance. At Peach Bottom,the Company learned the value of quality assurance through the problems it encountered and the resolutions it worked out.

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13. The Company has always been committed to high quality standards and, because of its experience at Peach Bottom, has committed itself to a strong quality assurance program to attain these high standards at its nuclear facilities. In an effort to provide continuity and assure that the lessons learned at Peach Bottom could be effectively taken into account at Limerick, Philadelphia Electric Company contracted with Bechtel Power Corporation, the Architect-Engineer for Peach Bottom, to design and construct the Limerick Generating Station. Philadelphia Electric Company also contracted with Bechtel Power Corporation to design and construct Limerick Generating Station because of its expertise, manpower and commitment to quality. Philadelphia Electric Company, in accordance with the Quality Assurance Program, oversees all aspects of Bechtel's work to to assure that high quality standards are met. The overall quality assurance requirements of the Limerick Project were established by Philadelphia Electric Company management at the beginning of the project and have been updated and emphasized on an as-needed basis. Bechtel Power Corporation was directed to incorporate these quality requirements into its Quality Assurance Program. The three-level verification program applies not only to original design and any subsequent changes, but to assuring that construction is in accordance with the design.

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J.Benkert
V.Aggarwal

14. The combined efforts of Philadelphia Electric Company and Bechtel Power Corporation in the preparation, review and approval of the documents governing and implementing the Quality Assurance program as it relates to welding results in a high degree of quality in welding-associated activities. As described later, the multi-tiered program of inspection and auditing has confirmed this conclusion.

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D.B.Hackney

15. Bechtel has been involved in nuclear power plant engineering and construction from the inception of the nuclear power industry and has participated in engineering, procurement or construction activities in approximately 40 percent of the domestic power plants either in operation or under construction. The experience gained in these activities is factored into engineering specifications, QA programs, welding procedures and construction methods.

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D.B.Hackney

16. This is further supplemented by special centralized service organizations such as Material and Quality Service (M&QS) which has a staff of technical experts to assure that Bechtel remains current in welding technology. M&QS has approximately 125 professional personnel representing a total of approximately 2100 man-years of experience in such disciplines as welding engineering, construction welding, metallurgy, materials selection, corrosion, and nondestructive examination.

Limerick Welding Program

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17. The Limerick field welding program covers all aspects of the welding operation including specifying and ordering weld filler metal, control and distribution of all weld filler metal, testing and training of all welders, authorization to weld, in-process inspections, field surveillance, problem solving, technical support, drawing review, final inspection, and record keeping and traceability systems.

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18. Limerick Field Welding Engineering is responsible for providing on-site direction to construction personnel involved in welding activities. Field Welding Engineering is comprised of people with a broad mix of skills including graduate metallurgical and welding engineers, journeymen welders and document control specialists. Presently thirty welding engineers represent a combined welding experience level of 514 years, of which 241 have been in the field of nuclear welding. This averages seventeen years of welding experience per engineer, of which about one-half is nuclear welding. Sixty-six percent are certified for Level II NDE examinations, and forty-three percent are AWS certified welding inspectors. This level of experience, combined with the availability of the Bechtel home office M&QS department, provides an efficient and experienced team to implement the Bechtel quality program.

Three-Level Quality Assurance Verification Program

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19. The three-level verification program mentioned earlier utilizes the defense-in-depth concept. As noted earlier, the three levels assure that the Limerick design contains high quality standards. The three levels also assure that construction is in accordance with design. The first level, defined as the quality control

inspection function, is performed by Bechtel Power Corporation's quality control organization, which is independent from the construction forces. Quality Control is responsible for assuring that the final end product meets the specified design requirements.

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20. The second level, defined as the quality assurance surveillance function, includes the auditing and/or surveillance performed by Bechtel Power Corporation's Quality Assurance organization which is independent from the construction forces and Quality Control. The third level, defined as the quality assurance auditing function, is performed by Philadelphia Electric Company's Quality Assurance organization which is entirely independent from all Bechtel organizations.

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21. Philadelphia Electric Company performs quality assurance audits and surveillances to assure that the Quality Assurance programs of the first and second level organizations actually function as required. In addition, Philadelphia Electric Company reviews specifications, site procedures and other required documents furnished by Bechtel Power Corporation to assure that the necessary quality requirements have been incorporated in these documents.

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22. The three organizational levels of the verification program, as they relate to welding at the Limerick Generating Station, are described below.

Bechtel Power Corporation Quality Control Weld Inspection Program

"First Level"

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R.A.Simanek

23. The purpose of the construction quality control program for inspection, examination and test control is to verify conformance of construction activities on welded safety-related structures, systems and components with the applicable requirements. This is accomplished by the use of quality control inspection instructions tailored for the Limerick project which specify the inspection activities required, the inspection criteria, and the method and frequency of the inspection activities. Construction Quality Control also provides documented evidence that the completed construction activities conform to the program requirements.

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24. Quality of workmanship is monitored by Field Weld Engineering and Quality Control Engineering on an in-process basis. Final visual examinations are performed by Bechtel Quality Control Inspectors on safety related installations prior to submittal for Nondestructive Examination (NDE) operations as required. Upon an acceptable visual examination, if NDE is required, the assigned Quality Control Inspector flags the component and initiates a Nondestructive Examination Request Form. This request form outlines the method of NDE to be performed, describes the component and its location and, if applicable, notes the welder that performed the work. This request form is submitted to Welding Quality Control where the supplied information is transferred onto an NDE Work Request Form and submitted for NDE.

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25. Bechtel Welding Quality Control monitors and witnesses NDE operations performed by subcontractor personnel to assure that NDE operations are performed on the correct items and within the parameters established by the applicable NDE procedures. Bechtel Welding Quality Control Inspectors witness 100 percent of the ultrasonic examination performed by the subcontractor and review 100 percent of the radiographic film submitted by the subcontractor for technique, film quality and component acceptability. Also, Bechtel Welding Quality Control Inspectors review all subcontractor NDE reports of liquid penetrant, magnetic particle, radiographic and ultrasonic examinations.

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26. Bechtel Quality Control also assures that the proper welding instructions are given to the craft prior to the start of work. This is accomplished by reviewing each weld joint field welding checklist which Field Welding Engineers prepare. Welding Quality Control Inspectors review the checklists to assure that entries by the Field Welding Inspectors are correct and conform to the governing installation requirements. This in-line review requirement also serves to keep Quality Control aware of all new welding starts.

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J.M.Corcoran
D.B.Hackney

27. The inspections, examinations and tests performed by Construction Quality Control assure that the installation is in compliance with design specifications and compliance with the Bechtel Quality Assurance Program.

Bechtel Power Corporation Quality Assurance Weld Quality Audit Program

"Second Level"

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28. The activities associated with field welding on the Limerick Generating Station are controlled by the Project Quality Assurance Program which has been evaluated, approved and monitored by Bechtel Quality Assurance Management, Philadelphia Electric Company and the applicable regulatory authorities (ASME and NRC). The Bechtel Quality Assurance Program for the construction of the Limerick Generating Station contains several methods that provide for the verification of the construction welding program by Quality Assurance. These methods include audit and monitoring of field activities by the project Quality Assurance Group and Management Audits of Quality Assurance.

Project Audits

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29. Project audits are accomplished by the use of the Master Audit Plan (MAP) as a planning tool which defines the frequency and scope of each audit area. Project audits are performed to cover each area annually or at least once within the life of a short term activity. Regularly scheduled audits are supplemented with additional audits on an "as-needed basis".

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30. The MAP for Limerick Project contains eight audit areas that specifically address welding activities and two audit areas that address nondestructive examination activities. One of these areas includes forty-two elements of verification of welding activities, which include filler metal control and distribution, welder qualification, Bechtel NDE personnel

qualification, in-process welding activities, welding procedures, weld repairs, Quality Control activities, post weld heat treatment, weld record documentation, and Quality Control Inspector qualifications. In addition, the MAP includes the audit of subcontractors performing nondestructive examination of welds to verify their conformance with project requirements

31. V.S.Boyer J.M.Corcoran Project audit reports, including all deficiencies noted during the audit and their scheduled completion date, are prepared and distributed to the responsible project management. All deficiencies are followed up and closed out by project quality assurance personnel after verification of the audited organizations' response to audit findings.

Project Monitoring Activities

32. V.S.Boyer J.M.Corcoran Monitoring activities are not intended to be as wide in scope as project audits, but are more in-depth, verifying the in-process controls. When determining the monitoring activities to be performed, previous monitoring and auditing results are considered. The monitoring activities cover applicable ongoing activities, utilizing construction and engineering schedules to determine the areas to be monitored and the frequency of monitoring. Monitoring includes checking for compliance with the project quality program control requirements and the observation of inspection activities, review of records and checking work activities.

33. V.S.Boyer J.M.Corcoran Deficiencies noted by Project Quality Assurance during monitoring activities are documented. The documented deficiency is transmitted to the applicable management

entity for requested corrective action. Completed action is verified by Project Quality Assurance prior to closeout.

Management Audits

34. V.S.Boyer J.M.Corcoran

The project construction activities are audited by Bechtel Quality Assurance Management. The QA Management audit plan includes the audit areas of welding and nondestructive examination control. The QA Management Audit Team includes technical specialists from the M&QS support group who review project welding and nondestructive examination and related activities and QA auditors who review other project quality related activities. The welding related activities audited include welding process control, welding qualification and weld filler material control.

35. V.S.Boyer J.M.Corcoran

At the completion of the QA Management audit, an audit report is transmitted to Philadelphia Electric Company and Bechtel Power Corporation project management. This report identifies all observed deficiencies which are documented as audit findings requiring corrective action. After completion of corrective action by the audited organization, quality assurance personnel verify that the action is complete and adequate before the audit finding is considered closed.

Philadelphia Electric Company's Weld Audit and Evaluation Program "Third Level"

36. V.S.Boyer J.M.Corcoran

Philadelphia Electric Company's third-level verification function of welding at Limerick for the design, construction and pre-operational phases of the project is directed by management through Philadelphia Electric Company's Quality Assurance Program. This third-level

function is accomplished by the performance of audits and surveillances which cover in-process welding and the weld-related activity of the first two levels of the verification program. This audit and surveillance program provides assurance that welding activities are accomplished in a manner that meets applicable Federal regulations and the plant's design criteria and verifies that the first two levels of the program are effective.

37. V.S.Boyer J.M.Corcoran

These audits and surveillances are performed by members of Philadelphia Electric Company's quality assurance organization who are qualified to the requirements of ANSI N45.2.23, "Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants." The scope and purpose of audits are predetermined and written checklists are prepared to conduct the audits. The audits are conducted in accordance with the requirements of the implementing procedures of Philadelphia Electric Company's quality assurance program. The results of the audits are documented, reviewed and evaluated by the quality assurance organization and then forwarded to management for its review and action if necessary.

38. V.S.Boyer J.M.Corcoran

Surveillances are utilized by Philadelphia Electric Company as "mini-audits". As compared to audits, they are limited in scope, usually consisting of the verification of only one activity. As such, surveillances are very useful in the auditing process. An audit to cover an area such as welding may be scoped to verify weld rod control, welder qualification, welding technique and inspection. If one of these areas is deficient, a limited scope surveillance can effectively follow up on the identified area. Over 350 surveillances have been conducted throughout the course of the project.

39. Philadelphia Electric Company has in-depth experience and expertise in welding and welding-related activities in both nuclear and fossil plants. The Company employs degreed metallurgists in both the Engineering and Research and the Electric Production Departments. These individuals have achieved and maintain their qualifications through formal university training, industry seminars and years of working experience.

V.S.Boyer
R.Zong

40. Within the Company's quality assurance organization, many of the individuals are graduate engineers and registered as Professional Engineers. Several of the key individuals are AWS Certified Welding Inspectors. This quality assurance organization is in close contact with the Company's metallurgists for technical consultation and assistance. The quality assurance organization uses the Company's metallurgical laboratory for chemical and physical property tests on materials as part of the performance of audits to determine the quality of materials.

V.S.Boyer
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41. The broad range of experience and integration of welding knowledge enables the Company to properly monitor the welding performance at Limerick. Philadelphia Electric Company's quality assurance organization prepares periodic reports to inform the Vice-President of the Engineering and Research Department, to whom it reports, of all quality assurance matters related to the Limerick project. The Vice-President also receives all audit and finding reports. The receipt of these reports often results in the Vice-President initiating discussions with the Company's Manager of QA and/or the QA Field Branch Head to obtain additional information or updates or to provide direction in certain matters.

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EXPERIENCE WITH IMPLEMENTATION OF THE WELDING QUALITY ASSURANCE PROGRAM AT LGS

Welding Audit and Surveillance Results

42. V.S.Boyer J.M.Corcoran

To date, Philadelphia Electric Company's quality assurance personnel have, on a planned and periodic basis appropriate to the status of the design and construction activities, conducted over 1500 audits. Of these audits, over 400 have been scoped, either in total or in part, to cover welding and welding related activities. These audits have confirmed that the first two levels of the quality program are working effectively to assure that Limerick Generating Station will be a safe and reliable plant.

43. V.S.Boyer J.M.Corcoran

Philadelphia Electric Company is confident its audit program works well. The overall scheduling of audits, as well as the techniques utilized in performing the audit function, provide this confidence. Audits have been scheduled to cover all aspects of the work activities while taking into consideration the quantity, difficulty and importance of each activity. As previously mentioned, Philadelphia Electric Company has performed over 1500 audits. Where these audits have identified nonconformances, the audit activities have been increased or Bechtel has been directed to perform additional inspections to determine the extent of the problems. In the majority of instances, the nonconformance is investigated and found to be an isolated case.

44. V.S.Boyer J.M.Corcoran

Philadelphia Electric Company also utilizes audits to monitor the corrective actions taken to resolve problems identified by Bechtel. All Bechtel Power Corporation's Management Audit Reports and

Quality Assurance Audit Reports having a Nonconformance Report "Use-As-Is" or "Repair" disposition are sent to Philadelphia Electric Company. If there are any questions about any item in the Bechtel reports, the Philadelphia Electric Company Quality Assurance organization performs an audit. This has been effective in assuring Philadelphia Electric Company management that Bechtel's corrective actions are satisfactory.

Outside Agencies Verifications of the Welding Quality

45. V.S.Boyer J.M.Corcoran

The welding quality assurance program at the Limerick Generating Station is also subject to review and verification by five independent outside organizations:

A) The American Society of Mechanical Engineers (ASME)

46. V.S.Boyer J.M.Corcoran D.B.Hackney

Bechtel Power Corporation has maintained its certificate to install nuclear pressure retaining components by receiving certification from the ASME. ASME teams audit every three years with welding being one of the major areas covered.

B) National Board of Boiler and Pressure Vessel Inspectors

47. V.S.Boyer J.M.Corcoran D.B.Hackney R.A.Simanek

Members of the Board participate in the ASME surveys and in the decision to grant the certificates. In addition, members of the National Board certify the Authorized Nuclear Inspectors who perform the ANI inspections described below.

C) Hartford Steam Boiler Inspection and Insurance Company

48. V.S.Boyer J.M. Corcoran D.B.Hackney R.A.Simanek

Hartford maintains a staff of Authorized Nuclear Inspectors (ANI) on site as required by the ASME Code. These inspectors monitor ASME welding-related activities and have the authority

to assign hold points on construction activities past which construction cannot proceed until their inspection is satisfactorily completed. In addition, Hartford supervision performs semi-annual audits of applicable Bechtel activities associated with ASME Code welding.

D) Joint Utility Management Audits (JUMA)

49. V.S.Boyer J.M.Corcoran

Philadelphia Electric Company has been a participating member in a Joint Utility Management Audit Group (JUMA) since the late 1970's. This group annually audits the Philadelphia Electric Company quality assurance organization's activities. The JUMA audits of Philadelphia Electric Company are conducted by senior supervisory quality assurance personnel from other utilities.

E) Institute of Nuclear Power Operations (INPO) - Construction Project Evaluation (CPE)

50. V.S.Boyer J.M.Corcoran

The INPO Construction Project Evaluation was developed as a standard method of evaluating utilities' nuclear construction programs. Philadelphia Electric Company supports INPO CPE and has actively participated in the development and trial of the Phase I evaluation.

51. V.S.Boyer J.M.Corcoran D.B.Hackney

The above organizations' evaluations, auditing and verifications of the Limerick project have all been positive. The ASME audits have resulted in the extension of Bechtel's ASME Certificate of Authorization. The on-site Authorized Nuclear Inspector has verified that ASME welding is done in accordance with the Code requirements. The semi-annual

audits by Hartford have never identified a major problem and all JUMA audits and INPO evaluations have concluded that the Limerick Generating Station quality assurance program is effective and is being effectively implemented. None of the evaluations or audits has revealed a welding problem.

52. V.S.Boyer J.M.Corcoran

The INPO evaluations and JUMA audits go beyond verifying conformance with the established programs. INPO and JUMA also evaluate the programs and recommend improvements. Philadelphia Electric Company has evaluated the INPO and JUMA recommendations and has adopted many of the recommendations. The results of these outside agencies' evaluations and audits have been beneficial to Philadelphia Electric Company. They have reported to the Company's management on the effectiveness of the program from a different perspective and this has further increased the confidence the Company has in its quality assurance program which, in turn, leads to a higher degree of confidence in welding quality.

Overall Results of NRC Inspections and Evaluation of the Quality Assurance Program as it Relates to Welding at Limerick

53. V.S.Boyer J.M.Corcoran

The NRC's March 15-April 23, 1982 inspection report (IR 352/82-06) (Ref.3,Appl. Exh ___) verified the adequacy of welding at Limerick through the use of its Mobile NDE Laboratory in separate nondestructive examinations, metallurgical tests and records review. This inspection found that welding and welding-related activities were satisfactorily performed without exception. The NRC's regional Construction Appraisal Team's ("CAT") inspection of November 29-December 10, 1982 (IR 352/82-16) (Ref. 4, Appl. Exh._____) in the welding area found

again that welding and quality assurance activities at Limerick were satisfactory. In addition, the report identifies two program strengths in this area as Significant Observations:

1) "Following ASME Section III NDE acceptance, the weldments associated with the reactor pressure vessel nozzle field modifications were tested with a supplementary ultrasonic inspection simulating future preservice inspection (PSI) requirements. This supplementary test should preclude unexpected results during PSI testing which have resulted in problems at other sites."

