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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the matter of:

COMMONWEALTH EDISON COMPANY

(Byron Nuclear Power Station,
Units 1 & 2)

Docket No. 50-454 OL
50-455 OL

Location: Rockford, Illinois

Pages: 10,146 - 10,350

Date: Thursday, August 2, 1984

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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY & LICENSING BOARD

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In the matter of:

COMMONWEALTH EDISON COMPANY, : Docket Nos. 50-454 OL
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(Byron Nuclear Power Station,
Units 1 and 2)

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Magistrate's Courtroom
Federal Building
211 South Court Street
Rockford, Illinois

Thursday, August 2, 1984

The hearing in the above-entitled matter was reconvened, pursuant to recess, at 9:05 a.m.

BEFORE:

IVAN W. SMITH, Chairman
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission

A. DIXON CALLIHAN, Member
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission

RICHARD F. COLE, Member
Atomic Safety & Licensing Board
U.S. Nuclear Regulatory Commission

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APPEARANCES:

On behalf of the Applicant:

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On behalf of the NRC Staff:

STEPHEN LEWIS, Esq.
MICHAEL WILCOVE, Esq.
Office of the Executive Legal Director
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

On behalf of the Joint Intervenors; DAARE/SAFE and Rockford League of Women Voters:

DOUGLASS CASSEL, JR., Esq.
Business and Professional People for the Public Interest
109 N. Dearborn Street
Chicago, Illinois 60602

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PROCEEDINGS

JUDGE SMITH: Is everyone ready?

We want to rule on the motion to bring the issue of the authorized nuclear inspector into the hearing, which we will do now.

The motion is denied. Our reasoning for denying the motion is, one, that, as Counsel candidly recognized from the outset, the allegations of the authorized nuclear inspector had, at best, a tenuous relationship to the identified issues for the remanded hearing. So that was the first judgment we made.

Having made that judgment, we moved on to whether the motion should be regarded as a motion to reopen the hearing for a new issue, and we applied roughly those standards. And we have decided that the allegations, as they stand, do not present a significant safety issue which is likely to or might have the effect of affecting the outcome of our decision.

Essentially, we agree with Mr. Miller's arguments and Mr. Lewis' arguments. The allegations of Mr. Podworny, although they may, if true, have significance within the activities of the authorized nuclear inspector serving Hunter's ASME needs, we agree with the observation that the authorized nuclear inspector is not an essential part of our review of the adequacy of the quality assurance program at Hunter. It was not argued as being the basis for us finding that the quality assurance program was adequate. It was not a part of our initial decision, and it does seem like the authorized nuclear inspector is a redundancy which appears to be designed to satisfy ASME Code requirements.

Another aspect of the situation which convinces us it's not a significant safety problem is that regardless of the role of the ASME Code and the authorized nuclear inspector, we believe that the manner in which it is being handled, the allegation is being handled, is an appropriate one. It is being handled regularly within the ASME organization. It's being handled apparently aggressively, and it's being handled by the appropriate people, experts. And we have no reason to believe that the results will not be satisfactory. That's an independent reason for finding that there is no safety significance to the allegations.

We do not nor do we have the authority to foreclose future motions in the event that the results are inconsistent with our reasons for denying the motion now.

Any questions on that?

MR. CASSEL: May I have a moment, Judge?

(Pause.)

No questions, Judge.

MR. MILLER: Excuse me, Judge Smith. I was wondering whether we also might resolve the question of mgcl-3t

what, if anything, should be done with the OI report in connection with the issue of Mr. Koca's termination. The report, I don't believe, independently has any probitive value with respect to any issues that are presently before the Board.

As I am sure you recall, Mr. Tuetken presented some prepared testimony with respect to the circumstances of Mr. Koca's termination, and his role with respect to -- that is, Mr. Koca's role -- with respect to the reinspection program. The Staff has not provided any testimony, to my knowledge, that is commensurate with that or that seems to address that issue.

JUDGE SMITH: Mr. Hayes addressed it yesterday. He addressed it in the sense that the OI report has not presented any technical problems for him with respect to Mr. Koca.

MR. LEWIS: It was more than that, Your Honor. He also testified that with respect to issues related to certification packages from Hatfield Electric Company, that the NRC had independently done a lot of checking of those packages.

JUDGE SMITH: I use "technical" in the sense of differentiating between his area of responsibility and the area of responsibility of the Office of Investigations.

MR. LEWIS: Yes. What I'm saying, Your Honor, is that the purpose of Mr. Hayes' testimony yesterday was to indicate that having now seen the Office of Investigations' report, that with respect to the issue that was identified in the prehearing conference memorandum about whether or not the circumstances surrounding the termination of Mr. Koca had any implications for the validity of the reinspection program, it was the Staff's position that it did not.

In fact, the OI report doesn't deal with the question of his termination. It does deal with the question of his function and certain allegations regarding his functions as QC Supervisor, and Mr. Hayes also addressed that and said that the matters addressed in the OI report do not, in the Staff's mind, raise any questions with regard to the integrity or validity of the reinspection program. And that was intended to be the Staff's position on that matter, which was raised in the prehearing conference memorandum.

JUDGE SMITH: As you recall, the prehearing conference memorandum did not bring into issue or the proceeding anything about Mr. Koca. All we did was authorize discovery on it. And it's up to somebody else to bring it into issue.

MR. MILLER: Certainly. On behalf of the Applicant, we have no further wish to get into the paragraphs that

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were deleted or the sentences or words that were deleted in the OI report. As far as we are concerned, that aspect of the issue is really over.

MR. LEWIS: Our perception of the initial decision was that the Board had wanted to be advised with respect to the resolution of allegations that were pending as of the time of the August 1983 hearing session.

JUDGE SMITH: So that would capture the Koca -- was there an allegation?

MR. LEWIS: Yes.

JUDGE SMITH: I see.

MR. LEWIS: It was not my understanding that the Board was indicating that in the absence of some relationship to the reinspection program, that there had to be a full evidentiary presentation on these allegations.

JUDGE SMITH: That's correct.

MR. LEWIS: And so in that sense, I do agree that the OI report is not in evidence in this case, and in fact, the Region III Staff is not in a position to sponsor it. It is my understanding that it was being provided to provide that close-out information with respect to those allegations.

The testimony of Mr. Hayes was offered to directly address those allegations which we did view as having been resolved in part or in whole based on the reinspection program. It is our understanding that, unless

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we are directed otherwise, we have discharged the mandate of the Board with respect to the allegations in question.

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MR. CASSEL: The only thing I would like to say on that issue Judge, is again I would like to reserve any comment whatever until after I have had a chance to look into the matter, based on the receipt of the last two days of the report, and the transcript.

I have no reason to believe that I would necessarily differ with anything that has been said, but frankly I have not had an opportunity to look into this matter.

JUDGE SMITH: That just leaves one other aspect of the report, and that is the Board members have not had a chance to look at it. And, as I indicated I had looked through it briefly before I returned, and I saw nothing which would move me to take Board action, but I can't speak for my colleagues. I don't think they have had a chance to look at it yet. Nor, have I had a chance to look at it thoroughly.

So, we will probably take the same time that you are taking, Mr. Cassel, to see if we have any interest in it.

MR. WILCOVE: Mr. Chairman, before this panel begins, the Staff has two Board Notifications to distribute, both from the Office of NRR. One is the SALP Report, which I realize has been distributed informally at an earlier time. But, since the NRR Notifications will be docketed, I think it best that the Board and Parties have what NRR

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is going to docket.

And the other Board Notification is on steam generator snubber failures.

JUDGE SMITH: Can we throw away the earlier one?

MR. WILCOVE: To my knowledge, the earlier one is identical to that Board Notification.

JUDGE SMITH: All right.

MR. WILCOVE: I should also state for the record that earlier this week I did pass out to the Board and to the Parties, a copy of Inspection Report 84-32, 84-25, transmitted to Commonwealth Edison Company by letter from John Streeter dated July 30th, 1984-- this I handed out informally Monday or Tuesday, regarding Systems Control Corporation.

MR. LEWIS: I take it you do have a copy of that, Mr. Chairman?

JUDGE SMITH: Yes, it is dated July 30th?

MR. WILCOVE: Right.

JUDGE SMITH: I am taken aback by your characterization of it, though. And Hatfield?

MR. WILCOVE: That's correct.

JUDGE SMITH: Any other preliminary business?