2) "Philadelphia Electric Company quality assurance audits and surveillances have a thoroughly comprehensive scope and have findings addressing technical adequacy in addition to program, specification, and procedure compliance."

54. In The NRC's 1982 Systematic Assessment of Licensee Performance (SALP) (Ref. 5,Appl.Exh.___), the areas that include the major welding activities "Containment and Other Safety-Related Structures" and "Piping Systems and Supports", both received the highest rating-Category 1. Further, in the "Piping System and Support" section the NRC concluded with the following:

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> The Construction Team Inspection and Resident Inspector's observations established that a strong QC program existed in this area. In addition to the A-E's well trained QC personnel, the Applicant's QA organization also has knowledgeable QA engineers. On many occasions, the NRC Resident Inspector has witnessed more than required inspection and/or NDE carried out by the applicant's QA engineers during their surveillance program to verify QC results.

55. The NRC 1983 SALP Report (Ref. 6,Appl. Exh.___) rated both of the areas that contained the majority of welding during that year, "Piping Systems and Supports" (includes welding, NDE and Preservice

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Inspection) and "Safety-Related Components" (including Vessel, Internals, and Pumps), Category 1, the highest rating. In fact, in the 1983 SALP Report the Limerick Project was rated highest in five of the eight functional areas evaluated. In the 1983 SALP Report the quality program in the welding areas received the following favorable evaluations:

1) "Observations by the Resident Inspector and the Construction Inspection Team indicated that a strong construction QC program was in place. In addition to the E-C's well staffed and trained QC organization, the Licensee's QA organization also is staffed by well trained and knowledgeable QA engineers. The Resident Inspectors have noticed that the Licensee's QA engineers have performed more than the required inspections and surveillances in this area. "

2) "The Licensee has a strong training and qualification program. Welder qualification has been above code requirements. Both engineering and craft personnel have structured programs to improve their skills. Additionally, Licensee senior management received monthly training progress reports. In-process and final quality control inspections have been properly documented and readily retrievable. A large and well trained staff of QC engineers, technicians, and inspectors also indicated Licensee's commitment to the assurance of quality."

Actions Taken to Improve the Quality of Welding and Welding Inspections

56. Over the course of construction, Philadelphia Electric Company and Bechtel have made the following improvements and refinements to both the welding and welding inspection program. While the program was adequate throughout the course of construction, improvements, refinements and clarifications of requirements to assure uniform application of applicable welding requirements have been made as necessary:

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J.M.Corcoran
D.B.Hackney
J.W.Benkert
H.W.Vollmer
R.H.Zong
R.H.Simanek

A. As a result of nuclear industry experience with structural welding, as well as an evaluation by Bechtel engineering of the AWS requirements, project specification requirements and actual design requirements , a new specification for visual examination acceptance criteria for welded structures was issued in 1982 to ensure a uniform interpretation of code requirements and to establish categories of welds and specific graded welding quality requirements for each category.

B. The site welding work instructions have undergone thirty-eight (38) revisions over the years. These revisions reflect refinement and further clarification of the welding program requirements. Examples are:

a) Establishing and distributing a listing of general instructions welders were given during training for their future reference on the job.

b) Clarifying instructions were added regarding adjustments to achieve fit-up tolerances.

c) Issuance of new or revised forms to improve welding administrative controls.

C. The quality control instructions for structural welding inspection have been revised over a dozen times since 1975. These revisions reflect changes in welding code and specification requirements as well as refinements and clarifications in the inspection instructions. For example:

a) Inspection instructions for unique welding such as stud welding and welding of electrical components have been addressed.

b) Inspection instructions have been revised to address code and specification changes.

c) Inspection instructions have been coordinated with improved work procedures.

D. The quality control reinspections, where appropriate, have been described by a generic quality control administrative procedure regarding quality control corrective action. This has been supplemented by a quality control administrative procedure which specifically addresses re-inspection and the associated documents.

E. Numerous on-site training sesions have been held on the subject of welding inspection. The training courses cover such topics as program, specification, procedure changes or field problems.

F. In addition, the American Welding Society has developed a program for training and certification of welding inspectors; "American Welding Society Standard for Qualification and Certification of Welding Inspectors (AWS QC1)". Training sessions in this program have been conducted at Limerick.

57. V.S.Boyer
J.M.Corcoran

Improvements in processing NRC Items of Noncompliance have been made by developing special Quality Assurance Finding Forms for use on NRC Items. The revised Finding Forms provides for additional tracking mechanisms when the response, to the NRC item indicates that the corrective action will not be completed until a later date. This additional provision was developed to assure positive corrective action verification of NRC commitments . Even with the revised Finding Report procedure, the Philadelphia Electric Company quality assurance has maintained over 50% audit or surveillance level of independent verification of NRC Items of Noncompliance. In addition, Philadelphia Electric Company has developed an audit program which includes NRC Items of Noncompliance for audits and/or surveillances to assure the adequacy and continued effectiveness of the corrective action taken.

Philadelphia Electric Company's Management Perspective of Welding At Limerick

58. V.S.Boyer
J.M.Corcoran

Philadelphia Electric Company is confident that the welding on the Limerick Project meets the Company's objectives for Limerick to be a safe and reliable plant. The competent people Philadelphia Electric and Bechtel have working within the Quality Assurance program have led to this confidence. The three levels of verification applied to the design of the welding program and three levels of verification applied to the welding performed within the program, have enabled Philadelphia Electric Company to maintain a constant awareness and control of the welding activities.

59. V.S.Boyer
J.M.Corcoran
F.J.Coyle
R.H.Zong
H.W.Vollmer

There are literally millions of safety-related welds at Limerick. With this volume of activity there is potential for occasional welding problems and a few have been experienced at Limerick. However, Philadelphia Electric Company is confident that the problems have been identified and it has monitored their satisfactory resolution.

60. V.S.Boyer
J.M.Corcoran
J.W.Benkert
H.W.Vollmer

The Limerick quality assurance program, which encompasses all phases of welding from design to final verification, is effective in assuring that the welding meets the quality requirements and satisfies the design criteria required for the safe operation of the plant.

Discussion of Inspection and Enforcement Report 353/76-06-01

V.S.Boyer
J.M.Corcoran
D.T.Clohecy

61. The NRC Office of Inspection and Enforcement Report No. 50-353/76-06 (Ref. 7, Appl. Exh.___) documents the results of an October 16 and 19-22, 1976 inspection by NRC Region I Inspectors at Limerick Unit 2. The report identifies Infraction 76-06-01, "Failure to Weld Structural Steel per AWS Code", which is described in detail on Page 5 of the report. In summary, an NRC Inspector was observing structural steel welding activities at Elevation 283' in the Unit 2 Reactor Building when he observed a beam connection where access to the required connection weld at the beam end was limited. He questioned craft personnel and their supervision as to how the weld would be performed. The NRC Inspector was informed that those welds would be performed with the electrode holder fastened to an extension and that an extension had been used on two other similar limited access weld joints (Elevation 253' near column lines F and H along Wall 23).

J.M.Corcoran

62. The NRC Inspector requested that the PECO Quality Assurance Branch Head arrange for provisions to permit his visual inspection of the limited access welds performed at Elevation 253' near column lines F and H along wall 23. The requested access and aids to permit visual inspection were provided the same day. The NRC Inspector determined that portions of the welds did not meet the workmanship and quality requirements of the AWS D1.1 Code. Portions of the two welds had unacceptable profile, contained excessive undercut, or were incomplete (portions undersized).

63. J.M.Corcoran

After visual inspection of these welds with the NRC Inspector, the PECO QA Field Branch Head discussed the matter with Bechtel. The PECO Field QA Branch Head then confirmed the welder's conversation with the NRC Inspector with regard to the welds at Elevation 253' made using an electrode holder extension. The PECO Quality Assurance Field Branch Head, during discussions with the NRC Inspector, disagreed with the NRC Inspector's opinion that separate welding procedures or welder qualification tests would be required for welding with an electrode holder extension.

64. J.M.Corcoran D.T.Clohecy

As to AWPP's allegation of an inconsistency in the records regarding the subject beam connections, (AWPP #138 and 139), PECO Finding Report N-093 (Ref. 8, Appl. Exh.___) does contain a typographic error in that it should have said elevation 253' rather than 257'. However, this error is not important since both the related PECO Finding Report (N-093) (Ref. 8, Appl. Exh.___) and the Bechtel Nonconformance Report (#1980) (Ref. 9, Appl. Exh.__) identify the beams by their unique beam identification numbers. (232B7 and 232B9).

65. J.M.Corcoran D.T.Clohecy

The two welds were made using an electrode holder attached to an extension because access for welding was somewhat limited by adjacent concrete surfaces, interference above, and the location of the work platform. The welder was qualified to perform the subject work; this determination was made by the quality control inspectors and was confirmed by a review of the welder's qualification records.

66. J.M.Corcoran R.H.Zong D.B.Hackney

The use of an extension is not prohibited by the welding procedure or the governing code requirements (AWSD1.1). AWSD1.1 Code, revision of 1972 and additions, does not require that welding procedures or welders be separately qualified to use an electrode holder extension, the Code does require that equipment be designed and manufactured to enable qualified welders to attain the results prescribed in the Code Part 3.1.2 (Ref. 12, Appl. Exh.). The welding equipment was designed and manufactured for welding; however, the extension used as an aid by the welder was not so manufactured. In our professional opinion, the use of such an extension versus use of a similar extension manufactured for welding would not by itself affect a welder's ability to produce a satisfactory weld.

67. J.M.Corcoran R.H.Zong D.B.Hackney

It is not unusual for a qualified welder using equipment designed and manufactured for welding to perform welding operations in compliance with an approved and qualified welding procedure and to occasionally produce welding results which do not conform with certain requirements of the AWS D1.1 Code. The quality control inspector is responsible for inspecting welds and verifying compliance with applicable requirements, including code requirements, and identifying welds which do not conform with requirements to be reworked or dispositioned accordingly. At the time there was no specific prohibition against the use of an extension. Today, it is not acceptable practice to use an electrode holder extension for welding at Limerick without engineering authorization and approval. Instructions issued in 1976 required authorization and approval by the Lead Staff Welding Engineer prior to any use of an electrode holder extension.

68. In the case of the subject welds, the inspection records showed that the Quality Control Inspector had accepted the welds which were later found nonconforming to the quality requirements of the AWS D1.1 Code.

J.M.Corcoran
D.T.Clohecy

Description of Disposition of Deficient Welds Reported in 1976

69. The two welds identified as deficient by the NRC in IE Report 353/76-06 (Ref. 7, Appl. Exh. __) were dispositioned as stated in Nonconformance Report (NCR) 1980 (Ref. 9, Appl.Exh. __). An NCR is a Bechtel form used to document and resolve any condition which does not conform to the design requirements. The disposition required removal of the welds by grinding, repair by fill welding of any grinding damage to the area and then grinding smooth and re-welding the two beam connections in conformance with the original requirements.

J.M.Corcoran
D.T.Clohecy
J.W.Benkert
V.Aggarwal
H.W.Vollmer

70. The two additional welds found to have minor deficiencies as a result of Bechtel's 1976 reinspection described below, as reported on NCR's 1998 (Ref. 10, Appl. Exh. __) and 2000 (Ref. 11, Appl. Exh. ___), were dispositioned requiring rework to complete the welds, restoring the two beam connections involved to conformance with the original requirements. The decision to restore the welded connections to conformance with original requirements was only one of several possible options for disposition. For example, even taking a conservative view of the defects, it has been determined by engineering analysis performed in 1983 that the four subject welds would have been acceptable for use without repair or rework, i.e., could have been dispositioned "Use-As-Is" as described below. The decision of which method to use depends on the particular circumstances and the available options. Nonconformance Reports are dispositioned in one of the following four ways:

J.M.Corcoran
D.T.Clohecy
J.W.Benkert
V.Aggarwal
H.W.Vollmer
D.B.Hackney

Rework - The process by which a nonconforming item is made to conform to a prior specified requirement by completion, remachining, re-assemblying or other means.

Repair - The process for restoring a nonconforming characteristic to a condition such that the capability of an item to function reliably and safely is unimpared, even though that item still may not conform to the original requirements.

Reject - The action taken to eliminate a nonconforming item from its specified use.

Use-As-Is - A disposition which may be imposed for a nonconformance when it can be established that the descrepancy will result in no adverse condition and that the item under consideration will continue to meet all engineering functional requirements including performance, maintainability, fit and safety.

Description of Resolutions and Corrective Action Taken in 1976-1977 Reinspection of 1976 Welds

71. V.S.Boyer J.M.Corcoran

Immediate actions to resolve the NRC's concerns for 353/76-06-01 involved the following (See Letter V.S. Boyer (PECO) to J. P. O'Reilly (USNRC), December 15, 1976 (Ref. 12,Appl. Exh. ___):

1) Welding directives were issued to instruct those associated with welding to use weld extension electrode holders only when authorized and approved by the Lead Staff Welding Engineer.

2) Training in inspection methods and responsibilities was provided for quality control and field welding engineers.

3) The deficient welds noted above were identified on Bechtel NCR's for control and disposition.

4) Reinspection of accessible structural welds where final inspection was performed by the subject Quality Control Inspector. This matter is described below.

72. V.S.Boyer J.M.Corcoran D.T.Clohecy

A reinspection program was initiated in 1976 by Bechtel Quality Control in preparation for a response to PECO and the NRC regarding the subject deficiencies identified by the NRC to determine if other structural welds previously inspected by the subject Quality Control Inspector conformed to AWS D1.1 Code requirements. PECO Finding Report No. N-093 (Ref. 8, Appl. Exh.__) was the mechanism used to track Bechtel's response to this matter.

73. J.M.Corcoran D.T.Clohecy

A search of the Bechtel Quality Control Vault was conducted to identify Quality Control Inspection Records for structural welding which indicated that the subject Quality Control Inspector had performed final weld inspection activities. The Quality Control Inspection Record is a form utilized to document Bechtel Quality Control inspection activities. Qualified Bechtel Quality Control Welding Inspectors located and reinspected the accessible structural welds identified from the review as having been previously accepted by the subject Quality Control Inspector.

74. V.S.Boyer, J.M.Corcoran, D.T.Clohecy

The contractor's Inspection Record review and reinspection of 1976, continued in 1977, as reported in the response to 50-353/76-06, Item 1 (Ref. 7, Appl. Exh.___) related to structural welding governed by the AWS D1.1 Code based on the original concern raised in 1976 associated with AWS structural welds. The results of the reinspections were documented on Field Inspection Reports C-63-7 through C-63-19 (Ref. 13 through 25, Appl. Exh.__ through ____). Approximately 350 welds were reinspected, with only two additional welds with deficiencies identified and dispositioned through the issuance of NCR's Nos. 1998 (Ref. 10, Appl. Exh.___) and 2000 (Ref. 11, Appl. Exh.___), as described above.

75. V.S.Boyer, J.M.Corcoran, D.T.Clohecy

Due to the passage of time, normal construction activities rendered a number of structural welds, which had been accessible for the subject Quality Control Inspector's inspection, temporarily or permanently inaccessible for reinspection for various reasons including construction interference or coverage by concrete. Only those identified welds which were accessible at the time were reinspected in 1976. The Philadelphia Electric Company's initial response to 50-353/76-06, Item 1, identifying the contractor's reinspection addressed only reinspection of accessible welds. The Company's response was based upon Bechtel's response as reported in Philadelphia Electric Company Quality Assurance Finding Report No. N-093 (Ref. , Appl. Exh.).

76. V.S.Boyer J.M.Corcoran D.T.Clohecy

During a subsequent NRC inspection, (353/77-01, January 5-11, 1977) (Ref. 26 ,Appl. Exh.___) an NRC Inspector reviewed the status of Philadelphia Electric Company's actions on Item 353/76-06-01 and reported that the condition was partially corrected, with the evaluation of and action on inaccessible welds remaining to be performed. As described in the NRC report (353/77-01), the Company indicated its intent to individually evaluate the inaccessible welds, but noted a delay due to diversion of personnel to other matters unrelated to the subject welding inspection.

Reinspection of Welds in 1977

77. J.M.Corcoran D.T.Clohecy

Additional welds that became accessible in 1977 due to changes in construction status were reinspected, e.g., temporary construction interferences such as concrete forms for adjacent placements were removed as the job progressed . Bechtel Field Inspection Reports C-63-20 (Ref. 27, Appl. Exh.__) and C-63-21 (Ref. 28, Appl. Exh.___), dated January 17, 1977 document initial reinspections of welds which became accessible in 1977. No unsatisfactory welds were found.

78. J.M.Corcoran D.T.Clohecy

Additional documentation reviews and reinspections were continued by Bechtel in 1977 to reinspect or otherwise document for disposition AWS structural welds considered inaccessible in 1976. Bechtel Field Inspection Report C-63-22 (Ref. 29, App. Exh.__) was initiated on April 5, 1977 to redetermine the accessibility for inspection of the installed structural steel beams and columns previously identified and to allow further

reinspection to assure that all accessible welds were inspected or otherwise dispositioned. During the continuing review and reinspection effort, an NRC Inspector reviewed the status of this open item (353/76-06-01) and noted on Page 5 of Inspection Report 353/77-06 (Ref. 30, Appl. Exh.___) that he considered the records somewhat ambiguous. As a result, Page 8 of Bechtel Field Inspection Report C-63-22 (Ref. 29, Appl. Exh.___) was added in July 28, 1977 as a reconciliation of all weld inspection plans that had been identified as the responsibility of the subject inspector against the Bechtel Field Inspection Reports indicating that such welds had been reinspected. The remaining Field Inspection Reports of reinspections completed in 1977 and the results are described below.

79. J.M.Corcoran D.T.Clohecy

Bechtel Field Inspection Reports Control Numbers C-63-24 through C-63-33 (Ref. 31 through 40, Appl. Exh.___ through _____) and C-41A-493 (Ref. 41, Appl. Exh.__), dated July 1, 1977 through July 21,1977 document additional reinspections not previously performed because they were inaccessible in 1976. Field Inspection Report Numbers C-63-30 (Ref. 37, Appl. Exh.__), C-63-31 (Ref. 38 , Appl. Exh.___), C-63-32 (Ref.39, Appl. Exh.___) and C-41A-493 (Ref. 41, Appl. Exh.___) describe reinspections of certain welds partially embedded in concrete. Because these welds were partially embedded, they were reported on NCR Nos. 2627 (Ref.42, Appl. Exh. ____) and 2710 (Ref. 43, Appl. Exh.___) to

document, evaluate and disposition the partially embedded welds. Field Inspection Report C-954-6 (renumbered C-63-33) (Ref. 40, Appl. Exh.___) resulted in the identification of two welds with minor deficiencies which were also identified on NCR 2710 (Ref. 43, Appl. Exh.___) for disposition. The partially inaccessible welds and the two welds with minor deficiencies identified during the 1977 reinspections were evaluated by engineering analysis and accepted as "Use As Is". NRC Inspection Report 50-353/77-14 (Ref. 44, Appl. Exh. ___), an inspection of November 21-23, 1977, documents additional review of the above records by the NRC Inspector and notes that previous inspection Finding 353/76-06-01 was considered resolved.

The Company's 1983 Re-evaluation

80. V.S.Boyer J.M.Corcoran D.T.Clohecy

In the course of preparing to respond to the Atomic Safety and Licensing Board's, Second Special Prehearing Conference Order (LBP-83-39) (July 26, 1983), it was discovered that not all welds which were inspected by the subject inspector had been identified and, therefore, not reinspected or evaluated as had previously been believed. While an effort was made to determine why the 1976-1977 reinspections did not identify all the welds inspected by the subject Quality Control Inspector, it is not possible to reach a definitive conclusion due to the passage of time. A general comparison of the 1983 reinspection effort to the 1976-1977 effort sheds some

light on this question. It appears that the discrepancies between the 1976-1977 effort and the 1983 effort resulted in part from the different methods used. The 1976-1977 effort apparently was primarily a search and review of structural welding QCIR's filed in the Bechtel Quality Control Vault. Only those Quality Control Inspection Records which are completed are stored in the QC Vault. Since Quality Control Inspection Records often cover a broad set of welds, the individual QCIR's frequently must be kept open until all inspections required by it are completed.

81. When it was determined that the 1976-1977 effort did not result in identification of all welds inspected by the subject Quality Control Inspector, the methodology for a new review and reinspection effort to assure that welds inspected by the subject inspector were reinspected or otherwise satisfactorily dispositioned was carefully considered. The 1983 review effort was not limited to structural welding QCIR's, but as discussed below, was based on the log books for all QCIR's and other quality documents to identify records which were open during the subject inspector's employment and certification as a welding inspector at Limerick. A page by page review of those records involving welding inspection, whether still open or completed, was conducted to identify weld inspections performed by the subject inspector. The Company conducted a thorough review of the original quality assurance welding records which were in-process during the subject inspector's employment at the facility (November 3, 1975 to October 22, 1976) to assure that the list of Weld Inspection Plans is complete and that the newly identified welds are reinspected or otherwise properly dispositioned.

J.M.Corcoran
D.T.Clohecy

Description of Company s 1983 Review Process

82. As there are many thousands of inspection records at the Limerick site, it was necessary to focus the scope of the Company's review effort to records where involvement by the subject Quality Control Inspector was possible, based on his term of employment certification and the discipline for which he was certified to perform inspections. The details of the Company's review are described and documented on Philadelphia Electric Company Quality Assurance Surveillance Check Reports and are summarized below. The Contractor's personnel records and Quality Control Certification Records for the subject Quality Control Inspector were reviewed to determine his hire date, date certified as an inspector, discipline of certification and date he resigned for other employment. The Company's review effort to identify inspections performed by the subject Quality Control Inspector was based on the log books for all QCIR's and other quality records to identify records which were open during the subject inspector's employment and certification at Limerick. The Contractor's Quality Control Records are listed in log books with information such as Log number, title, plan numbers, date issued, and date complete.

J.M.Corcoran
D.T.Clohecy

83. Inspection Record log books are divided into sections with record numbers assigned based on drawing or specification numbers. They include inspection records logged and filed by civil drawing, civil specification number, Mechanical P&ID (Pip[illegible] and Instrument

J.M.Corcoran
D.T.Clohecy
F.J.Coyle

diagram), Electrical Drawing, and Electrical Specification. Only some of the records in a file/log category may involve welding. For example, there is quite a large number of inspection records logged and filed by civil drawing which relate to placement of concrete or other work. While there are also inspection records logged and filed by civil drawings that relate to inspection of structural steel welding.

J.M.Corcoran
D.T.Clohecy
F.J.Coyle

84. Log pages for the various file/log categories were reviewed to identify pages containing welding records and NCR's which were open during the subject time period. The log entries were individually reviewed and pages marked to identify those records open during the employment and certification of the subject inspector and those involving welding inspection. Although weld records for ASME Section III pipe welds do not have log numbers, a similar method was used. Each record thus identified as open during the above time period and involving welding inspection was obtained and reviewed for involvement by the subject inspector.

J.M.Corcoran
D.T.Clohecy
F.J.Coyle

85. When it was determined that a weld for which a final weld inspection was performed by the subject inspector had not been reinspected by Bechtel prior to the Company's 1983 review, Bechtel Quality Control was requested to perform reinspection. The results of the reinspection records were reviewed to assure that Bechtel Nonconformance Reports were generated for inaccessible welds or deficiencies.

86. J.M.Corcoran D.T.Clohecy

The Company's 1983 review effort included a check of Weld Rod Oven Calibrations and Receipt Inspection Records for welded items. No involvement by the subject inspector was noted for those records. The Company also ensured, based on a representative review, that prerequisites, in-process and inspections other than final weld inspections performed by the subject Quality Control Inspector were performed satisfactorily . Prerequisite verifications and review of supplementary records are only administrative functions. Monitoring in-process activities documents the weld progression, but weld acceptability is determined by final inspection or NDE. The above review and verification effort conducted by the Company in 1983 was performed by qualified auditors or other trained participants.

Results of 1983 Review Effort

87. V.S.Boyer J.M.Corcoran D.T.Clohecy

As a result of the extensive 1983 review, it was determined that the subject inspector had responsibility for a total of 1,235 safety-related weld inspections, of which 654 were structural welds and 581 were on components other than structural steel, such as hangers (577), pipe (2), and electrical conduit supports (2).

88. V.S.Boyer J.M.Corcoran J.W. Benkert V.Aggarwal H.W. Vollmer D.T.Clohecy J.W.Fisher

The number of welds constituting the 1976-1977 reinspection effort were tabulated during the 1983 reinspection. The earlier program had identified 426 structural welds, of 423 were accessible and 3, inaccessible. The 423 accessible welds

had been reinspected in 1976-1977 with 6 minor deficiencies noted. Four of these had been reworked/repaired and 2 had been determined to be acceptable for use by engineering analysis. The 3 inaccessible welds were determined by analysis to be acceptable for "Use-As-Is".

89. V.S.Boyer, J.M.Corcoran, J.W.Benkert, V. Aggarwal, H.W.Vollmer, D.T.Clohecy, J.W.Fisher

The 1983 review identified 228 additional safety-related structural welds, 16 being totally accessible and 212 partially or totally inaccessible. The 16 totally accessible welds have now been reinspected with one minor deficiency found. This weld, together with the 212 partially or totally inaccessible welds, have been found by engineering analysis to be acceptable for "Use-As-Is".

90. V.S.Boyer, J.M.Corcoran, F.J.Coyle, H.W. Vollmer, V. Aggarwal, R.A.Simanek, J.W.Fisher

The safety-related non-structural welds, total 581, of which all are totally accessible. 577 of these represent hanger welds, with 534 of the 577 being welds which were completely reinspected prior to August, 1983 as part of a separate hanger inspection program. In December, 1980 a general hanger reinspection program was initiated due to job conditions which resulted in additional hanger work being required after partial inspections had been performed. This reinspection program required a final QC inspection of all safety-related hanger welds regardless of their previous inspection status. The subject inspector had inspected 534 welds on partially completed hangers which had subsequently been subject to modification and completely reinspected prior to August 1983. The remaining 43 hanger welds for which final inspections had not yet been made, together with the

4 non-hanger welds, have now been reinspected. Thee hangers contained 19 minor deficiencies which would have normally been identified and dispositioned as part of the final hanger completion and inspection program. Instead, those deficiencies were dispositioned "Use-As-Is" or "Rework" as appropriate.

Company's Physical Reinspection of 1983

91. V.S.Boyer J.M.Corcoran D.T.Clohecy H.W.Vollmer J.W.Fisher

As a further check on the adequacy of the welds that had been the responsibility of the subject inspector, Philadelphia Electric Company conducted,on an audit basis, surveillance reinspection of certain attributes of a number of structural welds which had been the responsibility of the subject inspector and which also had been reinspected by Bechtel. The results of this check are contained on a Quality Assurance Surveillance Check Report. The Company's Surveillance reinspection involved reinspections of 67 safety-related structural welds. Fifteen (15) of these welds were from the 1983 reinspection group of the 16 accessible welds and 52 were from the 1976-1977 reinspection group of 423 accessible welds. Six minor deficiencies were identified from the latter group. These deficiencies have been found by engineering analysis to be acceptable for "Use-As-Is".

92. V.S.Boyer, J.M.Corcoran, R.H.Zong, H.W.Vollmer, J.W.Fisher, D.B.Hackney

In addition, for 60 of the 534 completed hanger welds previously discussed where initial or in-process weld inspections were performed by the subject inspector, but where final weld inspections were performed by inspectors other than the subject Quality Control Inspector , Philadelphia Electric Company performed reinspections with one minor deficiency noted on an NCR. This deficiency has been found by engineering analysis to be acceptable for "Use As Is".

Evaluation of the Reinspection Program

93. V.S.Boyer, J.M.Corcoran, R.H.Zong, H.W.Vollmer, J.W.Fisher, D.B.Hackney

During the installation period of the welding in question (1975-1976) the accepted practices for inspecting welds included a degree of judgment based on visual inspection. A weld normally has variations in its width, height, convexity, and if, in the judgment of the inspector, it appeared that most of the weld was equal to or greater than the specified size, it was considered acceptable. However, unlike the 1975-1976 time period, gages are now used to measure weld dimensions for the full length of the weld. This difference accounts for some of the isolated minor deficiencies found in recent inspections which had not been identified in 1975-1976 . The 19 hanger weld deficiencies were on welds which had not received a final hanger weld inspection. The small number of minor structural weld deficiencies and the 1 minor deficiency

identified on a hanger which received final inspection, were all found to have no effect on safety and were determined to be acceptable for "Use-As-Is".

Evaluation of Inaccessible Welds and Minor Deficiencies

94. H.W.Vollmer, J.W.Benkert, V.Aggarwal, J.W.Fisher, D.B.Hackney, R.H.Zong

Since welds found inaccessible due to concrete could not be readily reinspected, an engineering evaluation was performed. Access to four of the welds was gained by removing concrete to permit partial reinspection as discussed below. Engineering evaluations were performed in accordance with project procedural requirements and design criteria consistent with the codes and standards referenced in Section 3.8 of the FSAR. Project procedural requirements require checking of the evaluation by an engineer who has a level of qualification at least sufficient to originate the calculation. The analysis is further reviewed by the responsible engineering group leader for technical adequacy and conformance with design requirements.

95. H.W.Vollmer, J.W.Benkert, V.Aggarwal, J.W.Fisher, D.B.Hackney, R.H.Zong

The inaccessible welds were analyzed to determine their purpose and the stresses resulting from the design loads to compare with the stresses due to the design capacity. The "design load" is the load required by calculation to be transferred by the welded connection. The "design capacity" is the load capacity of the weld furnished as specified by the design drawing. Out of approximately 200 inaccessible welds identified in 1983, approximately 80% of these welds were construction aids which serve no function in an operating plant. Construction aid welds

are welds used to attach items which are needed only to support construction loads such as those resulting from wet concrete. In approximately 10% of the cases, the evaluations were conservatively made assuming that welds or portions of welds inaccessible for inspection did not exist. In the case of the four welds discussed above, the calculated design capacity was close to the design load so access was gained by chipping away the concrete. These welds were partially exposed, reinspected and found to be acceptable . The remaining 10 percent (approximate) were evaluated and found to have a design capacity far in excess of the design load (ratios of approximately 5 to 70). These ratios are in addition to the factors of safety used in design. These factors are discussed in more detail below. The combination of the above ratios and factor of safety used in design are more than sufficient to conclude that these inaccessible welds are acceptable "Use-As-Is" even though reinspection of the welds could not be performed.

General Discussions of Factors Affecting Welding Design and Construction

96. H.W.Vollmer J.W.Benkert V.Aggarwal D.B.Hackney R.H.Zong

There are many factors which contribute to the conservatisms in the performance of welded construction that must be examined to understand the context and lack of importance of the "deficiencies" which have been discovered and to understand how welds inaccessible for reinspection may be evaluated. These matters are discussed below.

Factors of Safety Used in Design

97. H.W.Vollmer, J.W.Benkert, V.Aggarwal, J.W.Fisher, R.H.Zong, D.B.Hackney

Factors of safety are applied in structural design to cover a number of conditions such as uncertainties in load definition, variations in material properties, approximations used in analytical methods, variations in construction workmanship. Factors of safety are high in structural design in general, but are particularly high in the design of weldments. For example, even though compatible weld metal has higher yield and tensile strength than the structural steel being joined, in general, the stresses allowed in designing the connections are governed by the strength of the connected steel and not by the weld. In addition, the allowable stresses for the base material are small compared to the ultimate capacity of the material. For example, a factor of safety of 3.33 in shear on effective throat is applied against the ultimate tensile strength of fillet welds to establish design allowable loads. The factor of safety as discussed above in combination with the high ratios of design capacity to design load noted above for the inaccessible welds, form the basis for determination that the inaccessible welds are acceptable for "Use As Is", even though reinspection of these welds was not performed.

98. R.H.Zong, H.W.Vollmer, J.W.Benkert, D.B.Hackney, R.H.Zong

The type of deficiencies noted which are excessive convexity, slag, inclusion, undercut, and porosity, are the type recognized as normal welding conditions covered by these high factors of safety. In fact, a more recent revision of the governing welding code permits greater undercut depending on the base metal thickness and the direction of the stresses.

99. H.W.Vollmer, J.W.Benkert, V. Aggarwal, J.W.Fisher

The welds specified are generally larger than those theoretically required to transfer the design loads. This results from a number of considerations: (1) simplification of the welding requirement on design drawings, i.e., an "all around" weld is specified where a partial weld would do, (2) code requirements such as a fillet weld terminating at the end of a member shall, "whenever practicable", be returned for some distance around the corner of the member (3) welding is specified to the next highest nominal size, rather than to the exact dimension required by the calculation and, (4) minimum sizes of welds based on thickness of attached parts rather than on strength requirements. The above factors in weld design assure that the welds are able to withstand higher stresses than the structures, systems or components being joined.

Welding Code Requirements

100. R.H.Zong, J.W.Benkert, J.W.Benkert, V.Aggarwal, D.B.Hackney

Structural welding is in accordance with the American Welding Society (AWS) Code. This Code contains many requirements that are directed toward obtaining uniform overall quality welding, but are not necessarily required to meet the minimum serviceability requirement of any given weld when taken individually. While deficiencies in welding are to be avoided, isolated deficiencies such

as excessive convexity, slag inclusion, undercut and porosity, do not significantly lower the load carrying capacity of that weld for the service it will see at Limerick.

101. All of the structural welds inaccessible for reinspection due to concrete and the accessible welds listed as having deficiencies have been analyzed or evaluated as describe above and determined to be acceptable without repair or rework ,i.e., a "Use-As-Is" Disposition. To repeat, a "Use-As-Is" disposition may be assigned to a nonconformance when it is established that the discrepancy will result in no adverse condition ar that the item under consideration will continue to meet all engineering functional requirements, including performance, maintainability, fit and safety

J.M.Corcoran
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J.W.Fisher
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J.W.Benkert
V.Aggarwal
D.B.Hackney

Discussion of Instances Cited by AWPP in Support of Contention VI-1

102. In support of Contention VI-1, AWPP cites a number of instances which it states to be infractions or evidence of improper control or performance of welding and/or failure to take proper action when welding infractions have been discovered. When analyzing these instances in the context of the Contention, the following factors must be recognized. First AWPP has completely failed to identify a single instance of a welding deficiency which had not already been discovered and addressed. AWPP's examples consist entirely of instances which the Company, itself, or the NRC had discovered and documented. Second, the cited deficiencies or Unresolved Items occurred over the period of seven years. Furthermore, they pertain to a number of unrelated disciplines, including HVAC, hangers, pressure retaining components and building steel.

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D.T.Clohecy
F.J.Coyle

There is a general lack of repetition of the matters cited by AWPP. AWPP has failed to allege in its specification of issues exactly how proper and effective corrective and preventative actions were not taken, or the nature of the alleged patterns. In a number of the instances, these matters were initially determined by the Company as a result of its Quality Control and Quality Assurance effort. Finally, a number of these matters were, or are, Unresolved Items, which simply mean that the NRC is seeking more information before deciding whether further action is warranted. One item is unrelated to safety-related components and thus is not supportive of this contention. A discussion of each of the AWPP cited instances is set forth below. In certain cases, more than one AWPP item relates to the same item, and are grouped together.