(No response)

Gentlemen, if I may administer the oath.

Dr. Singh, you have already been sworn.

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Whereupon,

KENNETH T. KOSTAL

BRADLEY F. MAURER

were called as witnesses on behalf of Commonwealth Edison Company, and having been first duly sworn, were examined and testified as follows:

- and -

Whereupon,

ANAND K. SINGH

was recalled as a witness on behalf of Commonealth Edison Company, and having been previously duly sworn, was further examined and testified as follows:

MR. BECKER: Shall I proceed, your Honor?

JUDGE SMITH: Yes.

MR. BECKER: First of all, Judge Smith, it is my understanding the Board has received corrections to the testimony of Mr. Maurer and Mr. Kostal last evening, so I will not do that on the record.

And, the Court Reporter has received copies of the modifications to the testimony to be bound into the record. So, I will proceed without referring on the record to those modifications.

Let me begin with Mr. Maurer.

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DIRECT EXAMINATION

BY MR. BECKER:

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Q Mr.Maurer, would you please state your name for the record?

A (Witness Maurer) Bradley F. Maurer.

Q Do you have in front of you, Mr. Maurer, a 13-page document entitled Bradley F. Maurer?

A I do.

Q Did you prepare this testimony?

A I did.

Q Is it true and correct?

A Yes, it is.

MR. BECKER: Judge Smith, I would now move the testimony of Mr. Maurer be admitted into the record and be bound into the transcript as if read.

JUDGE SMITH: Are there any objections?

MR. CASSEL: No objection.

MR. WILCOVE: The Staff has no objection.

JUDGE SMITH: The testimony is received.

(Testimony of B. F. Maurer follows)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454-OL
	)	50-455-OL
(Byron Station, Units 1	)	
and 2)	)	

TESTIMONY OF BRADLEY F. MAURER

Q.1. State your name.

A.1. Bradley F. Maurer

Q.2. What is your business address?

A.2. P. O. Box 355, Pittsburgh, Pennsylvania 15230.

Q.3. By whom are you employed?

A.3. Westinghouse Electric Corporation ("Westinghouse").

Q.4. Describe your education after you graduated from high school.

A.4. I graduated from Kansas State University with a B. S. degree in Mechanical Engineering.

Q.5. Describe your employment by Westinghouse.

A.5. In July 1973, I joined Westinghouse in the Nuclear Safety Department of the Water Reactors Division. My duties included evaluation and application of safety criteria to various nuclear power plant systems and components, and preparation of licensing documentation.

In June 1977, I transferred to the Mechanics and Materials Technology Department in the Water Reactor Division. I was the primary technical interface between the Mechanics and Material Technology Department and the Nuclear Safety Department. I made a number of presentations and provided technical assistance in support of licensing activities. I performed thermal seismic and LOCA analysis of Class 1 piping systems. I was also responsible for the preparation of the design specification for NSSS primary equipment supports, and for the formulation and interpretation of criteria involving safety class piping and supports. In addition, I was responsible for the turbine missile probability analysis for the Philippine Nuclear Plant. I was promoted to Senior Engineer in May 1980.

In August 1981, I transferred to my present position in Equipment Qualification Analysis. My responsibilities include qualification of various electrical equipment and devices by analysis and by shake table testing, and main control board qualification by analysis. I have performed seismic qualification of Class 1E medium power transformers using a combination of shake table testing and analysis. I have conducted seismic testing programs on electrical components of the Process and Protection System. I have assisted in the analysis of main control boards for several nuclear plants. In conjunction with other senior engineers in the Equipment Qualification Analysis group, I performed the structural analysis of the Byron main control board and other main control panels.

Q.6. What is the scope of your testimony?

A.6. The scope of this testimony is to describe the analyses and inspections performed by Westinghouse to address the structural adequacy of main control panels which were designed and fabricated by Systems Control Corporation ("SCC") for the Byron Station. Analysis methodology and results are presented which demonstrate that these control panels will, with significant margin, maintain their structural integrity when subjected to a design basis seismic event, the safe shutdown earthquake, at the Byron site. This is the condition under which maximum loads would be applied to the main control panels.

Westinghouse has significant experience in seismic qualification of this type of equipment. Analyses using state-of-the-art computer modeling techniques have been completed for a number of main control boards at Byron and other nuclear plants. In addition, shake-table tests have been performed, the results of which validate the use of Westinghouse computer modeling techniques.

Q.7. Where are the main control panels located in the Byron plant?

A.7. They are located in the control room and contain the instruments, monitors and controls for all aspects of the operation of the Byron station. Some panels control safety-related functions while others control non-safety-related functions.

Q.8. Please describe the configurations of the main control panels and identify how many were supplied by SCC.

A.8. The main control panels are of two basic configurations. The first is characteristic of the main control board and consists of a vertical portion containing various meters, recorders, and indicators, and an angled bench portion which contains primarily switches and controllers. The main control board consists of seven separate sections which are arranged in a U-shaped assembly. The sections are bolted together and welded to the steel floor embedments. The main control board sections are a little over eight feet high and when assembled together are about 95 feet long. Four of the seven main control board sections contain equipment to monitor and control Nuclear Steam Supply System (NSSS) functions. These sections were designed by

Westinghouse and fabricated by the Reliance Electric Company. The remaining three sections, which contain equipment to monitor and control various balance of plant systems were designed and fabricated by SCC.

The second control panel configuration is characterized by stand-alone panels or panel line-ups in which the full height of the front face is vertical for location of the various instruments. The majority of these control panels were also designed and fabricated by SCC. The control panels which are mounted adjacent to each other are bolted together. All control panels are welded to the steel floor embedments. The control panels are approximately eight feet high and vary in length from about seven feet to over thirteen feet.

Q.9. What role did Westinghouse have with respect to an analysis of the structural adequacy of Byron main control panels supplied by SCC?

A.9. Westinghouse involvement with the structural adequacy of Byron main control panels initially began with a ~~contractural~~ Contractual obligation to seismically qualify the Westinghouse supplied portion of the main control board. In September 1981, Commonwealth Edison and Westinghouse agreed that, with some additional effort, the balance of plant sections could be evaluated as part of the main control board analysis. Thus all main control board sections would be coupled together in a single mathematical model which would be used to evaluate the response of the entire structure. In early 1982 Commonwealth Edison authorized Westinghouse to seismically qualify all control panels in the main control room.

Q.10. Had there been any earlier analyses or evaluations of the SCC main control panel?

A.10. At the time that Westinghouse began the main control panel qualification effort, it was recognized that Wyle Laboratories, under contract to SCC had performed seismic simulation shake-table tests on four of the control panels in the Byron main control room. The panels were tested individually to levels in excess of the main control room floor response spectra and demonstrated no degradation of structural integrity. I reviewed the reports of the tests conducted by Wyle Laboratories The tests were performed in accordance with standard practice and the results are reliable.

Q.11. Why were additional analyses necessary?

A.11. There were two areas in which the shake table tests did not provide complete information for panel qualification in view of the technology available in 1982 and 1983 to analyze these panels.

First, because the panels were tested as single units, the effect of any interaction due to other structures connected to the panels could not be obtained from the test results. Three of the four tested panels are bolted to adjacent control panels in the main control room. Second, for the qualification of Class 1E instrumentation mounted on these panels, it is necessary to define the seismic levels for these instruments at their mounting locations on the panel. The data recorded during the shake table tests was not sufficient to determine the necessary seismic levels for instrument qualification. For these two reasons, all main control panels were included in the Westinghouse analysis qualification program, regardless of their inclusion in the Wyle tests.

Q.12. What technique was used by Westinghouse to analyze the main control boards?

A.12. The structural adequacy of the main control panels was established through the use of detailed computer analysis using finite element modeling techniques. Analysis with finite elements involves building a computer model of the structure using mathematical representations of the structural members. The panels were analyzed as a unit to take account of the interactive effects described in answer to Question 11. For the modeling of the control panels, three basic types of member representations, or elements, were employed: beam elements, plate elements, and lumped mass elements. The welds in the main control panels were assumed to be adequate for this portion of the analysis. The mathematical models were constructed using the Westinghouse Electric Computer Analysis (WECAN) computer program, developed and maintained by Westinghouse. The finite element analysis generates loads and stresses in each structural member in the model based on the seismic input at the main control room floor elevation, which was developed by Sargent and Lundy.

Q.13. Did you make any further analysis of the welds in the main control panels?

A.13. Yes. In order to assure that the analysis addressed the as-built condition of the control panel welds I inspected the control panel structural welds in March 1983. I was accompanied by a certified Level II welding engineer employed by Westinghouse. The inspection was visual and was undertaken to determine the overall quality of the welds. Paint was not removed from the welds. The inspection included each control panel in the main control room. All accessible welds were inspected, concentrating on the welds connecting primary structural members, such as K-frames. These welds are the primary welds of significance to a determination of structural adequacy. Approximately 90% of the primary structural welds, and approximately 70% of the welds in members of secondary importance, were accessible for inspection.

Q.14. What were the results of this inspection?

A.14. The results of this inspection were:

1. Overall, the welds are evenly spaced and consistent in length and size.
2. Fillet contour was generally consistent; however, some welds exhibited excess convexity. This is only a cosmetic variation and does not affect the integrity of the weld.
3. Several instances of excessive weld spatter were noted. Again, the effect is only cosmetic; no rework was necessary.
4. No significant cratering, porosity, or undercut was observed.
5. No cracks were observed during this inspection, which concentrated on the primary structural member welds.

The results of our inspection demonstrated that the condition of the welds was acceptable. In addition, several welds were added to the Unit 2 main control board to assure that sufficient weld length existed for all members. The main control board for Unit 1 contained sufficient weld length for all structural members that were inspected.

Q.15. What use, if any, was made of the results of this inspection?

A.15. Using minimum values for weld length and size which were indicated as a result of our visual inspection, and the maximum loads generated by a seismic event acting on each type of structural member as determined by the finite element analysis described above, I then calculated whether specific welded connections would have sufficient strength to withstand these applied loads. The weld analysis and acceptance criteria followed the recommendations specified in Blodgett's "Design of Welded Steel Structures ", a recognized authoritative source for this type of analysis.

Q.16. What conclusions did you reach regarding the structural adequacy of the SCC main control panels and the welds you analyzed?

A.16. My conclusions are set forth in Westinghouse proprietary reports which were submitted to Commonwealth Edison Company in the fall of 1983. The results of the finite element analysis indicate that the main control board and most of the control panels do not have natural frequencies below approximately 25 hertz, and thus will not experience dynamic amplification of the floor seismic input. For those panels which do exhibit frequencies in this range, dynamic analysis was utilized to determine loads and stresses, and to develop amplified seismic levels for Class 1E instrument qualification.

The allowable stress criteria applied in the determination of acceptability of the structural members in the control panels were taken from the AISC Manual of Steel Construction; specifically, the allowable maximum stress is 60 percent of the material yield stress. The structural welds were evaluated using Blodgett's design criteria which limits the maximum stress to approximately 60 percent of the shear yield stress.

The maximum stress calculated for the internal structural welds in the SCC main control panels is 80% of that allowed by the Blodgett design criteria. Similarly, the maximum stresses calculated for the floor attachment welds are 51% of the allowable value for the main control board sections and 65% of the allowable value for the other main control panels, again based on Blodgett's design criteria. For structural members of the control panels, the maximum calculated stress is 60% of the allowable design value specified by AISC.

A more meaningful measure of the margin of safety inherent in the construction of the main control panels is a comparison of the maximum calculated stress levels to the shear yield stress for welded connections and material yield stress for structural steel components. The yield stress in a material is reached when the applied load is large enough to produce plastic behavior in the material. It is important to realize that even if a welded connection or a structural member were to experience loads sufficient to cause yielding, this does not imply structural failure, as the yield stress is still lower than the ultimate stress at which failure would occur.

For the internal structural welds in the main control panels, the calculated stress indicates a minimum margin of safety of 1.9, based on the shear yield stress of the weld metal. This means that the loads applied to the control panels would have to be 190% higher than the Byron seismic loads in order to reach the yield stress. Likewise, the maximum stresses in the floor attachment welds indicate a margin of safety of 3.1 for the main control board sections, and 2.4 for the other main control panels, again based on the shear yield stress of the weld metal. The maximum calculated stress in the structural members of the control panels indicates a margin of safety of 2.8, based on the material yield strength. Based on these considerable margins of safety, it is concluded that the structural integrity of the Byron main control panels, including those supplied by SCC, will be maintained in the event of a design basis earthquake for the Byron site.

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BY MR. BECKER:

Q Mr. Kostal, would you please state your name for the record?

A (Witness Kostal) Kenneth Thomas Kostal.

Q Do you have in front of you a 50-page document with 13 pages of attachments, each of which is entitled a figure, the entire package bearing the heading, Testimony of Kenneth T. Kostal?

A That's correct.

Q Did you prepare this testimony?

A Yes.

Q Is it true and correct?

A Yes.

MR. BECKER: Your Honor, with regard to Mr. Kostal's testimony, I move that it be admitted into the record and bound into the transcript as if read.

MR. CASSEL: No objection.

MR. WILCOVE: No objection.

JUDGE SMITH: Testimony is received.

(Testimony of Kenneth T. Kostal with attachments follows:)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In The Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454-OL
	)	50-455-OL
(Byron Nuclear Power Station,	)	
Units 1 & 2)	)	

SUMMARY OF THE TESTIMONY OF
KENNETH T. KOSTAL
ON CONTENTION 1

I. Kenneth T. Kostal is the assistant manager of the Structural Department of Sargent & Lundy.

II. Mr. Kostal is familiar with the work performed by Systems Control Corporation for Byron. Systems Control supplied, per S&L design specifications, main control boards (including DC fuse panels), local instrument panels, cable trays, and cable tray hangers. Mr. Kostal's testimony discusses the capacity of various Systems Control-supplied components to carry design loads.

III. The first component discussed in Mr. Kostal's testimony is cable tray hangers. The most significant engineering evaluation of cable tray hangers at Byron was performed pursuant to Edison Byron NCRs 850 and 885. A random sample of 80 hangers, encompassing 358 connections, was inspected, and all discrepancies were evaluated. None of the discrepant welds had design significance. Additional engineering evaluations were performed on specific weld connections as well, and each of these determined that the particular discrepancy at issue did not have design significance. Mr. Kostal concludes that the Systems Control cable tray hangers are capable of carrying design loads, and therefore their quality is adequate.

IV. Mr. Kostal's testimony then discusses Systems Control cable trays, including cable tray fittings, ladder cable trays, and ladder fittings. Cable tray stiffener welding was evaluated by S&L, and the discrepancies discovered in the sample of 227 stiffeners were found to be not design significant. In addition, further analysis demonstrated that the stiffeners are not required for the functioning of the cable trays. Cable tray fittings also were evaluated, and it was determined that because of redundant load paths the fitting welds are not required for the fittings to meet structural load-carrying requirements. A recent inspection of cable ladder trays and ladder fittings determined that all identified discrepancies are not design significant, and therefore these components are capable of carrying design loads. Mr. Kostal concludes that the Systems Control cable trays, including solid-bottom trays and fittings and ladder trays and fittings, are capable of carrying design loads, and therefore their quality is adequate.

V. Mr. Kostal's testimony then discusses Systems Control local instrument panels. Mr. Kostal describes the seismic qualification of the panels, and explains the recent weld inspection program implemented for the panels due to the weld discrepancies discovered by Torrey Pines Technology during its third party review of Systems Control. This inspection program was evaluated and the conclusion was reached that the entire population of local instrument panels is seismically qualified. Mr. Kostal concludes that the Systems Control local instrument panels are capable of carrying design loads, and therefore their quality is adequate.

VI. The final components discussed by Mr. Kostal are the DC fuse panels supplied by Systems Control. Mr. Kostal describes the seismic qualification of the DC panels, and then discusses the engineering evaluation of the weld discrepancies identified on the panels which was performed to determine whether the non-tested panels could be deemed to be equivalent to the seismically-tested panel for the purposes of seismic qualification. Mr. Kostal concludes that the Systems Control DC fuse panels are capable of carrying design loads, and therefore their quality is adequate.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454-OL
	)	50-455-OL
(Byron Station, Units 1 and 2)	)	

TESTIMONY OF KENNETH T. KOSTAL

Q.1. Please state your name.

A.1. Kenneth Thomas Kostal.

Q.2. Who is your employer?

A.2. Sargent & Lundy.

Q.3. Please describe Sargent & Lundy.

A.3. Sargent & Lundy is a consulting engineering firm providing services to the utility industry. The firm has been in existence since 1891 and has exclusively performed engineering and consulting work on energy related areas of the utility industry since its founding.