103. J.M.Corcoran D.T.Clohecy

AWPP-138 (PECO Finding Report N-93)
AWPP-139 (NCR 1980)

Both of these items relate to the Item of a Noncompliance 353/76-06-01 discussed above. AWPP-138, which is characterized by AWPP as a contradiction on elevations is merely a typographical error. (See Paragraph 64). Inasmuch as the beams have unique numbers, the typographical error on elevation has no significance. AWPP-139 is merely the first page of the NCR which dispositioned the two different welds identified in Item 76-06-01. AWPP-139B which refers to "Use-As-Is" was not provided. In any event, the use of this disposition is discussed in Paragraph 70 above.

104.

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F.J.Coyle
H.W.Vollmer
J.W.Benkert
V.Aggarwal

AWPP-140 (Page 1 of Appendix A to IE Report 352/77-02)
AWPP-142 (IE Report 352/77-02, Page 6)
AWPP-152 (PECO's Response to NRC Item 352/77-02-01)

AWPP items 140, 142 and 152 relate to Item of Noncompliance 352/77-02-01. As discussed in IE Report 352/77-02, Page 6 (Ref. 45 Appl.Exh.), this deficiency pertains to undersized fillet welds found on the spent fuel pool liner structure. Page 6 of the IE Report also notes that the welds were performed and inspected by a subcontractor.

The Applicant's response to this deficiency (Ref. 46 Appl.Exh.) describes the corrective actions taken to resolve the matter. These actions included reinspecting all of the involved subcontractor's safety-related welds which had been completed at the time and reinstructing the subcontractor's plant and jobsite superintendents in applicable welding requirements. Also the subcontractor's QA Department personnel were also reinstructed in the applicable requirements to be applied to the visual examination of welds.
IE Report 352/77-07, Pages 3 and 4 (Ref. 47 ,Appl. Exh.), describes The NRC Inspector's follow up and closure of this violation. The Inspector observed some of the reinspected welds and noted that no undersized welds were found. The Inspector determined that "Rigorous inspection control was in effect."

It should be noted that the original welds identified by the NRC Inspector were not safety related according to the applicable specification; they only served a purpose for construction. These welds were only required to hold forms together for concrete placement and, were not required after curing. However, because safety related welds were involved in other portions of the specification, the actions taken in response to the deficiency were prudent.

105. AWPP-155, 156, and 157 (NRC Letter to PECO dated 8/24/78)

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AWPP-155, 156 and 157 are three pages of an NRC letter to the Company dated August 24,1978. This letter pertains to two Items of Noncompliance, 352/78-03-03 and 352/78-04-03. Violation 352/78-03-03 is described in detail on Pages 14 and 15 of IE Report 352/78-03 (Ref. 48,Appl. Exh.___). This violation pertains to Liquid Penetrant (PT) examination of a pipe weld. The NRC Inspector observed that indications in excess of 1/16" length were evident in the developing powder remaining on a previously PT'd pipe weld. The NRC Inspector reviewed the test report of the completed PT and observed that the weld was accepted. To ascertain if the indications were false, the weld was re-examined by the Company's representative.

106. The NRC Inspector observed the performance of the re-examination which produced indications in excess of 1/16" in length. The indications were "nonrelevant" in that they were determined to be the result of surface conditions and not indicative of a rejectable defect. The NRC Inspector noted that the PT procedure used requires that tests producing indications which are considered to be" nonrelevant", be repeated or the weld be otherwise examined to verify that actual defects are not present. The NRC Inspector determined this to be an Item of Noncompliance because he could find nothing to confirm that the original examiner had verified the absence of actual defects.

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R.Zong
D.B.Hackney

107. Philadelphia Electric Company responded to this Item of Noncompliance on June 12, 1978 (Ref. 49 Appl.Exh._____) by conducting yet another PT examination which determined that the weld was acceptable. The Company wrote this response to indicate that the weld in question was acceptable and that the original PT was in fact a proper examination. The Company considered that since the original examination was good, no violation had actually occurred and that no further action was required.

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108. The NRC did not agree that this action resolved the violation and so stated in a letter dated August 24, 1978 (AWPP-155, 156 and 157) in which he indicated that further corrective actions were required to assure that the subcontractor's test personnel were properly implementing the testing procedure with respect to processing indications which exceed acceptance standards and to assure that other previous PT examination indications were not accepted without taking suitable actions to verify whether the indications represented actual defects.

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R.Zong
D.B.Hackney

109. Philadelphia Electric Company responded to this NRC request on September 18, 1978 (Ref. 50, Appl. Exh.___) further supporting its position that the indications were evaluated as part of the original examination and were determined to be nonrelevant. The Company's response expanded on the earlier response, stating that there was no requirement to document in the test record any indications which were evaluated by additional testing and determined to be nonrelevant. The existence of liquid penetrant test documentation indicating an acceptable weld is evidence that any indications requiring

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evaluation were, in fact, evaluated and found to be nonrelevant in accordance with the test procedure. The Company stated that Bechtel Quality Control performed surveillances and Philadelphia Electric Company's internal Quality Assurance organization also undertook audits to assure that the Nondestructive Examination (NDE) subcontractor was properly performing liquid penetrant examinations.

110. J.M.Corcoran F.J.Coyle R.Zong D.B.Hackney

IE Report 352/78-07, Page 4 (Ref. 51 ,Appl. Exh._____) is the NRC's discussion of the follow-up verification of the Company's response. As described in the IE Report, the NRC did not feel that these corrective actions were adequate. The IE Report describes the fact that the NRC Inspector interviewed six of the Nondestructive Examination technicians and that all were knowledgeable of the test acceptance criteria and the proper disposition of relevant and nonrelevant indications. The NRC Inspector then witnessed the performance of two PT examinations, each performed by a different technician. The first test was properly performed; however, the second test was not performed in strict compliance with the applicable procedure because the technician wiped a liquid penetrant indication from the part before the seven minute developer dwell time had expired.

111. J.M.Corcoran F.J.Coyle R.Zong D.B.Hackney

As a result of these findings, the Company decided that additional corrective actions were required. Therefore, the NDE technician involved in this matter was requalified. The weld which the NRC Inspector observed to be improperly examined was re-examined and found

to be acceptable. In addition, approximately 50% of the involved technician's examinations were re-examined. The results of these examinations proved that the technican had been performing PT examinations satisfactorily. To prevent recurrence, Bechtel QC increased its surveillance activities of the NDE subcontractor and added an inspection hold point to require a Bechtel Quality Control Engineer to witness the first examination performed by individual technicians of each NDE method that the technician is qualified to perform.

112. J.M.Corcoran F.J.Coyle

Philadelphia Electric Company informed the NRC of the above corrective actions in its letter dated December 4, 1978, (Ref. 52, Appl. Exh.___). The NRC noted on Page 7 of IE Report 352/79-11 (Ref. 53 ,Appl Exh.____) that it had verified that these corrective actions were complete and that these actions resolved the matter.

113. J.M.Corcoran R.H.Zong F.J.Coyle D.B.Hackney

The second matter discussed in the NRC's August 24, 1978 letter (AWPP-155, 156, and 157) is 352/78-04-03. This Item of Noncompliance is described on Pages 10 and 11 of IE Report 352/78-04 (Ref. 54 , Appl. Exh.____). The matter raised by the NRC pertained to the use of weld procedures for prequalified weld joints on weld joints which did not meet the applicable code criteria for prequalified weld joints. In addition, the NRC identified that weld joint gaps were filled with bars that did not meet the applicable code requirements.

114. The Company responded to this matter in its letter dated July 20, 1978 (Ref. 55, App. Exh.___) by stating that clarifying revisions had been made to drawings . In its letter dated August 24, 1978 (AWPP-155, 156, and 157), the NRC indicated that it did not believe the Company's action to be sufficient. Philadelphia Electric Company took further steps to resolve the matter and responded accordingly in its letter to the NRC dated September 18, 1978 (Ref. 50, Appl. Exh.___). Rather than attempt to pursue a potentially protracted technical discussion with the NRC, it was decided that alternative actions would more appropriately lead to a satisfactory resolution of these matters.

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115. The corrective actions taken included post qualification of the weld joint and filler bar to demonstrate the acceptability of the NRC identified welds. In addition, other drawings were reviewed to assure that similar situations did not exist elsewhere. To prevent recurrence, the Civil/Structural discipline was reinstructed to review welding configurations for conformance to the applicable code. On Page 2 of IE Report 352/79-04,(Ref.56, Appl. Exh._____) the NRC discusses the inspection activities which verified that the corrective actions were complete and notes the item as resolved.

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D.B.Hackney

116. At first the Applicant did not, agree that either Item of Non-compliance, 352/78-03-03 nor 352/78-04-03, were actual violations. Therefore, the original responses to these items did not indicate

that any corrective actions needed to be taken, but rather stated the Company's position that no violation had occurred and, therefore, no corrective actions were required. With regard to the NRC letter, AWPP has made three allegations: AWPP-155, "Example of failure to take proper and corrective action"; AWPP-156, "Improper action followed by improper corrective action by Applicant"; AWPP-157, "Applicant failed to take prompt proper and effective corrective action". As noted above, the NRC did not agree with PECO's position and informed the Applicant in its letter dated August 24, 1978 (AWPP-155, 156 and 157) that further actions were required to resolve the matters. Also as discussed above, the Applicant took further corrective actions to resolve the items.

117.

AWPP-176 (Page 1 of Appendix A to IE Report 352/78-12)
AWPP-180 (Attachment to PECO's response to NRC)
AWPP-181 (NRC Letter to PECO dated 4/23/79)

J.M.Corcoran
F.J.Coyle
R.A.Simanek
D.B.Hackney
R.H.Zong

AWPP items 176, 180 and 181 all pertain to Item of Noncompliance 352/78-12-02. The NRC had identified a condition in which welding had proceeded beyond the point where certain designated mandatory hold points could be performed. The missed inspections were for cleanliness and surface defects of a pipe weld joint fit-up. These fit-up "hold point" inspections were procedurally mandatory at the time, but are not necessary to assure the quality of the end product. In-process inspections of this type lend themselves to good workmanship which, in turn, prevents rejection at final inspections. In fact, the involved weld was found to be acceptable

through final inspection activities, including liquid penetrant examination. PECO's response to the NRC does not discuss the fact that these missed inspections are compensated for during final inspection since this fact is well understood by those versed in welding inspection. However, one without this knowledge may not realize that the type of inspections which were missed are not critical in assuring a satisfactory end product.

118. J.M.Corcoran F.J.Coyle R.A.Simanek D.B.Hackney R.H.Zong

PECO's action to resolve this matter is discussed in its response to the NRC dated March 2, 1979 (Ref. 57 ,Appl.Exh.). This corrective action notes that a review of all other open inspection plans determined that this violation was an isolated case in that no other inspection points had been bypassed. The Quality Control personnel were reinstructed to assure that no other mandatory inspection points would be missed.

119. J.M.Corcoran F.J.Coyle R.A.Simanek D.B.Hackney R.H.Zong

The Company response also states that the existing program contains measures to control such missed inspection points and that, the NRC identified condition would have been identified by the Applicant in the normal course of required follow up inspections and Quality Control Inspection Record reviews. Because the Company believed this programmatic feature should have been considered by the NRC before it classified this matter as a violation, a request of the NRC was made to reclassify the Item of Noncompliance to an Unresolved Item.

120. The NRC rejected the Company's request for reclassification in a letter dated April 23, 1979 (AWPP-181). This letter, However did not reject the Company's corrective action. The first paragraph of this letter acknowledged receipt of the Company's submitted corrective action and indicated that the actions would be examined during a subsequent inspection. Page 6 of IE Report 352/79-12 (Ref. 58 ,Appl. Exh.___) notes the NRC's verification of the above stated corrective actions and closes the Item of Noncompliance based on these actions.

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D.B.Hackney
R.H.Zong

121. With regard to this isolated instance, AWPP makes three statements. AWPP-176, "Failure of Applicant to Control performance resulting in inability to inspect welds"; AWPP-180, "Under response to Item of Noncompliance (response to Appendix A) Applicant's answer ignores the seriousness of infraction. If welds can no longer be performed discussion of corrective at final routine inspection is an apparent excuse to cover lack of control and lack of corrective action after improper welding has been discovered (emphasis in original)"; AWPP-181, "Letter shows total lack of control and failure to control performance and an effort to avoid proper corrective action after improper welding has been performed." As discussed above, this matter does not pertain to improper welding but to a missed weld inspection which was later found to be acceptable. Furthermore, the missed inspection was not critical in assuring the quality of the completed weld in that the missed inspections were compensated for by required additional inspections. Finally, the Company did not avoid taking proper corrective action. As discussed above, this matter was resolved to the satisfaction of both the Company and the NRC.

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R.H.Zong

AWPP-180B (Bechtel Nonconformance Report No. 1366)

122. J.M.Corcoran, D.T.Clohecy, F.J.Coyle, H.W.Vollmer, J.W.Benkert, V.Aggarwal

AWPP-180B is copy of a Bechtel NCR which documents a discrepancy identified by Bechtel during the course of normal program activities. The discrepancy documented on the NCR pertains to a non-safety related pipe hanger. This hanger is located in the turbine auxiliary building, which is not a safety-related structure. The hanger drawing required welding to be made parallel to the longitudinal axis of a building steel beam. The specification governing structural steel installation permits welding on beam flanges transverse to the beam axis subject to certain restrictions regarding weld size versus flange thickness and other considerations. The governing specification requirements were not exceeded for this welding. Bechtel's evaluation of this condition as acceptable for "Use-As-Is" includes a brief statement of its rationale, its consideration of the small weld size (1/4") noting that the hanger load is only 230 lbs, and that no damage (or deficiencies) were detected.

123. J.M.Corcoran, D.T.Clohecy, F.J.Coyle, H.W.Vollmer, J.W.Benkert, V.Aggarwal, J.W.Fisher

As to AWPP's allegation that "NCR 1366 demonstrates routine "Use As Is" follow up". AWPP has not demonstrated any impropriety here, to the contrary, "Use-As-Is" disposition here is appropriate in that it fulfills the requirements previously discussed. See paragraph 70.

AWPP-186 (Page 1 to Appendix A of IE Report 352/79-07)
AWPP-189 (IE Report 352/79-07, Page 4, Item 3)

124. J.M.Corcoran F.J.Coyle R.A.Simanek

Both AWPP 186 and AWPP 189, Item 3, relate to Item of Noncompliance 352/79-07-04. As discussed on Page 4 of IE Report 352/79-07 (AWPP-189), the NRC Inspector identified a condition in which an engineering design change was issued that affected the support after Quality Control had inspected and accepted it. The violation relates to the fact that the work and reinspection that the design change required was not accomplished. As noted in the last sentence on Page 4 of IE Report 352/79-07 (AWPP-189), this condition is contrary to Limerick Procedure PSP-G-6.1. This procedure requires Quality Control to review design changes for their effect on completed work and update the applicable Inspection Records accordingly to cause any required reinspection.

125. J.M.Corcoran F.J.Coyle

The NRC's report notes that the Quality Control Inspector accepted a weld joint and that, an engineering change was subsequently issued which added an acceptance criteria attribute. The report does not imply that the original inspection was incomplete because it did not inspect for all applicable requirements in effect at the time the inspection was performed.

126. J.M.Corcoran F.J.Coyle

The Applicant took corrective actions to resolve this item which it reported to the NRC in its October 31, 1979 letter (Ref. 59, Appl.Exh._____). These actions included reinspecting the

involved support and all other supports affected by the design change and repairing any deficiency as needed. This response also committed to developing corrective action to prevent recurrence. This preventive corrective consisted of developing a new procedure to make field engineers responsible for the review of design changes for the effect on completed work.

127. J.M.Corcoran F.J.Coyle

Page 5 of IE Report 352/80-02 (Ref. 60 Appl. Exh.____)describes the NRC inspection activities that verified the above stated corrective actions. Page 3 of IE Report 352/81-06 (Ref.61 ,Appl. Exh.__) describes the NRC inspection activities of verifying the corrective action to prevent recurrence. Page 3 of IE Report 352/81-06 also indicates that the matter is resolved.

128. J.M.Corcoran F.J.Coyle

With regard to this instance, AWPP states: "An indication is shown via acceptance of weld joint by Q.C. engineer on 4/9/79 that only certain welding activity is checked. There could be many such undiscovered deficient welds to cause subsequent problems." This statement is not supported by the NRC's description of the item. The NRC's report indicates that the Quality Control Inspector accepted a weld and that an engineering change was subsequently issued which added an acceptance criteria attribute requiring an additional inspection. The report did not imply that the original inspection was incomplete because it did not inspect

for all applicable requirements in effect at the time the original inspection was performed. As discussed above, when it was realized that inspection of an engineering change had not occurred appropriate corrective actions were taken.

AWPP-187 (Page 2 of Appendix A to IE Report 352/79-07)
AWPP-190 (IE Report 352/79-07, Page 5, Item 4)

129. AWPP Items 187 and 190 are related to Item of Noncompliance 352/79-07-05. In this item, the NRC Inspector identified a condition where non-safety related temporary attachments were welded to the primary containment liner with no evidence that the required preheat had been applied to the liner, and Quality Control inspection was not initiated prior to the welding.

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130. The Company's response to 352/79-07-05, V.S. Boyer to Boyce Grier dated October 31, 1979, (Ref. 59, App. Exh.____), informed the NRC that Weld Request Forms and Weld Filler Metal Authorization Forms existed for the subject welds which showed that the welding was performed by qualified welders. Corrective action included identifying temporary attachments to the Containment Liner, determining that qualified welders performed these welds, and initiating inspection records for the subject welds using information from the existing records noted above. The documentation and control forms were subsequently fastened to the temporary attachments, For these temporary attachments the inspection records require a visual examination and surface NDE of the base metal

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R.A.Simanek

after the removal of the temporary attachments. The surface non-destructive examination would have identified for disposition any indications that might have resulted from the lack of preheat for disposition. Additionally, instructions were issued to require inspection records to be issued prior to performing temporary attachment welding to the containment liner.

131. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney

As to AWPP's allegations regarding AWPP-187 and 190, proper corrective action has been taken as described above. The original inspections were not performed for preheat prior to performance of the subject welds because of misinterpretation of inspection requirements. It should be noted that much of the liner is less than 1 1/4 inch thick and does not normally require preheat because the normal ambient temperatures.