Q.4. What are Sargent & Lundy's responsibilities in connection with the Byron Station?

A.4. It is the architect/engineer responsible for the design of the plant.

Q.5. What types of engineering work does Sargent & Lundy perform at Byron?

A.5. Sargent & Lundy performs engineering work related to all aspects of design: mechanical, architectural, civil/structural, and electrical.

Q.6. What is your position at Sargent & Lundy?

A.6. I am a partner and assistant manager of the Structural Department.

Q.7. Please describe your job responsibilities.

A.7. I assist the manager of the Structural Department in coordinating all structural, architectural, and civil engineering design for Sargent & Lundy. I assist the manager in all matters of supervision, administration, personnel and technical policies. I have direct responsibility for the Specifications, Geotechnical, and Water Resources & Site Development Divisions.

Q.8. What is your educational and employment background?

A.8. I graduated from the University of Illinois in 1965 with a BA in Architectural Engineering and in 1967 with a MS in Architectural Engineering. I have 19 years of experience in the field of civil engineering which includes civil/structural/architectural engineering and design work for fossil and nuclear power plants. My assignments have included 14 units with a total capacity in excess of 10,000 megawatts. I have also been involved in numerous studies.

Prior to joining Sargent & Lundy in 1967 I was engaged by the University of Illinois as an instructor in structural design and as an engineer responsible for structural design and construction drawings for light office buildings.

I am a registered professional engineer in 25 states and I also have a separate structural engineering license in the State of Illinois and am licensed in Alberta, Canada. Presently I am a member of the following organizations:

American Concrete Institute
American Institute of Steel Construction
American Nuclear Society
American Society of Civil Engineers
Structural Engineers Association of Illinois
Western Society of Engineers

Q.9. How many years have your worked with nuclear power facilities?

A.9. Seventeen years.

Q.10. What nuclear power facilities have you been involved with?

A.10. Ft. St. Vrain (Public Service Colcrado), Donald C. Cook (American Electric Power), Byron/Braidwood, Zion, LaSalle County (Commonwealth Edison) Marble Hill (Public Service Indiana), and Clinton (Illinois Power).

Q.11. What types of work have you performed in connection with your work on nuclear power facilities?

A.11. Throughout my career at Sargent & Lundy I have been involved in the structural, architectural, and civil engineering aspects of numerous nuclear power plants. I began my career at Sargent & Lundy as a designer on the Ft. St. Vrain nuclear power plant. I was specifically involved in concrete foundation design and steel superstructure. As I progressed through a series of supervisory positions on various nuclear plants, I was responsible for coordinating civil/structural, architectural, and drafting activities. While assigned to these projects I was intimately involved with the licensing activities for each and have on numerous occasions made technical presentations to the NRC relating to structural issues. I have also provided testimony on technical issues to various ASLBs relating to civil and structural issues.

Q.12. Are you familiar with Systems Control Corporation?

A.12. Yes. Systems Control Corporation ("SCC") is a vendor that supplied components to Byron. The components supplied to Byron by Systems Control fall into four broad categories: main control boards (including DC fuse panels), local instrument panels, cable trays, and cable tray hangers. The components supplied by Systems Control were designed to meet specifications established by Sargent & Lundy. These design specifications are F/L 2788 (main control boards), F/L 2809 (local instrument panels), and F/L 2815 (cable trays and hangers).

Main control boards provide the mountings for various types of instrumentation in the main control room at Byron. DC fuse panels also were provided under the Sargent & Lundy specification for main control boards. The DC fuse panels provide the mountings for various fuses and relays which protect the direct current system, and are located in the battery rooms adjacent to the main control room at the plant. Local instrument panels are the mountings for various instrumentation located throughout the plant. Cable trays support the plant's cables. Cable trays supplied by Systems Control were in two configurations. The first type, which comprises about 97% of the safety-related cable trays at the plant, is a steel trough way composed of sheet metal steel, 12", 18", 24", or 30" wide by 4" to 6" in height. The second tray configuration is known as a "ladder" or "open bottom" tray. It resembles a steel ladder, with pipe rungs at approximately 12" intervals. This type of tray is used where cables must be permitted to drop below the tray (through the rungs) for routing to electrical equipment. Both types of cable trays are connected to the plant's main structure by cable tray hangers.

Q.13. What is the scope of your testimony?

A.13. My testimony discusses the capacity of various Systems Control-supplied components to carry design loads. In particular, my testimony will encompass cable trays, cable tray hangers, local instrument panels, and DC fuse panels. The testimony of Bradley Maurer, of Westinghouse, addresses the main control boards supplied to Byron by Systems Control. My testimony will include discussion of the engineering evaluations performed by S&L on the Systems Control components, and after reviewing the condition of each component I will testify to my professional opinion of the component's adequacy.

Q.14. Are you familiar with the engineering evaluations performed by Sargent & Lundy on the Systems Control-supplied components?

A.14. Yes, I am. Each of the evaluations to which I refer in my testimony falls within my area of professional expertise, and I have reviewed each of them. The evaluations of the Systems Control cable trays and cable tray hangers were performed by structural engineers who work under my indirect supervision. The evaluations involving the DC fuse panels and local instrument panels were performed by mechanical engineers, who do not work under my supervision. The evaluations of the DC panels and local instrument panels at issue, however, involve structural issues, even though these components fall within the overall scope of work performed by our mechanical engineers.

Q.15. What is the purpose of the engineering evaluations that have been performed by Sargent & Lundy on components supplied to Byron by Systems Control?

A.15. The purpose of these evaluations is to determine the design significance, if any, of the discrepancies identified in the Systems Control equipment supplied to the site.

Q.16. Over what period of time have these evaluations been performed?

A.16. They have been performed since 1977, first as a means of dispositioning specific nonconformance reports and, more recently, in preparation for this hearing after it was learned that source inspections of SCC-supplied components by Pittsburgh Testing Laborabory after February 1980, had not been fully implemented.

Q.17. Please define the term "design significance."

A.17. "Design significance," as used in my testimony, relates to the ability of structural components to perform their intended function, which is to carry all design loads within code-established allowable stresses. Code-established allowable stresses are incorporated into the design criteria for all equipment supplied to Byron. These code-established allowable stresses have been developed to assure additional margins of safety against failure. Code writers typically attempt to attain a margin of approximately two. This means that a structure designed to a code could carry approximately twice the design load and not fail. Anything which affects the ability of a structural component to perform a function within the code-allowable stresses has design significance. As is discussed in detail in the following testimony, Sargent & Lundy's engineering evaluations demonstrated that the stresses on Systems Control components installed at Byron are within the code-allowable stresses, and consequently no item was found to have design significance.

Q.18. What are the elements that comprise the design loads that Systems Control equipment must be able to carry?

A.18. Systems Control equipment is designed to carry both dead loads and seismic loads. Dead loads derive from the weight of the equipment itself along with additional dead loads imposed by cable, instruments or other equipment. The equipment also is designed to withstand the effects of seismic loads, which are a function of the building seismic response at the location of the equipment.

Q.19. Please define the term "design margin."

A.19. The concept of margin is one that is inherent in the engineering discipline. Engineers design a structure such that it is sufficiently strong to withstand the expected forces and stresses with spare or extra strength to account for uncertainties and contingencies. This extra strength is called margin.

"Design margin" is the difference between code-allowable stress and actual stress. Engineers maintain the presence of design margins by ensuring that actual stress is less than code-allowable stress. For example, connections are designed in groups rather than individually. The most highly stressed connection is designed to be within code-allowable stresses; therefore, all other connections within the group, which are not highly stressed, have even greater design margins. Thus, the actual stresses for most connections in the example will be appreciably less than those allowed by the applicable code.

There is a second margin in the structural design of connections. This is the margin that code writers put into the design process in the form of the difference between code-allowable stresses and the failure of a component. Code writers typically attempt to obtain a margin of approximately two when they write a code. This means that a structure designed to a code could carry approximately twice the design load and not fail.

Q.20. Please describe the Systems Control cable tray hangers at Byron.

A.20. Systems Control provided cable tray hanger assemblies at Byron. Figure 1, attached to my testimony, depicts a typical cable tray support system: a cable tray hanger is comprised of both horizontal and vertical members, which can be tube or channel strut members. These members are fabricated in the shop with end connections which are welded to the connecting vertical or horizontal members. Figures 2 and 3 are details of the connection of a horizontal to vertical member. They illustrate the location of the Systems Control shop weld and the Hatfield Electric Company field weld (Hatfield installed the components supplied to the site by SCC). The hanger assembly, when field installed, supports the cable tray.

It should be noted that each weld, both the shop weld by Systems Control and the field weld by Hatfield, is required to support the total design loads for the hanger. Depending on the connection detail, one of the two welds will govern the capability of the connection to accept design loads in that it will be the most highly stressed weld in that connection. Regardless of which weld is governing, both welds are designed to accept code-allowable stresses; therefore, the noncontrolling weld is less highly stressed and has a greater design margin which allows the weld to accomodate discrepancies. This represents an additional conservatism in the design of the plant's cable tray hanger system.

Q.21. Please describe the engineering evaluations performed by Sargent & Lundy on cable tray hangers provided by Systems Control.

A.21. The most significant engineering evaluation performed by Sargent & Lundy for Systems Control cable tray hangers at Byron occurred in 1984, pursuant to Commonwealth Edison's Byron NCRs 850 and 885. NCR 850 was issued to document and track the problem of general weld quality discrepancies found on Systems Control hangers by Hatfield Electric Company quality control personnel at Byron.

NCR 850 was issued in September 1983, and subsequently Hatfield was asked to provide more detailed information on the weld discrepancies it had identified. NCR 885 was issued in February 1984 to track disposition of the detailed weld discrepancies provided by Hatfield. Thus NCRs 850 and 885 encompass the same issue.

In order to address the general concern for weld quality covered in NCRs 850 and 885, a random sample of 80 hangers from the population of 5,717 Systems Control hangers at Byron was identified by Sargent & Lundy for weld inspection. The sample was selected from the population of hangers using a list of random numbers. This selection process ensured that the sample was unbiased and representative of all hangers in the plant. The sample captured all commonly used connection types, including 44 connections that, based on the original design, were deemed to be highly stressed.

The inspections of the selected hangers were performed by Hatfield with verification through field inspections by CECo's third party inspectors (Sargent & Lundy Level III inspectors on loan to Commonwealth Edison). The 80 hangers included 358 Systems Control shop-welded connections. Of the 358 connections inspected from the sample of 80 hangers, 252 connections had no discrepancies, and 106 were found to have some form of discrepancies such as underlength, undersize, overlap, undercut, craters, and two connections with missing portions of welds. None of the welds had cracks.

The engineering evaluation of the discrepant welds was performed in the same manner as in the Byron QC Inspector Reinspection Program. That portion of a weld with a discrepancy was conservatively deleted from the total weld length, and new connection capacities were calculated. These new connection capacities were evaluated against the design capacities. Based on the results of the evaluations, none of the discrepant welds had design significance. This fact was later confirmed by the results of a structural computer analysis of the three hanger assemblies which include the three most discrepant welds identified during the inspection program.

Q.22. Please explain the nature of the analysis performed with respect to the most discrepant welds.

A.22. In order to determine whether the hangers which incorporated the most discrepant welds identified in the inspection program remained capable of carrying design loads notwithstanding the discrepant weld, detailed computer models were developed for the three hanger assemblies. These hangers were those which contained the three welds found during the evaluation of the 358 connections to have the greatest reductions in load capacity. Each connection in these hanger assemblies was mapped, encompassing both Systems Control and Hatfield welds associated with these connections, and all identified weld discrepancies, including the most discrepant welds, were incorporated into the ~~the~~ computer model.

Each model was then analyzed for design loading conditions for the entire hanger assembly. This analysis redistributed the loads among the hanger connections to reflect the presence of the weld discrepancies.

The analysis showed that even though an individual connection had reduction in weld capacity, none of the connections or structural members exceeded the code-allowable stress, even when loaded to twice the design load.

This demonstrates that inherent margins do exist in the hangers in the cable tray hanger system in the form of load-bearing ~~redundanices~~ redundancies. These analyses thus further demonstrate that the weld discrepancies identified in the inspections of System Control hangers are not significant in relation to hanger load-carrying capacity.

Q.23. Has Sargent & Lundy performed other engineering evaluations at Byron which indicate the adequacy of Systems Control cable tray hangers?

A.23. Yes. Sargent & Lundy has performed various other evaluations on specific hanger connections. In each case these evaluations showed that the weld discrepancies did not compromise the design.

Byron NCR 813, issued in April 1983, identified the fact that welds were undersized for DV-2 connections (Figure 4) which use strut members (P5501). For the connection detail specified, only a 1/16" fillet weld could be installed, in lieu of the 1/8" weld specified.

Drawings called for the use of the DV-2 connection with P5501 strut members on 593 hangers. 64 of these hangers ~~connections~~ were randomly selected for engineering evaluation to determine if the use of a 1/16" weld was acceptable. Due to the extremely low stress in this connection type as originally designed, all of the sampled connections were found to have adequate load carrying capacity.

In evaluating the DV-2 connection no credit was taken for weld penetration into the radius of the strut member. Figure 4 illustrates the curvature of the strut members. Weld is deposited between the plate and the curved section of the strut. This portion of the weld is not considered in the design to carry loads, although the weld penetration provides additional weld capacity.

In addition, the macro-etching of a DV-2 connection showed that the actual effective weld size was twice that of the 1/16" weld size used in the initial disposition of NCR 813. A macroetch is made by cutting through the weld joint transverse to the weld length, polishing the surface and applying an etching acid to reveal the exact amount of weld penetration. The connection selected for macroetching was the DV-2 connection with a P5501 strut with the smallest weld size from among the 13 DV-2 connections with discrepancies identified in the random sample of 80 cable tray hangers reviewed in response to NCRs 850 and 885. The results of the eight macroetches performed on the connection indicated that the actual effective throat on the macroetched sides ranged from 0.09 to 0.15 inches. The assumed effective throat used in the evaluation of NCR 813 was 0.044 inches (the effective throat of 1/16" weld), which is approximately one-half of the minimum value found on the macroetched samples.

Because NCR 813 did not identify weld quality as a problem, its disposition addressed the issue of weld size only. Subsequently, in order to consider the effect of possible weld quality discrepancies in the DV-2 connections, the results of the weld quality inspections of DV-2 connections in the sample of the 80 hangers associated with NCRs 850 and 885 were used to establish the weld with the greatest reduction in load-bearing capacity. This weld capacity level was applied to all DV-2 connections. Since large design margins exist in the DV-2 connection it was found that the connection can accomodate the lowest weld capacity level and still remain within code-allowable stress.

Sargent & Lundy's evaluations in connection with Byron NCR 893 are also pertinent to the issue of overall hanger weld quality. This NCR, issued in March 1984, documented an allegation that welds in the DV-162 connections (Figure 5) were undersized by 1/8". The DV-162 connection is used in two types of hanger assemblies, those in longitudinally-braced hangers and those in unbraced hangers. For longitudinally-braced hangers it was shown that the Hatfield field welds associated with this connection govern the design capacity of the connection. Therefore, our engineering evaluation determined that a shop weld undersized by 1/8" was acceptable.

For unbraced hangers, which constitute approximately 50% of the total DV-162 connections, the SCC weld generally governs the design; therefore, an inspection biased toward a group of highly stressed unbraced hanger connections was performed. A sample of 100 connections out of a total population of 2,563 DV-162 connections was inspected for weld size, length, and quality. 41 connections contained no discrepancies. 59 connections contained discrepancies, although nine contained only weld quality discrepancies, and not discrepancies of weld size. All of the 59 connections with discrepancies were determined to be capable of carrying design loads. Moreover, the inspection revealed that there was no general tendency toward welds being undersized by as much as 1/8", as originally stated in NCR 893; in fact, a portion of the weld was undersized by 1/8" or more in only 6% of the connections sampled, and 50% of the connections had full size or larger welds.

The disposition of Byron NCR 772 represents a comparable situation. This NCR was issued in January 1983, and documented the fact that the horizontal weld to the inside of the gusset plate in DV-1 and DV-4 connections was omitted in some cases. Upon review of the connection, Sargent & Lundy concluded that the weld could be omitted without having an impact upon the required design capacity. Engineering evaluation demonstrated that the ~~two~~ four vertical welds in the connection were, in themselves, sufficient to carry the design loads.

Q.24. Are there other CECo Byron NCRs related to cable tray hangers supplied by Systems Control?