AWPP-189 - (IE Report 352/79-07, Page 4)

132. J.M.Corcoran, D.T.Clohecy, F.J.Coyle, R.H.Zong, D.B.Hackney

AWPP-189, Item 1, pertains to Unresolved Item 352/79-07-02 regarding the need for certain acceptance criteria. As described in the referenced NRC Inspection Report, no weld deficiencies were identified. The NRC inspector questioned the QC Inspector regarding acceptance criteria for allowable gap between the backing bar and restraint. (Backing bars were used for groove weld joints

joining two circumferential pieces of certain pipe restraints.) The Quality Control Inspector stated that his criteria was "tight against the restraint." The NRC Inspector considered this matter an Unresolved Item since specific acceptance criteria for the allowable gap between the weld root and backing bar was not available. In order to clarify the requirements the Company issued a drawing change notice to the applicable drawing, stating that allowable separation between the backing bar and the weld joint shall be no more than 1/16 inch.

133. J.M.Corcoran, D.T.Clohecy, F.J.Coyle

The NRC Inspector reviewed and verified that this matter had been addressed and closed the Unresolved Item in a subsequent NRC IE Report (Ref. 62, Appl. Exh. ___). As to AWPP's allegation, this Unresolved Item did not involve any welding deficiencies ,however, action to specifically define the acceptance criterion was taken.

AWPP-189 (IE Report 352/79-07, Page 4, Item 2)

134. J.M.Corcoran, F.J Coyle, R.H.Zong, D.B.Hackney

AWPP-189, Item 2, relates to the NRC's discussion of Unresolved Item 352/79-07-03. This Unresolved Item is an engineering question raised by the NRC Inspector. As described on AWPP-189, the Inspector noted that components of pipe restraints supplied by a certain vendor had copes forming access holes to facilitate full penetration welding. The NRC Inspector also noted that components supplied by a different vendor did not have access holes and, therefore, questioned whether the required full penetration welds could be obtained.

135. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Benkert, V.Aggarwal, J.W.Fisher

At the time the NRC Inspector raised this question, four pipe restraints without copes with the subject weld configurations were complete. The welds of all four restraints had met the

full penetration requirements. In addition, an engineering evaluation determined that the full penetration requirement could be relaxed to ease the installation of the remaining restraints containing the same weld configuration. Page 4 of IE Report 352/81-16 (Ref.63 , Appl. Exh.___) dicusses the NRC Inspector's closure of this Unresolved Item. The Inspector reviewed the drawing revisions which deleted the requirement for full penetration welds.

With regard to this item, AWPP states: "There is an indication of incomplete control by Licensee." As discussed above, complete control was demonstrated by examination of the completed welds which met all requirements.

AWPP-194 - (IE Report 352/79-11, Page 9)

136. AWPP-194 pertains to Unresolved Item 352/79-11-01.

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D.T.Clohecy
F.J.Coyle
R.A.Simanek
R.H.Zong
D.B.Hackney

This item identifies that remachining of a pipe butt joint end preparation had begun prior to necessary approval. However, since the Company had identified this condition prior to the NRC Inspector, it was designated as an Unresolved Item by him.

Philadelphia electric Company's Quality Assurance had identified this condition and to resolve the matter Bechtel Quality Control documented the condition on an In-Process Rework Notice and obtained proper approval for the machining. Corrective actions taken as a result of the Applicant's identification included instruction of responsible personnel, emphasizing that no rework no rework is to be performed prior to obtaining the necessary approvals. The NRC Inspector reviewed the above actions and stated that the item was considered closed (Ref.64 ,Appl. Exh.___).

137. As to AWPP's allegations, the referenced NRC IE Report clearly
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indicates that the Company had identified that remachining had begun without approval on its own finding report prior to the NRC noting the situation. This is an example of the Company's Quality Assurance Program at work.

AWPP-195 (IE Report 352/79-11, Page 10)
AWPP-204 (IE Report 352/80-03, Page 11)

138. Both AWPP items 195 and 204 relate to Unresolved Item 352/79-11-02.
J.M.Corcoran
F.J.Coyle
AWPP-195 is Page 10 of IE Report 352/79-11, which is only a portion of the NRC's discussion of this Unresolved Item. The discussion actually starts on Page 9 of the Report (Ref. 65 ,Appl. Exh. ___). As noted on Page 9 this Unresolved Item relates to a welding deficiency identified by Bechtel Quality Control, not by the NRC. The NRC Inspector stated his opinion of what caused the deficient weld and made the matter an Unresolved Item so that he could track the Company's corrective action.

139. AWPP-204 is Page 11 of IE Report 352/80-03. In this report, the NRC
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F.J.Coyle
R.H.Zong
D.B.Hackney
J.W.Fisher
Inspector discussed his follow up inspection activities of the item. As noted, the NRC Inspector reviewed a Bechtel engineering memorandum which concluded that the identified weld deficiency was due to weld sequencing . The memorandum further stated that the manner of weld sequencing was an isolated case. The NRC Inspection Report also notes that the NRC Inspector reviewed a memorandum issued by the Company's Quality Assurance dated January 23, 1980 (Ref. 66 , Appl.Exh. _____), which requested its own engineering division to evaluate this matter. This engineering review concluded that the weld deficiency could have resulted from the

thickness of the material being welded. Therefore, the Company directed Bechtel to require a soaking preheat prior to welding and to require NDE of the completed weld.

140. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Fisher

Page 4 of IE Report 352/81-16 (Ref.67 ,Appl. Exh. ___) is a further NRC Inspector follow-up of this item. The Unresolved Item was closed in this report based on the NRC Inspector's verification of the drawing revision which required a soaking preheat to prevent weld deficiencies and an NDE to assure that none occur for this welding.

141. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Fisher

With regard to these items, AWPP states: 195, "Further Indication of careless or inadequate control of performance"; 204, "Referring to un-resolved item (352/79-11-02) Licensee's memo dated 1/23/80 demonstrates improper follow up by Applicant after a deficiency is discovered." As discussed above, proper follow-up was taken to assure that welding deficiencies had not occurred and that none would.

142. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Fisher

Note that AWPP's statement with regard to AWPP-195 was quoted from his handwritten comments in the margin of the Exhibit itself. No statements were made in reference to this matter nor was the Item listed in AWPP's chronology.

AWPP-210 (Page 1 of Appendix A to IE Report 352/80-12)

143. J.M.Corcoran, D.T.Clohecy, F.J.Coyle

This Item of Noncompliance 352/80-12-14 related to one individual employed by a subcontractor as a Quality Control Inspector performing receipt inspections who was not properly qualified

(Ref. 68 ,Appl. Exh.____). The NRC Inspector reviewed personnel records of the subcontractor's QC inspectors. Satisfactory results were reported except for that individual. The subject individual's file contained a letter stating that he was qualified based on his having read the procedural requirements, satisfactory performance during two field receipt inspections and satisfactory performance during an oral interview with the Subcontractors Quality Control Supervisor. However, the certification file was not complete in that all the documents required by the qualification procedures were not present to indicate the level of the individual's certification. In addition, the individual did not have previous work experience in Quality Control or related work. The subject subcontractor Quality Control Inspector was performing receipt inspections that did not involve welding inspections, inasmuch as quality inspection of welds at that time were made at the fabricator's facility.

The Company's corrective action as reported to the NRC (Ref.69 , Appl. Exh._____), involved halting the performance of inspections by the subject individual, reinspection of items previously inspected by this individual by a properly certified inspector, and revision of the subcontractor's procedure to improve the inspection program by providing for specialized training and certification of inspectors to one or more of three separate inspection categories or disciplines. The reinspection activity was reviewed by the Company and found to be complete.

The NRC Inspector reviewed the Company's corrective actions during a subsequent IE Inspection (Ref. 70 ,Appl. Exh.___) and verified the corrective actions. The NRC Inspector also reviewed a sampling of the Subcontractor's inspector qualification records, verifying that the requirements had been implemented and reviewed a sample of receipt inspections performed by the subject individual and verified that they were reinspected. The NRC IE Report referenced above notes that the corrective actions were satisfactory and Item 352/80-12-14 was closed.

As to AWPP's allegation, proper corrective action was taken as described above. This item did not relate to welding or welding inspection.

AWPP-235 (One page from IE Report 352/80-20 not page numbered)

144. J.M.Corcoran F.J.Coyle R.H.Zong D.B.Hackney H.W.Vollmer J.W.Benkert V.Aggarwal J.W.Fisher

AWPP-235 relates to the Item of Noncompliance 352/77-12-01. As discussed on Pages 3, 4, 5 of IE Report 352/77-12 (Ref. 71 , Appl. Exh._____), this violation identified very minor deficiencies in welds on the Residual Heat Removal ("RHR") structural supports. The Applicant reported the corrective action taken to resolve this item to the NRC in its letter dated December 9, 1977 (Ref. 72 ,Appl. Exh.___). These actions included reinspecting all field welds of the four RHR heat exchanger support structures and documenting any deficiencies on NCR's. In addition, a sample of each of the involved quality control inspectors work was reinspected and no other deficiencies were identified. To prevent recurrence, the Lead Quality Control Welding Engineer conducted a training class to reinstruct inspectors in verifying compliance with specifications and drawing requirements.

145. AWPP-235 consists of one page from IE Report 352/80-20 describing the NRC's follow-up inspection activities. The discussion is continued on the following page of the IE Report (Ref. 73 ,Appl. Exh. ___). This report notes that the NRC Inspector reviewed the documented results of the Company's reinspections. The NRC Inspector then personally performed inspections and found no welding deficiencies which had not been identified by the Company's reinspection. The NRC Inspector closed the Item of Noncompliance 352/77-12-01, but held open Unresolved Item 352/77-12-02. This Unresolved Item was related to the Item of Noncompliance and the Inspector decided that he would track the disposition of the NCR's generated by the reinspections through this Unresolved Item. The NCR's had already been dispositioned "Use-As-Is", but the NRC Inspector wanted to more thoroughly review the dispositions than given the time remaining in that inspection period. Page 4 of IE Report 352/81-12 (Ref. 74 , Appl.Exh. ___) notes the NRC Inspector's closure of this Unresolved Item. The NRC Inspector stated that he had reviewed the Company's evaluation of the weld defects and concurred with the disposition of this matter.

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J.W.Benkert
V.Aggarwal
J.W.Fisher

146. With regard to this item, AWPP states: "Under (3) it is shown there is improper inspection proceedure(sic) by Applicant found by NRC inspector similar to 76-06-01." From AWPP's handwritten notes in the margin of its AWPP-235, it was determined that AWPP made this statement in reference to the sample reinspection of previously accepted welds of the Quality Control Inspectors

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F.J.Coyle
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H.W.Vollmer
J.W.Benkert
V.Aggarwal
J.W.Fisher

involved. As discussed above, all the weld deficiencies, which the NRC Inspector identified as having been missed by the Quality Control Inspectors, were dispositioned "Use-As-Is". This is indicative of the minor nature of the deficiencies. In addition, the sample reinspection of the involved inspectors' previously accepted welds did not find any other deficiencies. These findings were evaluated and it was determined that the involved inspector's work was satisfactory.

AWPP-236 (One page of IE Report 352/80-20, report is not page numbered)

147. J.M.Corcoran D.T.Clohecy F.J.Coyle R.H.Zong D.B.Hackney

AWPP-236 is a single page from IE Report 352/80-20 which includes discussion of two separate NRC inspection activities. As determined from AWPP's handwritten notes on the face of AWPP-236, the first part of his statement applies to 352/80-20-01. The remaining portion of AWPP's statements will be addressed in the next section in conjunction with Item AWPP-246A since they pertain to the same matter. The NRC IE Report 352/80-20, Item 1 identifies grinding on a General Electric Company supplied reactor recirculation pipe butt-joint end preparation without the required General Electric approval.

148. J.M.Corcoran D.T.Clohecy F.J.Coyle R.H.Zong D.B.Hackney

Misalignment was identified during the initial fitup of this section of recirculation piping. Approval was obtained by Bechtel from General Electric Company to miter the subject weld prep to obtain alignment at the top of the riser with the reactor pressure vessel nozzle prior to welding. During welding of the joint,

the top of the riser moved out of alignment and a segment of the weld prep was widened by grinding to permit the deposit of more weld metal to draw the riser back into alignment. Bechtel did not obtain General Electric approval for the additional grinding to the subject weld prep prior to grinding.

149. J.M.Corcoran D.T.Clohecy F.J.Coyle R.H.Zong D.B.Hackney

The Company's response to this Item of Noncompliance (Ref. 75 ,Appl. Exh. ___) describes the corrective actions taken to resolve this isolated oversight. These actions included documenti ıg the matter on an NCR and obtaining General Electric disposition and authorization for grinding the weld preparation. Additionally, training was provided to the responsible personnel in which the requirements were explained and emphasized.

150. J.M.Corcoran D.T.Clohecy F.J.Coyle R.H.Zong D.B.Hackney

As to AWPP's allegation concerning "Applicant's failure to control performance and QC, the Company's contractor did not again obtain approval to alter the subject weld preparation prior to the additional grinding; however, proper corrective action as described above was taken. No weld deficiencies were involved in this item and none resulted from it. The associated records and radiographs for the subject weld joint were found satisfactory and the item was closed by the NRC Inspector during a subsequent inspection, 352/82-05,(Ref. 76 ,Appl. Exh. ____).

151. Both AWPP item numbers relate to NRC Item 352/81-01-04, involving the use of an In-Process Rework Notice (IPRN), rather than a NCR to document nondestructive indications found on the surface of an ASME valve body casting (Ref. 77 ,Appl. Exh._____).

J.M.Corcoran
D.T.Clohecy
F.J.Coyle

Use of IPRN is permitted to report deficiencies identified during in-process inspections. NCR's are required to be used to report deficiencies identified during or after final inspection activities. In the special case of a "stamped" ASME component, the component has already been accepted by the vendor's ASME QA/QC program. Therefore, any deficiencies identified should be documented on NCR's rather than IPRN's. This instance involved a "paperwork" or administrative error only, since the indications identified on the IPRN were properly dispositioned. The disposition would have been the same whichever form was utilized.

The corrective actions reported by the Company (Ref.78 ,Appl. Exh.___) included a number of actions. The condition noted was subsequently identified on a NCR. Open IPRN's were reviewed and several additional instances where IPRN's were employed in lieu of Nonconformance Reports were identified and then reported on NCR's Instructions concerning the applicable requirements were issued to the responsible personnel, and a training class on the requirements for the use of NCR's was held for responsible QC personnel.

It should be noted that the components identified were fabricated in accordance with the applicable ASME code requirements and passed the required NDE. The governing code does not require liquid penetrant examinations of the valve body castings, which was the subject examination being performed in the field on the adjacent welds. Therefore, the valves were acceptable for installation as received from the manufacturer. Because the valve bodies are castings and thus have inherent surface irregularities, a liquid penetrant indication does not mean that it is unsatisfactory for service.

As to AWPP's allegation, proper corrective action was taken as described above, and the instances noted of an administrative error in the form used to document a discrepancy and obtain resolution, does not demonstrate "improper follow-up on infraction and improper action after deficiency is found."

AWPP-246A (Telephone Conference between NRC AND PECO on 5/20/81)
AWPP-236 (Page from IE Report 352/80-20)

152. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, R.A.Simanek

AWPP-236 is an excerpt from IE Report 352/80-20 which states that the involved NRC Inspector had become aware of the fact that pipe fit-up inspections had been changed from "Hold Point" inspections to "Surveillance" inspections. This report only denotes the recognition of the change in the inspection program and the NRC did not make any judgment with regard to the acceptability of the change in this report. Page 6 of IE Report 352/80-21 (Ref. 79, Appl. Exh. _____) discusses ~~of~~ the NRC's follow-up inspection activities of this item. In this report the Inspector determined this to be a violation (352/80-21-05). However, the

violation did not relate to the change from "Hold Point" inspections to "Surveillance" inspections, but rather to the fact that no provisions were described in the Surveillance inspection program in which to base the need for increased surveillance if an inordinate number of rejectable findings were identified.

153. Philadelphia Electric Company responded to this violation in a letter dated February 13, 1981 (Ref. 80, Appl. Exh. ___). In its response, the Company requested that the designation of this matter as an Item of Noncompliance be reconsidered since the concept of progressive levels of monitoring was inherent in the definition of the term "Surveillance" contained in the Limerick Quality Assurance Manual. The letter notes that, as the NRC Inspector recognized, the increase in surveillance was not based on any quantitative rules, but rather on the judgment of the Bechtel Quality Control Inspectors. These individuals are familiar through their experience with the many variables associated with the inspection activities. The Company took the position that to require surveillances to be numerically quantified would restrict the inspectors' discretion. The response also noted that the acceptance of pipe welds is based upon the satisfactory completion of the inspection program requirements of 100% percent final inspections, including tests and nondestructive examinations

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D.B.Hackney
R.A.Simanek

required by the applicable codes and standards or specification. AWPP-246A is a Philadelphia Electric Company memorandum of a telephone conversation between the NRC and Philadelphia Electric Company regarding the response to the Item of Noncompliance discussed above. The item of this telephone conversation to which AWPP has drawn attention was the NRC's statement that it could interpret the Company's response to infer that additional inspection impedes the progress of work. The immediately following response of H. R. Walters (then Manager of Quality Assurance for Philadelphia Electric Company) was: "I assure you that PECO/Bechtel do not believe that inspection impedes the work, and we had no intention to convey such an inference to the NRC."

154. As a result of the telephone conversation, a meeting was arranged to answer the NRC's questions regarding the above discussed response and to clarify both organizations' positions on this matter. At the meeting, Philadelphia Electric Company provided a general description of the surveillance inspection and informed the NRC of the decision process behind the inspection change. The Company also informed the NRC that there had been an evaluation to assure that quality would not be reduced. The Company presented the results of acceptance and rejection rate studies for welds at Limerick which were done prior to and after the inspection change to assure that quality was not sacrificed. Acceptance rates after the change were virtually the same as those prior to the change. However, the NRC still thought that

J.M.Corcoran
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D.B.Hackney
R.A.Simanek

a surveillance inspection program should have qualitative as well as quantitative criteria. As a result, the Company committed to submitting a supplemental response to this Item of Noncompliance.

155. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, R.A.Simanek

The Company's supplementary response dated July 17, 1981,(Ref. 81 , Appl. Exh._____) indicated the program changes made to resolve the NRC's violation. These changes included a requirement for the surveillance of fit-ups to include a minimum of 10 percent of all pipe welds and for the Lead Welding Quality Control Engineer (LWQCE) to monitor the results of these inspections. When the LWQCE receives two or more reports of unacceptable fit-ups on any one day, he is required to increase the surveillance inspections to include 20% of all pipe welds until no unacceptable conditions occur. The NRC acknowledged receipt of this supplementary response in its letter dated July 27,1981 (Ref. 82 ,Appl. Exh.___)

156. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, R.A.Simanek

With respect to this matter, AWPP states under its Item 236: "Licensee is arbitrarily ignoring required "hold point"; and under its Item 246A, "Example of PECO short cuts re QA, QC criticized by NRC." As discussed above, no required hold point was ignored. The hold point requirement was originally established by the Company and after careful consideration of the need for such inspections, deleted the requirement. After informing the NRC of the consideration given this inspection change, the NRC did not criticize the deletion of the hold point requirement, but rather questioned the method of the new "Surveillance" inspection. As discussed above, the Company has incorporated the NRC's recommended improvements into its inspection program.

AWPP-237 (PECO's response to Item of Noncompliance 352/80-20-03)

J.M.Corcoran
D.T.Clohecy
F.J.Coyle
R.H.Zong
D.B.Hackney

157. The NRC Inspection Report 352/80-20-03 (Ref. 83 ,Appl. Exh. ____) identifies areas of undercut in excess of the allowable on vendor-supplied feedwater pipe restraint welds.

J.M.Corcoran
D.T.Clohecy
F.J.Coyle
R.H.Zong
D.B.Hackney

158. The Company's response (Ref. 75 , Appl. Exh. ____) and the NRC follow-up inspection closing this item (Ref. 84 , Appl. Exh. ____) describes the corrective action taken. Corrective actions included review of purchase orders issued to the particular vendor to identify other safety-related feedwater and main steam restraints and other assemblies supplied by the subject vendor and performance of reinspections by Bechtel QC. Weld deficiencies were identified and properly dispositioned on nonconformance reports. The vendor was notified of the nonconforming conditions and it took steps to improve its inspection program; by instructing responsible personnel in the applicable requirements to assure compliance with the AWS D1.1 Code. A Philadelphia Electric Company audit of the vendor involved was subsequently conducted to verify the effectiveness of his welding inspection program. No deficiencies were identified. The NRC inspector verified that appropriate corrective actions were implemented, and he reinspected the subject pipe restraints, finding that required repairs were made and noting no additional defects.

159. The quality inspections of vendor supplied weldments is performed by
J.M.Corcoran
D.T.Clohecy the supplier's own QC organization and, on a surveillance basis,
F.J.Coyle
R.H.Zong by a Bechtel Supplier Quality Representative (shop inspector).
D.B.Hackney
To supplement the above inspection program, additional instructions for inspections of AWS welds were added to the jobsite receipt inspection activities in 1980. These added inspections did not supplant the supplier's inspection responsibility, but added an additional level of assurance against vendors supplying deficient welds.

160. As to AWPP's allegation that this instance "shows Applicant's inadequate
J.M.Corcoran
D.T.Clohecy control of QC and QA", the weld deficiencies identified were isolated
F.J.Coyle
R.H.Zong to welds performed and inspected by a particular vendor.
D.B.Hackney
Proper corrective actions were taken as described above. This instance does not support AWPP's general statement.

AWPP-243 (Page 2 of Appendix A to IE Report 352/81-01)
AWPP-244 (IE Report 352/81-01, Page 4)

161. Both AWPP 243 and 244 relate to Item of Noncompliance 352/81-01-02.
J.M.Corcoran
F.J.Coyle As discussed on Page 4 of IE Report 352/81-01 (AWPP-244), this
R.H.Zong
D.B.Hackney violation consisted of welding on an electrical support without
J.W.Fisher
the required 150°F preheat of the base metal.

162. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Fisher

The corrective actions taken to resolve this violation included qualifying the weld procedure used without preheat. The results of these qualification tests demonstrated that the subject welds were acceptable and that, therefore, similar welding done without preheat were also acceptable. The corrective actions and test results were submitted to the NRC by a Company letter dated March 23, 1981, (Ref. 85 ,Appl. Exh.____). This response also describes the requirements of the technical codes supporting the Company's position that 150°F preheat is not required for base material up to 2" thick of the type involved. The response notes that, although the preheat requirement is not necessary to attain satisfactory welds, as a good practice, it would be continued as a requirement. The response also describes the corrective actions to prevent recurrence, i.e, of training the responsible personnel and revision to the field welding instruction procedure to clarify and emphasize preheat requirements.

163. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Fisher

Pages 6 and 7 of IE Report 352/81-12 (Ref. 86 ,Appl. Exh.____) describe NRC follow-up inspection activities of this item. As noted in the report, the NRC Inspector verified corrective actions. In addition, he requested nondestructive examinations of the subject weld and other welds with similar joint configuration to further assure that the lack of preheat was not detrimental to the welding. The Company performed magnetic particle examination of the subject weld and three others and all were acceptable. Based on these actions, the NRC closed the Item of Noncompliance.

164. J.M.Corcoran, F.J.Coyle, R.H.Zong, D.B.Hackney, J.W.Fisher

AWPP did not characterize this item. The fact of the violation is all that is stated. As discussed above, the violation did not result in any deficient welds and corrective actions were taken to prevent a similar recurrence.

AWPP-246 (PECO's response to the NRC regarding Item of Noncompliance 352/81-06-02)

165. J.M.Corcoran, F.J.Coyle

This Item of Noncompliance identified the fact that corrective actions to a previous violation relating to HVAC weld and inspection accessibility deficiencies, which the Company committed to complete by a certain date, were not completed by that date, and that it had closed this item based on commitments made by a subcontractor.

166. J.M.Corcoran, F.J.Coyle

Corrective actions were taken by the Company to assure that identified Items of Noncompliance would be completely corrected and would not recur (Ref. 87 ,Appl. Exh._____). Philadelphia Electric Company Finding Report N-173 was initially closed out based on a commitment by the HVAC Subcontractor to perform a reinspection of all previously installed fire dampers. As a result of this occurrence, Philadelphia Electric Company instituted a policy that all finding reports generated as a result of NRC Items of Noncompliance with acceptable resolutions would not be closed out based on commitments, but would remain open until the corrective actions had been satisfactorily accomplished and verified in the same way that Finding Reports on other items

have been processed. The initial distinction had been based upon the NRC's requirement that a response to a Notice of Violation must be submitted within thirty days. In addition to the above actions, it was verified that the HVAC subcontractor had inspected all installed trap door fire dampers to determine if the welds were accessible for inspection. Any welds found to be inaccessible for inspection were repaired by placing a new weld on the inside of the duct or were evaluated and dispositioned as acceptable for use "Use-As-Is" by Bechtel.

167. J.M.Corcoran F.J.Coyle

The corrective actions taken by the HVAC subcontractor to prevent recurrence were that its Quality Control Inspectors were given training courses in the requirements, on the actions to be taken when, and if, welds or other attributes cannot be adequately inspected because of accessibility. The inspection procedure was revised to include a check to verify accessibility during in-process inspections to preclude recurrence. A review of other Company responses submitted to NRC Items of Noncompliance was performed. Any response which had committed to future actions was followed up to ensure that the actions were satisfactorily accomplished. The NRC Inspector reviewed the corrective actions taken during a subsequent inspection (Ref.88, Appl. Exh._____) and verified they were completed, and closed this item.

168. J.M.Corcoran F.J.Coyle

With regard to this matter, AWPP states: "re 50-352/81-05; 06 see underlined --refering to welding inadequacies disccvered but not properly corrected. Further, improper welding accepted by Licensee on 2/6/80". As discussed above, the Company did not accept improper welding on 2/6/80 but a commitment to resolve improper welding. The commitment rather than the completion of the resolution was accepted because of the time restraint associated with the required response to the NRC. The Company has improved its administrative procedures to assure that commitments are no longer the basis of acceptances and has assured that past commitments have been carried out.

AWPP-247 (PECO response to Item of Noncompliance 352/81-06-03)

169. J.M.Corcoran F.J.Coyle R.H.Zong D.B.Hackney H.W.Vollmer J.W.Benkert V.Aggarwal J.W.Fisher

AWPP-247 relates to Item of Noncompliance 352/81-06-03. As described on page 7 of IE Report 352/81-06 (Ref. 89, Appl. Exh.____), this matter pertains to vendor-fabricated structural steel which was supplied with welds containing undercut in excess of the code allowable 1/32". The cited structural steel was located in the Reactor Building North exhaust stack.

170. J.M.Corcoran F.J.Coyle R.H.Zong D.B.Hackney H.W.Vollmer J.W.Benkert V.Aggarwal

The welding deficiencies identified by the NRC Inspector were evaluated and found to be acceptable for "Use As Is." However, reinspection of all the shop-welded connections in the Reactor Building South exhaust stack was performed. Minor discrepancies

J.W.Fisher

were identified similar to those identified by the NRC Inspector. These discrepancies were also evaluated and found acceptable for "Use As Is". As a result of the 100% inspection of the South stack, the structural steel in the other three stacks was given a sample inspection of shop welds. Minor weld deficiencies were also identified in these stacks and dispositioned similarly.

Based on the minor nature of all the deficiencies identified, engineering determined that a complete inspection of all the shop welds was not required. These corrective actions were reported to the NRC in the Company's letter dated June 26, 1981 (Ref.87, Appl. Exh._____). The response notes that no corrective action to prevent recurrence was sought from the involved vendor because its scope of supply was complete. However, Bechtel Quality Control Receipt Inspectors were instructed to increase their inspections of any future structural steel to be received from other vendors.

171. With regard to this item, AWPP states: "Same reference as AWPP 246 see underlining under Violation B." AWPP's statement regarding AWPP 246 implies that the Company had accepted improper welds and that proper corrective action was not taken. As discussed above, corrective actions were taken to assure that the welds involved were satisfactory to perform their required functions.

J.M.Corcoran
F.J.Coyle
R.H.Zong
D.B.Hackney
H.W.Vollmer
J.W.Benkert
V.Aggarwal
J.W.Fisher

172. AWPP-260 (Page 1, Item A of Appendix A to IE Report 352/82-03)

J.M.Corcoran
F.J.Coyle
R.H.Zong
D.B.Hackney

Item A of AWPP-260 is Item of Noncompliance 352/81-17-02. As described on pages 3 and 4 of IE Report 352/82-03 (Ref. 90, Appl. Exh. ___), this matter consisted of an anomaly in the manufacturing process not specifically dealing with welds having defects, but rather with the heat treating practices employed and the radiographic testing methods used for valve body castings. The valve bodies were post-weld heat treated (PWHT) to a temperature of 1340°F. The weld procedure used was qualified to 1300°F. Radiography of the valve bodies was performed prior to heat treatment which was contrary to the applicable code requirements.

173. The corrective actions taken to resolve this item were reported to the NRC in the Company's letter dated March 11, 1982 (Ref. 91, Appl. Exh.). A technical evaluation determined that the performance of radiography before heat treatment was acceptable. This position is supported by more recent editions of the applicable code which now allows this practice. Qualification tests were performed which demonstrated that the PWHT at 1340°F did not cause any detrimental effects. These qualification tests consisted of subjecting sample specimens to the same heat treatment as the valves in question and then destructively testing the the specimens to determine the strength of the material. The sample specimens were of the same material type as the valves. To determine if there were other problems of this nature, a review of the documentation of several other items supplied by the same foundry and samples of other suppliers was made. This review determined that this violation was isolated.

J.M.Corcoran
F.J.Coyle
R.H.Zong
D.B.Hackman

174. Page 3 of IE Report 352/82-10 (Ref. 92 ,Appl. Exh.___) contains a discussion of the NRC's inspection activities which verified the above corrective actions. The NRC noted that it considers the matter resolved and closed the Item of Noncompliance.

J.M.Corcoran
F.J.Coyle
R.H.Zong
D.B.Hackney

175. With regard to this item, AWPP states: "re: notice of violation inspection of 1/11-29/82 under A and B severd (sic) violation of welding procedure by Applicant." As discussed above, this item did not involve welding, but rather heat treatment and NDE methods which did not conform to the code requirements in effect at the time the valves were fabricated. Corrective actions proved that the valve body material strength met all specification requirements for satisfactory service.

J.M.Corcoran
F.J.Coyle
R.H.Zong
D.B.Hackney

AWPP-260 (Page 1, Item B of Appendix A to IE Report 352/82-03)

176. AWPP-260 relates to Item 352/81-17-02 initially considered unresolved and later identified as an Item of Noncompliance in IE Report 352/82-03, which identifies the fact that hold point inspections for preheat on full penetration groove welds had been left unsigned on an Inspection Record and work had proceeded (Ref. 93 , Appl. Exh._____). The involved NRC Inspector determined this item to be a severity level VI violation which is defined in 10 CFR Part 2, Appendix C, Supplement II, as Violations that have minor safety or environmental significance".

J.M.Corcoran
D.T.Clohecy
F.J.Coyle
R.H.Zong
D.B.Hackney
R.A.Siminek
J.W.Fisher

J.M.Corcoran
D.T.Clohecy
F.J.Coyle
R.H.Zong
D.B.Hackney
R.A.Siminek
J.W.Fisher

177. The Company response to this matter describes the corrective actions which are summarized as follows (Ref. 91 , Appl. Exh. ___) : An NCR was written reporting that preheat had not been verified on the subject Quality Control Inspection Record. The welds identified on the NCR have been dispositioned by Bechtel engineers as acceptable for "Use-As-Is". This decision was based on the fact that the preheat requirements for these welds are to preheat to 70°F only if the ambient temperature is below 32°F. The subject welds were performed during May and June of 1979 when the ambient temperature was above 32°F. Therefore, preheat was not required for these welds. It should be noted that subsequent Quality Control inspections and inspection record reviews would have identified the missed sign off had the NRC not identified it first. In an effort to determine if the inspector had overlooked other preheat hold point inspections, a sample of other inspection records completed by him were reviewed for similar discrepancies. No other discrepancies or missing sign-offs were found. Open Civil Quality Control Inspection Records were reviewed for preheat requirements and sign-offs. Each was found to be in conformance with the applicable procedures. Additionally, a training session was held for Quality Control Welding Inspectors emphasizing the proper preheat requirements.

J.M.Corcoran
D.T.Clohecy
F.J.Coyle
R.H.Zong
D.B.Hackney
R.A.Siminek
J.W.Fisher

178. As to AWPP's allegation of a "severe violation of welding procedures by Applicant", the welding procedure was not violated since preheat was not required for the above welds. Proper corrective actions was taken as described above when this administrative oversight was identified. Further, the in-process hold point inspection sign-off omission would have been identified within the Company's program had it not been identified by the NRC.

Conclusion

179. V.S.Boyer
J.M.Corcoran

On the basis of its strong welding and QA programs, Philadelphia Electric Company is confident that the welding and welding inspection at the Limerick Project meets the Company's objectives for Limerick to be a safe and reliable plant and is in conformance with the requirements of 10 CFR Part 50 Appendix B and the Quality Assurance Program described in the Application. The safety factors used in the design process and the competent people Philadelphia Electric Company and Bechtel Power Corporation have assigned to perform and implement the design, construction and quality assurance programs, justify this confidence. The three levels of verification applied to the design of the welding program and three levels of verification applied to the welding performed at the Limerick Generating Station have enabled Philadelphia Electric Company to maintain a constant awareness and control of the welding activities.

There are in excess of two million safety-related welds at Limerick. With this much welding activity, there is potential for occasional welding deficiencies and some have been experienced at Limerick. Most of these have been discovered and corrected as the result of the effective implementation of the Quality Assurance Program. Although the NRC has also identified a few such deficiencies, they have not generally been repeated instances of a similar nature. This is a testament to the effectiveness of the Quality Assurance Program. The programmatic evaluation done by the NRC (1983 SALP Report) made the following statement with respect to welding:

"Observations by the Resident Inspector and the Construction Inspection Team indicated that a strong construction QC program was in place. In addition to the E-C's well staffed and trained QC organization, the Licensee's QA organization also is staffed by well trained and knowledgeable QA engineers. The Resident Inspectors have noticed that the Licensee's QA engineers have performed more than the required inspections and surveillances in this area."

It may be concluded that Philadelphia Electric Company has controlled performance of welding and inspection thereof in accordance with the Quality Assurance Program, and has taken proper and effective corrective and preventative actions when improper welding has been discovered. Thus, there is assurance that the Limerick Generating Station is built in accordance with the Application and may be safely operated .