A.24. Yes. CECo's Byron NCR 105 encompassed the welder qualifications and procedures utilized by Systems Control in the fabrication of cable tray hangers. One hundred percent of the hangers on site at that time (1977) were inspected and all weld discrepancies were corrected.

CECo's Byron NCR 407 also involved Systems Control hangers. This NCR, issued in August 1979, documented the fact that two hangers were fabricated with DV-1 connections rather than the specified DV-5 connections. These types of connections are similar, however, and Sargent & Lundy concluded that the substitution of one for the other was acceptable on the subject hangers.

Q.25. Do you have an opinion concerning the quality of the cable tray hangers supplied ~~by~~ to Byron by Systems Control?

A.25. Yes, I have concluded that because the cable tray hangers are capable of carrying design loads, the quality of these hangers is adequate.

Q.26. What is the basis for your opinion?

A.26. My opinion is based on engineering judgment that relies on the following significant elements, each of which reflects the margins which characterize the cable tray hanger system: first, the absence of design significant discrepancies identified in any of the evaluations performed with respect to Systems Control hanger work; second, the load-bearing redundancies which exist in the cable tray hanger system; and third, the conservative design and analytical criteria utilized by Sargent & Lundy at the Byron Station.

With regard to the first point, the 358 connections on the 80 randomly sampled hangers that were inspected in conjunction with NCRs 850 and 885 did not have any design significant discrepancies. Moreover, the connections inspected and evaluated in connection with resolution of the Byron NCRs involving specific hanger connections also did not demonstrate design significant discrepancies. Specifically, the evaluations of the DV-2 and DV-162 connections determined that they were adequate in their as-built condition to sustain design loads. In sum, no discrepancies with design significance were identified in any of the engineering evaluations of Systems Control cable tray hangers performed over the years by Sargent & Lundy.

With regard to the second point, the analysis of the three hanger assemblies with the most discrepant welds showed that the hangers, through the distribution of loading, are capable of carrying design loads. The computer analysis demonstrated that none of the connections or members exceeded the allowable stress even when loaded to twice the design load. The large design margins in these hangers confirms my professional judgment that large design margins exist in Systems Control hangers throughout the plant, and that the SCC hangers are able to absorb weld discrepancies through their load-bearing redundancies and still carry design loads.

With regard to the third point, there exist conservatisms in the design and analytical criteria utilized by S&L. Conservatism is applied in the design of cable tray hangers through an enveloped seismic response spectra, which is typically used in the industry. Further design conservatism derives from the use of a time history analysis to determine a more exact seismic response for Byron hangers.

Sargent & Lundy's conservative analytical criteria in evaluating weld capacity further confirms my judgment concerning Systems Control hangers. This further conservatism derives from the deletion in our engineering evaluations, for the purposes of recalculating weld capacity, of that portion of a weld which has discrepancies. The discrepant portions of the welds still have a significant amount of structural strength in most cases; e.g., in cases of porosity the weld may have no reduction in strength at all.

Because of the absence of design significant discrepancies, the load-bearing redundancies present in the cable tray hangers system, plus the conservatisms of overall Byron design and the Sargent & Lundy analyses of the hangers, it is my professional judgment that the Systems Control cable tray hangers at Byron Station are capable of carrying design loads.

Q.27. Are any additional inspections of Systems Control cable tray hangers being performed?

A.27. Yes. During the inspection of the 358 connections, two instances of missing portions of welds were observed. These welds were associated with a DV-8 connection (Figure 3) and a DV-120 (Figure 6) connection. Even though these missing portions of welds were evaluated and found to have no design significance, they caused the largest amount of capacity reduction in the discrepant connections. Consequently, in order to assure that missing portions of welds do not compromise the adequacy of other connections, an additional inspection program for missing portions of welds is being performed. 100% of all connections which cannot accomodate the largest amount of capacity reduction as determined in the evaluation of the missing portions of welds and still remain within code-allowables will be inspected for missing portions of welds. Any weld missing a portion of weld will be evaluated and the portion will be restored if current design requirements require such a disposition.

Q.28. Please describe the Systems Control cable trays at Byron.

A.28. The cable tray system is shown in Figure 7. This figure depicts cable trays, a cable tray fitting, associated stiffeners attached to the cable tray, and fitting and adjoining attachments. The figure also depicts the cable tray hangers which support the cable trays to the main building structure. The cable trays are steel trough-ways comprised of sheet metal which support the plant cables. The trays are formed by bending flat pieces of steel into trough configurations that can be 12", 18", 24" or 30" in width, with side channels 4" to 6" in height. Sheet metal V-shaped stiffeners are stitch welded across the bottom of trays to provide support (Figure 8). These stiffeners are placed at 5' intervals. The fabricated sections of tray are bolted together in the field and the sections are supported by cable tray hangers.

Cable tray fittings are used when a change in direction of the cable tray run is required, to form the intersection of two or more trays, or to make a transition from one size tray to another (Figure 9). Cable tray fittings are fabricated in a similar manner to straight sections of cable tray. Additional welds are provided in tray fittings to splice together vertical side channels located where the fittings change direction in order to form a continuous side channel. Stiffeners are also attached to the bottom of tray fittings.

In addition to the solid bottom cable trays and fittings just described, ladder trays (Figure 10) are also used. Ladder trays are constructed utilizing two sheet metal side channels which are connected together with pipe rungs at approximately 12" intervals. These pipe rungs are welded to the side channels. The resulting open bottom of this type of tray allows cables to drop out of the bottom of the tray to equipment located beneath the tray. T-type ladder tray fittings are used where two ladder trays intersect and these fittings are constructed in a similar manner to straight ladder trays.

Q.29. Please describe the engineering evaluations performed by Sargent & Lundy on cable trays provided to Byron by Systems Control.

A.29. Engineering evaluations have been performed on all the types of Systems Control cable trays and fittings described in Question 28. These evaluations have been based on the inspection results obtained at various times during fabrication and erection.

First, the welding of cable tray stiffeners has been evaluated. Discrepant welds on cable tray stiffeners were identified in July 1980, and Commonwealth Edison's Byron NCR 529 was issued to document and track this concern. Specifically, weld length and spacing on tray stiffeners did not conform to design specifications. As I stated above, cable tray stiffeners are steel sheet metal members stitch welded to the underside of cable trays to provide additional structural rigidity to the trays. Continuous welds attaching the stiffener to the tray bottom are provided at the ends of the stiffener.

A random sample of cable tray stiffeners was inspected to address this issue. The sampling plan was established to ensure that representative types of cable trays and cable tray fittings were selected. Cable trays and fittings at all building floor elevations were included in the sample and consequently no specific floor was favored by inspection of a majority of samples from that elevation. Both straight sections of cable tray and various types of cable tray fittings were included in the sample.

Inspections were performed by Pittsburgh Testing Laboratory and verified by Commonwealth Edison's Byron site quality assurance personnel. 123 cable tray and cable tray fit..ng sections encompassing 227 individual stiffeners were inspected. All of the stiffeners had weld in excess of the minimum amount required by design.

After completion of the inspection of stiffener weld length and spacing, in early 1981, the NRC Staff requested a review of the quality of the stiffener welds, in addition to the length and spacing of the welds. Review of stiffener weld quality subsequently was documented in Edison Byron NCR 707. Reinsp .tion of the same 123 cable trays and fittings examined for weld length and spacing was performed for weld quality. Weld discrepancies were found in each stiffener, and included lack of fusion, undersize, cracks, craters, undercut, and porosity. In addition, small linear crack indications approximately 1/4" in length were observed. These indications were evaluated to be non-propagating due to their material characteristics and small size. Engineering evaluation of the discrepant welds was performed. That portion of a weld with a discrepancy was conservatively deleted from the total weld length, and new weld capacities were calculated. These new capacities were evaluated against the actual required capacities. It was determined that all welds were adequate to transfer design loads.

Sargent & Lundy performed an additional evaluation of cable tray stiffeners in preparation for these hearings which focused on the ramifications of the presence of cracks in the end welds of stiffeners. As noted above, small cracks had been identified in the weld inspections performed in connection with the evaluation of stiffener weld quality. In the Byron QC Inspector Reinspection Program, when a crack was observed in a weld the entire weld conservatively was considered to carry no load. To follow the same methodology with regard to Systems Control welds, Sargent & Lundy performed an engineering evaluation which, to reflect the existence of cracks in the end welds of a stiffener, conservatively assumed the complete absence of a stiffener from a cable tray. This analysis thus conservatively assumed the absence of both the stiffener's end welds and the stitch welding to the bottom of the cable tray. The analysis demonstrated that the membrane capacity of the sheet metal cable tray bottom is adequate to support the cable load for the tray span between hangers. The analysis showed that the bottom of the cable tray transfers the cable load either directly to the adjacent hangers or to the side walls of the tray and from the side walls to the adjacent hangers. Consequently, the evaluation indicated that the absence of tray stiffeners is not significant to the design, and cable trays will carry design loads even without stiffeners.

The results of the above-described evaluations of stiffeners have led me to conclude as a matter of engineering judgment that the stiffeners supplied by Systems Control to Byron are adequate to carry design loads.

Q.30. Please describe the engineering evaluation performed by Sargent & Lundy with regard to Systems Control cable tray fittings.

A.30. Inspections of cable tray fittings were performed in 1977 pursuant to Commonwealth Edison's Byron NCR 105. NCR 105 was issued in response to the fact that Systems Control did not have approved welder qualifications and procedures. As part of the overall response to the nonconformance 99 fittings, out of approximately 1,200 which were at the Byron site at that time, were inspected by Industrial Contract Services for the purpose of determining SCC weld quality. Both stiffener welds and side channel welds were inspected. No discrepancies were found in the stiffener welds. Four fittings were found to have side channel weld discrepancies. These discrepancies included lack of fusion, porosity, and a missing weld attaching a corner bent plate to the cable tray side channel. None of these discrepancies had design significance.

An engineering assessment was performed to review discrepant side channel welds. This assessment considered all load carrying elements in the fitting. Since alternate load paths are available to transfer loads through the fitting around the discrepant fitting weld the engineering assessment, at that time, concluded that these discrepancies had no design significance and would not be detrimental to the performance of the cable tray fittings. Although fitting welds do provide an added element of structural rigidity, the close proximity of hangers and the presence of stiffeners provide the needed structural integrity to assure the proper performance of the cable tray system.

In June 1984, Sargent & Lundy performed an additional engineering evaluation in order to confirm that the fitting welds are not required to meet structural load-carrying requirements for any fitting because of the presence of alternate load paths to carry the cable loading through the tray fittings. The evaluation confirmed that the fitting welds are not required to enable fittings to meet load requirements due to the existence of redundant load paths.

However, the evaluation determined that in one configuration, involving the outside fitting weld of a 90 degree fitting, only one load-bearing redundancy exists, the fitting stiffener. The fitting weld therefore is required if the stiffener weld in that corner of the fitting is missing. The condition of a missing stiffener weld at the outside corner of a 90 degree fitting has not been found in any inspection. In order to assure that this condition does not exist, however, all 90 degree fittings will be inspected to ensure that the outside fitting weld is there and uncracked. If a fitting side channel weld is either missing or cracked, the stiffener weld at that corner will be inspected. If the fitting weld is missing or cracked and the stiffener weld is also discrepant, the fitting will be repaired.

Q.31. Please describe the engineering evaluation performed by Sargent & Lundy on Systems Control ladder cable trays and ladder fittings.

A.31. Ladder-type trays (Figure 10) and ladder-type fittings make up less than 3% of the entire length of cable trays found on the Byron project. A review of ladder trays and fittings was recently conducted in response to a question from the NRC Staff concerning the welding on these components. This review found that one of the two welds called for in the design specifications to connect the tray rungs to the side channels generally was not present in the trays. The specifications called for the rungs to be connected to the side channels by both a horizontal weld along the bottom of the rung and a circumferential weld at the point where the rung meets the side channel. It is the horizontal weld that is not present (Figure 10, weld B).

Subsequent to this review, S&L determined that in 1976 it had informed Systems Control that the horizontal weld did not have to be installed. This decision was documented in meeting notes. The drawings for the ladder trays issued shortly thereafter did not reflect the deletion of the horizontal weld. Systems Control apparently acted in accordance with the decision made at the meeting. We learned of this problem at the time of the recent review of the ladder trays.

To confirm that the present condition of the ladder trays is adequate to carry design loads, an inspection program was implemented. Sargent & Lundy Level III inspectors on loan to Commonwealth Edison inspected a random sample of 17 straight sections of ladder tray, encompassing 300 weld connections. Discrepancies identified in this inspection included lack of fusion, craters, underlength, and overlap. No cracks were observed nor were there any circumferential welds missing.

An engineering evaluation was performed to determine whether the inspected ladder trays can adequately support design loads while incorporating the identified weld discrepancies in the circumferential welds and the absence of the horizontal weld. Further engineering evaluation was performed to determine whether the entire population of ladder trays can adequately support design loads while incorporating the greatest reduction in circumferential weld capacity determined to exist based on the ladder tray weld inspection.

In addition, ten randomly selected ladder tray fittings, approximately 20% of the total fittings, were inspected to verify that the welded connections on the fittings are similar to those found in the straight sections of ladder trays. The connections on the ladder fittings were determined to be similar to those on the straight ladder tray sections, and the ladder tray fittings then were evaluated incorporating the greatest reduction in circumferential weld capacity associated with the weld discrepancies observed on the inspected straight ladder tray sections.

No design significant weld discrepancies were identified in the 300 ladder tray connections inspected. Moreover, application of the greatest reduction in weld capacity for the circumferential welds determined in the sample inspection of straight ladder tray connections to the entire population of ladder trays, including ladder tray fittings, did not reveal any instances in which a component could not carry design loads, even in the absence of the horizontal weld. Consequently, my pro- fessional judgment is that the ladder trays and ladder tray fittings supplied to Byron by Systems Control are adequate to carry design loads.

Q.32. Do you have an opinion concerning the quality of the cable trays supplied to Byron by Systems Control?

A.32. Yes, I have concluded that because the cable trays are capable of carrying design loads, the quality of these trays, including solid-bottom trays and fittings and ladder trays and fittings, is adequate.

Q.33. What is the basis for this opinion?

A.33. My opinion is based on engineering judgment that relies on the following significant elements, each of which reflects the margins which characterize the cable tray system: first, the absence of design significant discrepancies identified with respect to Systems Control cable tray work, including solid bottom trays, ladder trays, and associated fittings; second, the load-bearing redundancies which exist in the cable tray system; and third, the conservative design and analytical criteria utilized by Sargent & Lundy at the Byron Station.

With regard to the first point, the inspections of Systems Control cable tray stiffeners, cable tray fittings, and cable ladder trays and ladder fittings, resulted in the identification of no discrepancies with design significance.

The second point relied upon for my engineering judgment is illustrated by the engineering evaluations of cable trays, which demonstrate the load-bearing redundancies that exist in the cable tray system. For instance, the strength of the cable tray sheet metal bottom to transfer loads to the vertical sections of the trays is not taken into account in the stiffener design and required stiffener welding. In our evaluation of stiffener welds all loads were assumed to act on the stiffener, which transfers the loads to the side sections of the cable tray and through the side sections to the cable tray hangers. In actuality, a major portion of the load is transferred through the cable tray bottom into the vertical side sections of the tray or directly to a hanger. This was demonstrated in Sargent & Lundy's recent analysis of the cable tray without stiffeners, which showed that cable trays will function within code-allowables even in the absence of stiffeners.

In addition, S&L's evaluation of fitting welds confirmed the presence of load-bearing redundancies in cable tray fittings. Because of alternate load paths, fitting welds are not required to maintain the structural adequacy of the component.

With regard to the third point, as in the case of cable tray hangers conservatism is applied in the design of cable trays through an enveloped seismic response spectra, which is typically used in the industry. As with the hangers, further conservatism derives from the use of a time history analysis to determine a more exact seismic response for cable trays at Byron.

In addition, the methodology of the engineering evaluations performed by S&L for cable trays provides further conservatism in the analysis of this Systems Control component. This conservatism derives from the deletion, for the purposes of recalculating weld capacity, of that portion of a weld which is deemed discrepant. The discrepant portions of the welds still have a significant amount of structural strength in most cases, and this load-bearing capacity is disregarded for the purposes of analysis.

In view of these design and evaluation conservatisms and the fact that no significant design discrepancies were identified for the Systems Control cable trays, my professional judgment is that the Systems Control cable tray system, encompassing solid bottom trays and fittings, and ladder trays and fittings, is capable of carrying design loads.