IN 30TF2

VINCENT S. BOYER

Employer: Philadelphia Electric Company

Position: Senior Vice President - Nuclear Power

Born: Philadelphia, April 5, 1918

Education:
B.S. in Mechanical Engineering - Swarthmore College - 1939
M.S. in Mechanical Engineering - University of Pennsylvania - 1944
Nuclear Energy Courses - University of Pennsylvania and Drexel University - 1960-1962

Experience: Philadelphia Electric Company - 1939 to date

1939 - 1951 - Engineering positions in power plant

1951 - 1953 - Engineering Department

1953 - 1960 - Cromby Generating Station - Assistant and Station Superintendent

1960 - 1963 - Superintendent, Peach Bottom Atomic Power Station

1963 - 1968 - Manager, Nuclear Power and Electric Operations

1968 - 1980 - Vice President, Engineering & Research Department

1980 - Present - Senior Vice President, Nuclear Power

Professional Organizations:

American Nuclear Society
American Society of Mechanical Engineers
Society of American Military Engineers
National Society of Professional Engineers

Honors:

Fellow of ~~ANS~~ ANS and ASME
Honorary Doctorate of Engineering Technology - Spring Garden College
Engineer of the Year - Delaware Valley - 1979
National Academy of Engineering - 1980
ASME James M. Landis Medal - 1981
George Washington Medal of Engineers Club of Philadelphia - 1982

PROFESSIONAL QUALIFICATIONS

David T. Clohecy
Quality Assurance Engineer
Engineering and Research
Philadelphia Electric Company

My name is David T. Clohecy. My business address is 2301 Market Street, Philadelphia, PA., 19101. I am an Engineer currently assigned to the Quality Assurance Field Branch at Limerick Generating Station. I presently lead a group of Quality Assurance Engineers performing Quality Assurance program reviews, audits, and surveillances of Limerick jobsite construction and preoperational test activities.

I attended Villanova University from 1969 to 1973 and received a B.S. in Civil Engineering.

I have been employed by Philadelphia Electric Company since July of 1973. Since joining Philadelphia Electric Company in 1973 I have worked as a civil engineer on various Company projects involving rework, repair or new facilities at various Philadelphia Electric Company generating stations, engineering review of civil specifications and design drawings for Limerick, design and design review for transmission towers/poles and foundations, and construction field engineering at Limerick.

I have worked as a Quality Assurance Engineer since December of 1977. Activities within my Quality Assurance program review and audit responsibility at Limerick Generating Station have at various times, included concrete placement activities, structural steel erection, reactor internals installation, spray pond soils and shotcrete work, and preoperational test activities.

I am a Professional Engineer registered in Pennsylvania. I am a Qualified Lead Auditor to ANSI N45.2.23 Standard.

PROFESSIONAL QUALIFICATIONS

Frank J. Coyle
Quality Assurance Engineer
Engineering and Research
Philadelphia Electric Company

My name is Frank J. Coyle. My business address is 2301 Market Street, Philadelphia, PA., 19101. I am an Engineer currently assigned to the Quality Assurance Field Branch at Limerick Generating Station. I am presently responsible for performing Quality Assurance program reviews, audits, and surveillances of the Limerick jobsite construction activities. I attended Drexel University from 1974 to 1979 and received a B.S. in Mechanical Engineering. I am presenly nearing of completion of studies relating to an MBA degree at St. Joseph's University.

I have been employed by Philadelphia Electric Company since July of 1979. After joining Philadelphia Electric Company in 1979 until December of 1980, I worked as a Project Engineer on the various Company undertakings involving repair, modifications and additions made at various operating Philadelphia Electric Company generating stations including Peach Bottom Atomic Power Station. In addition to my project engineering duties, I have also performed design and design review of power piping systems which involved pipe stress analysis.

In my current capacity as a Quality Assurance Engineer, my responsibility is to help assure that the Quality Assurance Program of the Limerick Generating Station is effective and effectively implemented . In fulfilling this responsibility, I review program changes, design specifications, and implementing procedures. In addition, I audit the jobsite activities performed within the program. These audits include inspecting the contractors' construction activities for compliance to drawings and specifications, observing the

execution of controls (inspection, review and approval) applied to performing these construction activities, checking design calculations and reviewing the identification and resolution by the contractors of nonconforming conditions. As a Quality Assurance Engineer, I am also responsible for reviewing corrective actions taken to resolve deficiencies to determine if the actions are complete and appropriate. I also act as a Company representative during Nuclear Regulatory Commission inspections.

I am a Professional Engineer registered in Pennsylvania. I am a Qualified Lead Auditor to ANSI N45.2.23 Standard, I am also a member of the American Society of Mechanical Engineers.

PROFESSIONAL QUALIFICATIONS

James M. Corcoran, Jr.
Branch Head
Field Quality Assurance Branch
Philadelphia Electric Company

My name is James M. Corcoran, Jr. My business address is 2301 Market St., Philadelphia, Pa. 19101. I am the Branch Head of the Field Quality Assurance Branch of the Engineering and Research Department at the Limerick Generating Station. As a Branch Head, I supervise a group of Quality Assurance Engineers and Quality Control Inspectors responsible for the performance of Quality Assurance and Quality Control activities for the Limerick Generating Station.

I attended Villanova University from 1960 to 1964 and received a Bachelor's Degree in Electrical Engineering in 1964. I also received a Masters Degree in Business Administration from Drexel University in 1971. Additionally, I have taken various courses in nuclear engineering, reactor operations, codes, nondestructive examinations, and Quality Assurance.

After graduating from Villanova University in 1964, I worked for Philadelphia Electric Company in various engineering capacities including, Station Operations, Electrical Substation Field Engineering, Transmission and Distribution, Station Test Engineering, Electrical Project Design Engineering where I performed engineering design and design review work associated with the Peach Bottom Units 1, 2 and 3 and Limerick. In 1971 I was assigned to the Philadelphia Electric Company's Engineering and Research Department Quality Assurance organization where I have since been involved with Quality Assurance activities associated with the design, construction and operation of Peach Bottom. From 1974 to the present, I have supervised the Field Quality Assurance Branch at Limerick Generating Station. At Limerick my group performs Quality Assurance audits and reviews of design and construction at Limerick.

I am a member of The American Society For Quality Control. I am a Professional Engineer registered in Pennsylvania and California. I am certified by The American Welding Society as a Welding inspector. I am a Qualified Lead Auditor to the ANSI N45.2.23 Standard.

PROFESSTIONAL QUALIFICATIONS

Robert H. Zong
Senior Metallurgical Engineer
Research and Testing Division
Philadelphia Electric Company

My name is Robert H. Zong. My business address is 2301 Market St., Philadelphia, Pa. 19101. I am a Senior Metallurgical Engineer of the the Engineering and Research Department. As a Senior Metallurgical Engineer it is my responsibility to review Philadelphia Electric Company's and contractor welding procedures for technical adequacy and adherence to the respective codes for the Limerick Generating Station.

I attended Pennsylvania State University from 1951 to 1956 and received a Bachelor of Science Degree in Metallurgy in 1956. Additionally, I have received formal education in nuclear engineering, nondestructive testing, weld examination and quality assurance. After graduating from Pennsylvania State University in 1956 I worked for 4 years for Curtis Wright in their Research Department. In 1960 I joined Philadelphia Electric Company. My assignments from that time forward have included the overseeing welding and welding qualifications, materials selections, failure analysis, and nondestructive testing for many phases of the Company's operation. Of particular interest are Peach Bottom 1, Eddystone 1 and 2 maintenance work, Peach Bottom 2 and 3 welding procedures, nondestructive testing and the ASME Section XI base line inspection. For the Limerick Generating Station I am responsible for the technical adequacy of welding procedures, welding qualifications, nondestructive testing procedures and qualifications and the ASME Section XI base line in-service inspection program. I have reviewed all of the Bechtel welding procedures used on Limerick. In addition to these responsibilities, I have

assisted Quality Assurance and the Mechanical Engineering Division of the Company in their assignments with respect to the Limerick Generating Station.

I am a member of the American Society of Mechnaical Engineers, the American Society for Metals, the American Society for Nondestructive Testing. I am a past President of the American Society for Nondestructive Testing. I am a Professional Engineer registered in the state of California as a Quality Engineer. Also I am a certified Nondestructive Testing Level III for Philadelphia Electric Company in the specialties of Radiography, Ultrasonic Testing, Dye Penetrant Testing, Magnetic Particle Testing, Eddy-current Testing and Visual Inspection.

PROFESSIONAL QUALIFICATIONS
H. WILLIAM VOLLMER
ENGINEER-IN-CHARGE
STRUCTURAL BRANCH
PHILADELPHIA ELECTRIC COMPANY

My name is William Vollmer. My business address is 2301 Market St., Philadelphia, PA 19101. I am Engineer-in-Charge of the Structural Branch. As a Branch Head, I supervise a group of engineers that provide the structural engineering for generating stations (fossil, hydro, and nuclear) and other facilities on the Philadelphia Electric Company System.

I received training as an engineer by attending Bucknell University from 1963 through 1968 and received a B.S. in Civil Engineering.

Following my graduation, I was employed by the Boeing Company as a Technical Support Engineer. The work was primarily in the field of correlating structural analysis with test results.

I have been employed by Philadelphia Electric Company since April of 1970. In my present capacity, I supervise the work of six graduate structural engineers who handle the structural engineering for Philadelphia Electric Company. Prior to my present assignment as Branch Head of the Structural Branch, I was a Design Engineer in the Structural Branch. In this capacity I was involved in various projects, including modifications to the containment structures at Peach Bottom and Limerick.

For the Limerick Station, I supervise Philadelphia Electric Company's review of structural design and analysis. My group reviews and approves all design specifications related to civil design matters.

I am a member of The American Concrete Institute. I am a Professional Engineer registered in Pennsylvania.

PROFESSIONAL QUALIFICATIONS
JOHN W. BENKERT
ENGINEERING SUPERVISOR
BECHTEL POWER CORPORATION

My name is John W. Benkert. My business address is 50 Beale Street, San Francisco, California 94109. I am a professional civil engineer. I am an engineering supervisor in that position. I supervise the civil/structural group assigned to the Limerick Generating Station. I am a registered Professional Engineer in the Commonwealth of Pennsylvania (PE-017066-E) and a registered Professional Engineer in Civil Engineering in the state of California (C-024342).

I attended Georgia Institute of Technology from 1959 through 1963 and received a Bachelor of Aerospace Engineering degree.

Following my graduation until 1965, I was employed by Hayes International Corporation as a design engineer performing structural design and drafting of launch support equipment for National Aeronautics and Space Administration Saturn Project.

From 1965 through 1969, I was employed by Combustion Engineering, Inc. as a structural engineer performing design of boiler houses, support structures and steam generator internal structural components for approximately 12 fossil fueled power plants.

From 1969 through 1972, I was employed by Gilbert Associates Inc. as a structural engineer primarily involved with two nuclear fueled power plants. Activities included engineering/design of various structures, development of structural portions of Safety Analysis Reports, and development of criteria and specifications.

I have been employed by Bechtel Power Corporation since 1972. My present title is engineering supervisor and I supervise the civil/structural group assigned to the Limerick Generating Station.

PROFESSIONAL QUALIFICATIONS

Vinod K. Aggarwal

Engineering Supervisor
Bechtel Power Corporation

My name is Vinod K. Aggarwal. My business address is 50 Beale Street, San Francisco, California 94109. I am an Engineering Supervisor in the Civil Engineering discipline on the Limerick Project for Bechtel Power Corporation.

I attended M.B.M. Engineering college in Jodhpur (Rajasthan, India) from 1962 through 1967 and received a Bachelors degree in Civil Engineering. I also attended Delhi College of Engineering, Delhi (India) from 1967 through 1969 and received a Masters degree in Structural Engineering. I attended Carnegie Mellon University from 1969 through 1970 and received a Masters degree with a major in Structures.

Following my graduation until July 1972, I was employed by Reliance Contracting Company in Pittsburgh (PA) as a design engineer performing structural design of a glass plant, sand handling plant and mining-related structures.

From August 1972 through July 1973, I was employed with R. M. Gensert Associates in Cleveland, (Ohio) as a structural engineer. I designed multi-storied moment-resistant steel structures for hospital/school buildings, crane girders for industrial building and multi-story block wall apartment complexes.

From August 1973 through July 1974 I was employed with Lockwood Greene Engineers in Atlanta (GA) as a group leader supervising engineers and drafters involved in design of precast, prestressed textile plant, concrete/steel building for a food processing plant.

I have been employed by Bechtel Corporation since August 1974. I have been involved in design and supervising engineers for three nuclear power plants, a fossil power plant and a mining plant. My present title is Group Leader and I supervise field support group in Civil discipline assigned to the Limerick Generating Station.

I am a Registered Professional Engineer in the Commonwealth of Pennsylvania (PE-018891-E).

PROFESSIONAL QUALIFICATIONS

Dr. John W. Fisher
Professor of Civil Engineering
Associate Director
Fritz Engineering Laboratory, #13
Lehigh University
Bethlehem, Pennsylvania 18015

Dr. John W. Fisher has been a member of the Lehigh University faculty since 1964 and was promoted to Professor of Civil Engineering in 1969. In August 1971, he was named Associate Director of Fritz Engineering Laboratory at Lehigh University. Prior to joining the Lehigh staff, he was Assistant Bridge Research Engineer with the National Academy of Sciences at the AASHO Road Test for three years.

A native of Scott City, Missouri, Dr. Fisher graduated from Washington University in St. Louis, Missouri, in 1956 with the Bachelor of Science degree in Civil Engineering, and received his Master of Science and Doctor of Philosophy degrees from Lehigh University in 1958 and 1964, respectively.

A structural engineer, he is a specialist in structural connections, fatigue and fracture resistance of riveted, bolted and welded connections, and the behavior and design of composite steel-concrete members. He has been engaged in some forty-five research projects in these areas since 1961, supervising about fifty (50) graduate research assistants on these projects. He is currently director of the following on-going research projects:

1. Steel Bridge Members under Variable Amplitude Long Life Loading, National Academy of Sciences.

2. Fatigue Studies of Sudan Railroad Bridges, Sudan Railways Corporation

3. Fatigue Strength of Weathered and Deteriorated Riveted Members (DOT)

4. Assessing Fatigue Damage of Norfolk and Western Railroad Bridge at Hannibal, Missouri (Norfolk and Western Railroad)

Dr. Fisher received the Walter L. Huber Research Prize from the American Society of Civil Engineers in 1969 for research on high strength bolts, composite design of continuous beams, fatigue behavior of welded steel beams, field performance of bridges and behavior of rigid frame connections.

Dr. Fisher received the American Welding Society Adams Memorial Membership Award in 1974 for recognition of advancing the knowledge of welding for undergraduate and graduate students.

Dr. Fisher was featured in Highway Research Profiles of Transportation Research News in 1975 for his outstanding contributions to highway research.

In 1977, Dr. Fisher received the T. R. Higgins Lectureship Award for outstanding contribution to engineering knowledge of fabricated structural steel as author of the paper "Fatigue Strength of Steel Beams with Welded Stiffeners and Attachments."

In 1979, Dr. Fisher received the American Society of Civil Engineering Ernest E. Howard Award for outstanding contributions to structural engineering through added understanding and design criteria in the area of fatigue, connections and composite action.

In February 1980, Dr. Fisher was named Engineer of the Year by the Lehigh Valley Chapter of the Pennsylvania Society of Professional Engineers, receiving his award from thirteen different Lehigh Valley engineering and technical societies.

In October 1981, Dr. Fisher received the American Society of Civil Engineers Raymond C. Reese Research Prize for the paper "Fatigue Strength of Fillet Welded Cruciform Joints," co-authored with K. H. Frank.

From March 1982 to August 1982, Dr. Fisher was Visiting Professor at the Swiss Federal Institute of Technology - Lausanne, Switzerland.

In 1983, Dr. Fisher was named Civil College Eminent Overseas Speaker by the Institution of Engineers, Australia.

In 1974, Dr. Fisher assisted with rewriting the Swiss Steel Specifications in Zurich, Switzerland, from May through August for Basler and Hofmann Consulting Engineers, Zurich, Switzerland.

Dr. Fisher is the author of the American Institute of Steel Construction booklet Bridge Fatigue Guide - Design of Details, 1977. He is the principal author of the Guide for Design Criteria for Bolted and Riveted Joints, published by Wiley Interscience in 1974, and is a co-author of the book, Structural Steel Design, published by Ronald Press Company in 1965 and 1974. He has published over one hundred twenty (120) reports and articles which have appeared in scientific journals.

Dr. Fisher, upon their request, developed and presented short courses on fatigue and fracture of bridge structures and inspection of bridges for the Federal Highway Administration, U. S. Department of Transportation, the Pennsylvania Department of Transportation and the New Jersey Department of Transportation.

Dr. Fisher has given over one hundred (100) lectures and talks on the design and behavior of welded and bolted connections, composite members and fatigue and fracture of steel structures. This includes special seminars in Chicago (1975), (1980), New York (1976) and Pittsburgh (1981) on the design of connections and fatigue resistance of structures for the local chapters of ASCE.

Dr. Fisher is the author of Fatigue and Fracture in Steel Bridges: Case Studies, which will be published by John Wiley & Sons in April 1984.

Dr. Fisher is listed in Who's Who in the East, Who's Who in America, Who's Who in American Education, Who's Who in Engineering, Who's Who in Technology Today, International Who's Who in Engineering, American Men and Women of Science, Engineers of Distinction, and Men of Achievement. He is a member of Tau Beta Pi, National Engineering Honor Society, Chi Epsilon National Civil Engineering Honor Society, and Society of Sigma Xi, Honorary Scientific Research Society.

He is a member of the International Association of Bridge and Structural Engineers; member of Commission II, International Association of Bridge and Structural Engineers; American Society of Civil Engineers; the Pennsylvania Society of Professional Engineers; the National Society of Professional Engineers; the American Society for Engineering Education; American Railroad Engineering Association; and the American Welding Society.

He was Chairman of the Steel Bridge Committee of the Transportation Research Board, National Academy of Sciences (1974-1980). He is a member of the American Society of Civil Engineers Task Committee on Bridge Safety. He is a member of the Research Council on Structural Joints; American Railway Engineering Association Committee 15 - Steel Structures; and the American Institute of Steel Construction Specification Committee. He is Chairman of Task Committee 11, Ontario Highway Bridge Design Code.

Dr. Fisher was licensed to participate by the State of Illinois, Department of Registration and Education, February 6, 1961.

Since 1965, Dr. Fisher has been a consultant to many companies and organizations, including the following:

1. Nelson Stud Welding Company, A United-Carr Division of TRW, (1965-); Structural Consultant on miscellaneous composite design problems.

2. Bethlehem Steel Corporation (1965, 1967, 1968, 1971, 1976); preparation of article and design examples on high-strength bolted connections; development of design procedures for composite beams with slabform.

3. CAVA Industries (1967); evaluation of bolted crane rail system.

4. American Iron and Steel Institute (1966, 1967, 1970); develop load factor design criteria for welded and bolted connections; subsequently adopted as interim specifications by AASHO Committee on Bridges and Structures.

5. Air Products and Chemical Corporation (1968); review of bolted field connections for lifting ring for Esso Heat Exchangers in Libya. Recommended modifications for a fail-safe erection.

6. Delaware River Port Authority (1968, 1969, 1970); determination of cause of fatigue cracking in floor beam stringers of Walt Whitman Bridge, and development of corrective measures to prevent further cracking and failure.

7. Hewitt-Robbins Division of Litton Industries (1969); review of bolted and welded shear connection design for rotary elevator of large ore carrier for Great Lakes.

8. Galloway and Guthrey, Architects and Engineers, Knoxville (1970-71); determination of cause of collapse of high school gymnasiums.

9. Connecticut Department of Transportation (1970-71); determine cause of fatigue cracking of bridge stringers on Connecticut Turnpike and recommend corrective measures as necessary.

10. Texas Department of Highways (January, 1971); provided instruction on the design and behavior of welded connections under static and cyclic load conditions to bridge design personnel in Austin, Texas.

11. DiStasio and VanBuren, Inc., Consulting Engineers, (February-April, 1971); assisted with field testing of composite steel-concrete building in New York City to determine adequacy with understrength concrete slab.

12. Other miscellaneous consultations during the period 1966 to 1971 on the behavior and design of welded and bolted joints for such firms as R. C. Reese and Associates, Consulting Engineers; Parsons, Brinkerhoff, Quade and Douglas, Consulting Engineers; Zorah Vosganian and Associates.

13. Modjeski and Masters Consulting Engineers (January-June, 1972); assisted with the evaluation of dynamic deformations of the steel support bents of the Summit Bridge and the determination of whether or not the induced vibrations would lead to fatigue crack growth.

14. Page Communication Engineers, Inc. (February-March, 1972); developed installation procedure for galvanized high strength bolts for use in microwave towers in Iran.

15. Paul Weidlinger and Associates (September, 1972-76); field studies on vibrations of rock crushing plant and fracture evaluation of cracked girders for Con Edison Astoria Plant.

16. Chicago Heights Steel Company, Allied Structural Steel Company, C. E. Morris Company, and Fort Pitt Bridge Works (March-July, 1973); determination of the cause of cracking of welded built-up girders at end of cut-short transverse stiffeners, during handling and transportation to site.

17. Ohio Department of Transportation (Spring, 1973); determined cause of cracking in cut-short stiffeners, developed repair procedures and design modifications.

18. Delaware River Port Authority (March, 1973-76); to provide an evaluation of the causes for the cracks forming in the vertical members of the Chester-Bridgeport Bridge; determine whether or not other vertical members are susceptible to cracking; and to provide recommendations for correcting the existing undesirable conditions and preventing their occurrence elsewhere.

19. Basler and Hofman Consulting Engineers, Zurich, Switzerland (May-August, 1974); assisting with rewriting of Swiss Steel Specifications.

20. Ammann and Whitney, Consulting Engineers (1974-76); assisting with evaluation of Jamaica Elevated for fatigue and fracture damage.

21. American Institute of Steel Construction (1974); preparation of Design Guide on AASHTO Fatigue Specifications.

22. Lukens Steel Corporation (1974-76); consultation on the failure of Bryte Bend Bridge.

23. Ontario Ministry of Transportation and Communications (1974); consultation on fatigue damage.

24. Tippetts, Abbett, McCarthy and Stratton, Consulting Engineers (1975); evaluation of cause of fracture of Tehran Airport Structure.

25. Paul Weidlinger and Associates, Consulting Engineers (1975); assisted with evaluation of the fatigue and fracture resistance of a welded crane girder.

26. Hansen, Holley and Biggs, Consulting Engineers (1975); assisted with evaluation of the performance of various bolted and welded joints.

27. Canadian National Railways (1975-76); investigated the estimated fatigue damage in components of the Fraser River Bridge, New Westminister, B. D.

28. Minnesota Department of Highways (1975); investigated the causes of cracking of the Lafayette Street Bridge in St. Paul and recommended repair procedures.

29. H. C. Lochner, Inc., Consulting Engineers (1975); investigated the causes of cracking of the Poplar Street Complex approach ramps in East St. Louis and recommended repair and retrofit procedures.

30. Richardson, Gordon and Associates, Consulting Engineers (1975); evaluated effect of fire damaged material in steel bridge structure.

31. Acres Consulting Services, Ltd., Niagara Falls, Canada (1975); investigated connections used on Whitelake Bridge to ascertain fatigue strength.

32. Ontario Department of Transportation (1976); assisting with preparation of Specification for Design of Highway Bridges.

33. Bethlehem Steel Corporation (1976); revised article in Bolt Booklet.

34. Washington State Highway Commission (1976); investigated the fatigue and fracture resistance of Broadway Interchange Bridge in Everett, Washington.

35. Richardson, Gordon and Associates, Consulting Engineers (1976-77); evaluation of fracture resistance of the Sewickley Bridge eyebars.

36. Scott Paper Company (1975-76); assisted with assessment of fatigue failure of welded machinery.

37. American Institute of Steel Construction (1976-77); preparation of booklet on "Bridge Fatigue Guide."

38. Esso Research Corporation (1977); assessment of fatigue and fracture resistance of welded details for offshore platform.

39. The Lummus Company, Division-Combustion Engineering (1977); assessed strength of welded beam-to-column connections.

40. Louisville and Nashville Railroad (1977); evaluation of fatigue and fracture resistance of electroslag weldments in railroad bridge.

41. Fuller Company - GATX (1977); assessed fatigue strength of welded connections on large dryers.

42. Bethlehem Steel Corporation (1978-); failure of Hartford Coliseum.

43. Regional Transit Authority - Chicago (A. Tedesko) (1978); assisted in assessment of failure of Dan Ryan Elevated structure.

44. CONRAIL (1978); investigated the cause of the failure of a Hulett Walking Beam at Astabula, Ohio.

45. Allied Structural Steel (1977-); Consultant on the defects found on New Silver Bridge at Point Pleasant, West Virginia.

46. Ontario Hydro (1978-82); Consultant on fatigue failures in bolts and weldment of intake cover structure in Lake Ontario.

47. Vermont Public Service Board (1978-81); Consultant on cracks that formed in torus of Vermont Yankee Nuclear Reactor.

48. Kaiser Transit Group (1978); developed loading spectrum for laboratory fatigue test of prestressed concrete T-beam for Dade County, Florida Rapid Transit System.

49. Bechtel Power Corporation (1978); supervised and evaluated influence of bent anchors on capacity of anchor plates.

50. Buckland and Taylor (1978-82); assisted with fatigue design criteria for Lions Gate Bridge, Vancouver, British Columbia, Canada.

51. Aetna Insurance (1978-83); evaluation of causes of failure of Cargill Grain Elevator - Shiloh Tank Company.

52. Sealand Services (1978-82); assisted with lawsuit on failure of SL7 type crane; provided consultation on retrofitting fatigue damaged crane structures.

53. Wiss, Janney & Elstner (1979-81); assisted with evaluation of crack problems on Fremont Bridge.

54. Illinois Central Gulf Railroad (1979); evaluated potential fatigue damage in southern pine stringers of Bluford District.

55. Louisiana Department of Transportation (1979-81); evaluated cracking in Gulf Outlet Bridge, New Orleans.

56. Deleuw, Cather and Company (1979-); evaluation of fatigue critical details on aerial structures of Washington, D. C. Metro System.

57. Illinois Department of Transportation (1979); provided instruction on the fatigue and fracture concepts and their application to bridge design.

58. Bethlehem Steel Corporation (1979-); failure of Kemper Arena.

59. Iowa Department of Transportation (1979); assisted with recommendations for retrofitting fatigue damaged structures.

60. Illinois Department of Transportation (1979-83); providing services on significance of cracking in I24 Bridge at Paducah, Kentucky.

61. General Electric Company (1977-78); provided consultation on the fatigue design of the MOD-1 1500 KW Wind Turbine Generator.

62. DeStasio and VanBuren Inc. (1980); provided consultation on the capacity of Type 3 semirigid connections.

63. Maryland Department of Transportation (1980); provided evaluation on causes of failure of aerial inspection crane and the cracking of curved box girder bridge.

64. Lukens Steel Corporation (1977-80); consultant on failure and litigation of Raccoon Mountain Stay Rings.

65. Richardson, Gordon and Associates (1980-); assisting with evaluation of Susquehanna River Bridge, Northeast Corridor.

66. Cumberland Bridge Company (1974-80); assisted with litigation on I24 and I79 Bridges in Kenton County, Kentucy.

67. Burlington Northern (1980-81); evaluated the reasons for failure of Sandpoint, Idaho Bridge.

68. Dravo Corporation (1980-82); assisting with arbitration of failure of ore unloader at Solmar, France.

69. Catapillar Tractor Company (1980); provided consultation on fatigue design of welded details.

70. Zaladastani Associates (1980); provided consultation on improperly installed bolts at Worcester Civic Center.

71. Envirodyne Engineers (1980); provided consultation on fatigue damage in Illinois Toll Road structures.

72. Bechtel Power Corporation (1980); assisted with evaluation of embedded anchor plates at the Callaway site.

73. Modjeski and Masters Consulting Engineers (1980-83); assisted with evaluation of cracking in girder webs of Luling Bridge near New Orleans.

74. Canadian National Railways (1979-); providing consultation on fatigue cracking in steel pier caps and in riveted bridges.

75. New Jersey Transit (1981-82); providing consultation on fatigue design of frame of Grumman Buses that they ordered.

76. Modjeski and Masters Consulting Engineers (1981); assisted with evaluation of cracking of I470 hanger cables in West Virginia.

77. United States Steel (1981-); consultant on cracking and litigation of the Praire due Chien Bridge, Wisconsin, Iowa.

78. Bechtel Power Corporation (1981); assisted with evaluation of welded joint capacity of embedded plates with porosity in welds at Salem site; assisted with evaluation of weld penetration at the Limerick site.

79. Ammann and Whitney Consulting Engineers (1981-83); assisting with evaluation of the Willets Point Elevated structures.

80. Sherman and Jackson, Attorneys at Law (1981-83); Hyatt Regency Pedestrian Walkway Failure in Kansas City.

81. Bechtel Power Corporation (1981-); serving as a consultant on various structural problems related to steel welded and bolted connections, composite steel-concrete connections and fatigue and fracture.

82. Orange County Civic Center (1981-); evaluated cause of fracture of large rolled welded truss sections and provided recommendations for retrofit.

83. International Steel Corporation (1982); consultant on repairs of large jumbo steel columns with seam defects at Southwestern Bell Building in St. Louis.

84. Atlas Iron Works (1982); consultant on repair of cracked jumbo columns in U. S. Bancorp Building - Portland.

85. I. M. Pei Partners (1982-); consultant on the New York Exposition and Convention Center steel space frame.

86. Greiner Engineering Sciences (1983-); consultant on cracking in steel structure of Woodrow Wilson Memorial Bridge.

87. Zetlin-Argo Liason Corporation (1983-); assisting with the evaluation of the failure of the Mianus River Bridge, Greenwich, Connecticut.

88. Bethlehem Steel Corporation (1983); evaluated the cause of failure of high strength bolted connection at counter support.

89. Shawinigan Engineering Consultants (1983); reviewed fatigue analysis and design of Wind Turbine for Project EOLE, Hydro, Quebec.

List of Published Books and Papers

1. Fisher, J. W., Driscoll, G. C., Jr. and Schutz, F. W., Jr.
BEHAVIOR OF WELDED CORNER CONNECTIONS,
Welding Journal, Vol. 37, No. 5, p. 217-s, 1958.

2. Fisher, J. W., Driscoll, G. C., Jr. and Beedle, L. S.
PLASTIC ANALYSIS AND DESIGN OF SQUARE RIGID FRAME KNEES,
Welding Research Council Bulletin Series No. 39, April 1958.

3. Fisher, J. W. and Driscoll, G. C., Jr.
CORNER CONNECTIONS LOADED IN TENSION,
Welding Journal, Vol. 38, No. 11, p. 425-s, 1959.

4. Kingham, I., Fisher, J. W. and Viest, I. M.
CREEP AND SHRINKAGE OF CONCRETE IN OUTDOOR EXPOSURE
AND RELAXATION OF PRESTRESSING STEEL,
Highway Research Board Special Report No. 66, 1961.

5. Fisher, J. W. and Viest, I. M.
FATIGUE TEST OF BRIDGE MATERIALS OF THE AASHO ROAD TEST,
Highway Research Board Special Report No. 66, 1961.

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PROFESSTIONAL QUALIFICATIONS

Richard A. Simanek
Supervising Quality Control Engineer
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My name is Richard A. Simanek. My business address is 50 Beale Street, San Francisco, Ca. 94119. I am a Supervising Quality Control Engineer within the San Francisco Construction Department of the Bechtel Pwoer Corporation.

I attended Purdue University from 1966 to 1970 and received the Degree of Bachelor of Science in Metallurgical Engineering in 1970. I continued my studies at Purdue and received the Degree of Master of Science in Metallurgical Engineering in 1971. Additionally, I have participated in further educational programs in nondestructive examinations, codes and standards, quality assurance,and engineering applications.

While attending Purdue University, I spent the first summers working in the metallurgical department of a manganese steel foundry. The last summers before graduation were spent working in mechanical engineering groups of Bechtel's Gaithersburg power office. After graduating in 1971, I worked for Bechtel as a metallurgical engineer in the Materials and Quality Services Group. I then held Bechtel field assignments as a procurement inspector of power plant components, welding engineering on a petroleum project, and an engineering supervisor on a major pipeline project. In 1978 I was assigned as the Construction Quality Control Supervisor for Bechtel's Ann Arbor projects. I resigned from Bechtel in 1980 to work for Impell Corporation as a consultant on pipelines, industrial plants and power stations. I returned to Bechtel in 1982 and assumed my present position as a Supervising Quality Control Engineer within the San Francisco Construction Department.

I have obtained State of California Professional Engineering registrations as a Metallurgical Engineer (1976) and as a Quality Engineer (1977). The American Welding Society has certifed me as a Welding Inspector (1980). I have held prior certifications as a SNT-TC-1A Level II interpreter in radiographic, liquid penetrant and magnetic particle examinations. I have been certified as a Lead Auditor to ANSI N45.2.23 Standard. I am a member of the American Society for Metals and the American Welding Society.

PROFESSIONAL QUALIFICATIONS

Dale Hackney
Assistant Manager-Materials and Quality Services
Bechtel Power Corporation

My name is Dale Hackney. I am the Assistant Manager of the Materials and Quality Services (M&QS) Department of Research and Engineering for Bechtel Power Corporation.

I received training as an engineer by attending San Jose State College and received a B.S. in Metallurgical Engineering in 1962.

I have over 20 years in the welding field. This includes working as a welder, a welding engineer, a welding specialist and working in the following areas; materials development, specifications development, procedures development, inspection on nuclear components and supervision and management of welding and fabrication services.

From 1973 to present, I am an Assistant Manager of the Materials and Quality Services (M&QS) Department of Research and Engineering for Bechtel. I am responsible for the technical and administrative direction of the Department Area Offices in Ann Arbor, San Francisco, Los Angeles, Houston, Gaithersburg and London. From 1976 through 1979, I was Manager of Welding Engineering and Fabrication Services for M&QS with responsibility for welding engineering, field welding services, recruiting of welding engineers and welders and for performance of welding development. From 1973 to 1976, I was responsible for consultation on codes and standards, responses to NRC regulatory guides, preparation of Bechtel ASME Quality Manuals and supervising jobsite audits.

From 1968 to 1973 I spent one year as Manager of Memphis Engineering for the General Electric Nuclear Energy Division. In addition, I spent four years with General Electric in Zurich, Switzerland, as Manager of Fabrication Engineering and Quality Assurance for European Nuclear Power Projects.

From 1962 to 1968 I was a senior Materials Engineer with General Electric with responsibilities for the direction of welding and materials development and preparation of process specifications. I reviewed and approved vendor-submitted fabrication, test and inspection procedures for reactor vessels, core structures and containment vessels. I was an instructor in metallurgy and welding at San Jose State and San Jose City Colleges.

Prior to my degree, I had three years experience as a journeyman welder, draftsman, welding engineer and methods analyst with the Ordnance Division of FMC Corporation.

I am a registered professional engineer in California, and a member of the American Society of Mechanical Engineers, the American Welding Society and the American Society of Testing and Materials. I am the author of numerous papers on welding and materials development.

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2.	PECO Letter to US Nuclear Regulatory Commission dated 9/15/83
3.	USNRC Inspection and Enforcement Report 50-352/82-06 (Weld Inspection-Mobile NDE Lab)
4.	USNRC Inspection and Enforcement Report 50-352/82-16 (CAT Inspection-Appendix B)
5.	USNRC 1982 SALP Report (Pages 7 through 10)
6.	USNRC 1983 SALP Report (Pages 12 through 15)
7.	USNRC Inspection and Enforcement Report 50-353/76-06
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9.	Bechtel Power Corporation Nonconformance Report 1980
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15.	Bechtel Power Field Inspection Report C-63-9
16.	Bechtel Power Field Inspection Report C-63-10
17.	Bechtel Power Field Inspection Report C-63-11
18.	Bechtel Power Field Inspection Report C-63-12
19.	Bechtel Power Field Inspection Report C-63-13
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46.	PECO Letter to U.S. Nuclear Regulatory Commission dated 5/13/77 (77-02)
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48.	USNRC Inspection and Enforcement Report 50-352/78-03, Pages 14 and 15
49.	PECO Letter to U.S. Nuclear Regulatory Commission, dated 6/12/78
50.	PECO Letter to U.S. Nuclear Regulatory Commission, dated 9/18/78

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52.	PECO Letter to U.S. Nuclear Regulatory Commission, dated 12/4/78
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