Q.34. Please describe the local instrument panels supplied to Byron by Systems Control.

A.34. 76 local instrument panels were supplied to Byron by Systems Control. These panels are located throughout the plant and support instrumentation which monitor and control functions and equipment located in proximity to the panels.

The panels (Figures 11 and 12) are either 4' wide or 8' wide. They consist of vertical channel sections, horizontal structural tubes and angles and diagonal angle members. The entire instrument panel is welded together and anchored to the main building structure by bolting or welding. The instrument panel is braced with angle knee braces and diagonal cross braces. These members provide additional structural support in the lateral direction. The instruments are mounted on the horizontal tube steel members.

Q.35. Were any weld discrepancies discovered on the local instrument panels supplied by Systems Control during their installation at the Byron plant?

A.35. Yes, discrepant welds were found in 1980 on local instrument panels supplied by Systems Control. A 100% reinspection was performed on the instrument panels by Pittsburgh Testing Laboratory. Weld discrepancies were repaired.

Q.36. Why were these discrepant welds repaired?

A.36. They were repaired in order to preserve the validity of the seismic qualification test performed on these panels.

Q.37. When was the seismic qualification test performed?

A.37. It was performed in ~~1980~~ 1978 and 1979 by Wyle Laboratories.

Q.38. What was the nature of the testing?

A.38. Prior to conducting seismic qualification testing, the natural frequency of the equipment first must be determined. This determination is made by conducting resonance search tests. In the case of local instrument panels supplied by Systems Control, resonance search tests were conducted on one 4' wide and one 8' wide panel.

These tests determined that the natural frequency of both the 4' and 8' panels is greater than 33 hertz (cycles per second). Panels with natural frequencies greater than 33 hertz will not experience dynamic amplification ~~on~~ of the floor seismic input and are therefore considered rigid for seismic qualification purposes. Since the construction of the 4' local instrument panels is similar to the construction of the 8' panels, and since both panels were determined to be rigid and therefore would not experience amplification of the seismic input motion, Systems Control selected the 8' wide panel for the required seismic qualification test.

The 8' wide local instrument panel was then tested for seismic qualification by being subjected to a "shake table" test. This test subjects the panel to an input motion that bounds the highest floor response spectra calculated at the location of all the local instrument panels in the plant. The test is deemed to be successful if the panel and the associated instrumentation mounted on the panel remain functional after the test has been completed. The 8' wide panel supplied by Systems Control passed the "shake table" test. As provided in the applicable ~~IEE~~ IEEE 344-1975 standard, it was concluded that all 4' and 8' wide local instrument panels fabricated by Systems Control were seismically qualified as long as their fabrication was accomplished in conformance with the same fabrication drawings and specifications as that used for the fabrication of the tested panel.

The test results of the resonance search test on the 4' and 8' panels and the shake table test on the 8' panel were reviewed by Sargent & Lundy. It was concluded that the tests were properly conducted by Wyle Laboratories, and that the results met the requirements of the specification (F/L-2809) developed by Sargent & Lundy.

Q.39. Were any discrepant welds discovered on Systems Control-supplied local instrument panels subsequent to 1980?

A.39. Yes. In June 1984, Torrey Pines Technology, while reviewing local instrument panels as a part of its third party review of the Systems Control work at Byron, inspected approximately 10% of the welds on seven different local instrument panels, ~~207~~ 205 welds in total. Torrey Pines found no discrepancies on three of the seven panels. The other four panels were found to have 17 total discrepancies, eight on one, five on another, three on another, and one on the other. The weld discrepancies found by Torrey Pines resulted in minimal reduction in weld capacity.

Nevertheless, because of the Torrey Pines inspection findings, a weld inspection program was implemented to confirm that the local instrument panels installed at Byron were sufficiently equivalent to the panel qualified by Wyle to warrant applying the Wyle test results to the entire Byron local instrument panel population.

Q.40. What was the nature of this weld inspection program?

A.40. Sargent & Lundy Level III weld inspectors on loan to Commonwealth Edison inspected 17 local instrument panels, one of which had also been inspected by Torrey Pines. On four of these panels, two 4' and two 8' panels, all accessible welds were inspected. One of these four panels was the Wyle-tested 8' panel, panel 1PL54J, which had been partially inspected by Torrey Pines. In addition, one of the four panels, panel 1PL78JA, was the 4' panel that had been resonance search tested by Wyle. These panels were completely inspected in order that a direct comparison could be made for equivalency purposes between the Wyle-tested 4' and 8' panels and two randomly selected 4' and 8' panels. On the other 13 inspected panels, ten weld connections were inspected for length, size, and quality. The ten connections were chosen as follows: two highly stressed connections in each panel, two connections similar to those found discrepant by Torrey Pines, and six connections selected randomly. A total of 389 weld connections were inspected, totalling ~~1,457~~ 1,455 welds (including the ~~207~~ 205 welds inspected by Torrey Pines).

Inspection of the local instrument panels by Sargent & Lundy identified similar weld discrepancies to those found by Torrey Pines. 271 discrepancies were found; they included overlap, craters, undercut, arc strikes, and underlength. No cracked or missing welds were found.

Q.41. How were these discrepancies dispositioned?

A.41. These discrepant welds were dispositioned by determining the effective quantity of weld on the inspected panels and by comparing that quantity with the same welds on the panels tested by Wyle Laboratory. In calculating the effective weld we conservatively deleted from the total weld that portion of the weld which was deemed to be discrepant. Our review of the inspections found that the total effective weld on the completely inspected two randomly selected 4' and 8' panels was greater than the total effective weld on the 4' and 8' tested panels. In the other 13 inspected panels the total effective weld on each of the panels was greater than the total effective weld on the similar welds of the tested 4' and 8' panels.

Comparison of the as-built condition of the two fully-inspected local instrument panels and the 13 partially-inspected panels with the Wyle-tested 4' and 8' panels thus demonstrated that the untested panels were equivalent to the tested panels for the purposes of seismic qualification. Based on these results we concluded that the entire Byron local instrument panel population is in sufficiently equivalent condition to the tested 4' and 8' panels to justify applying the seismic qualification test results from the tested 8' panel to the non-tested panels.

Q.42. Did Sargent & Lundy use any other means to determine whether or not the non-tested panels were equivalent to the tested panels for purposes of the seismic qualification performed by Wyle Laboratories?

A.42. Yes, in addition to using the results of the weld discrepancy evaluations to confirm the equivalency of the local instrument panels, Sargent & Lundy developed a detailed computer model of an 8' local instrument panel utilizing finite elements. A dynamic analysis was performed on this model to determine forces and stresses at each connection on the panel. The results of the analysis confirmed that the computer model was similar in dynamic characteristics to the Wyle-tested 8' panel. The analysis also showed that the most highly stressed connection was stressed to only 10% of the code-allowable stress. Consequently, by applying the greatest reduction in weld capacity identified in the inspections of local instrument panels to the most highly stressed connection the connection is stressed only to 12% of its code-allowable stress. In other words, the greatest reduction in weld capacity identified in the inspections when applied to the most highly stressed connection of a local instrument panel still results in a design margin of eight. Because this is the design margin at the most highly stressed connection, the margin at other connections will be greater than eight.

Q.43. Do you have an opinion concerning the quality of the local instrument panels supplied to Byron by Systems Control?

A.43. Yes, I have concluded that because the local instrument panels are capable of carrying design loads, the quality of these panels is adequate.

Q.44. Please describe the DC fuse panels supplied to Byron by Systems Control.

A.44. Four DC fuse panels were supplied to Byron by Systems Control. Two panels are located in the Unit 1 Auxiliary Building Battery Room, and two are located in the Unit 2 Auxiliary Building Battery Room.

Each panel is 72" wide by 90" high by 18" deep. The panels each have a right half and a left half, with an outward opening door on each half. Each panel is constructed utilizing structural angles for horizontal, vertical and diagonal members. These members are welded together to form an integral frame. Light-gauge sheet metal is attached by welding to the structural angle frame. Fuses and relays which protect the DC system are mounted to the internal structural steel members.

Q.45. Were any weld discrepancies discovered in the DC fuse panels supplied to Byron by Systems Control?

A.45. Yes. Discrepant welds were found in 1981 on the DC fuse panels supplied by Systems Control during an inspection of the panels by Sargent & Lundy Level III inspectors on loan to CECo.

Q.46. Were these discrepant welds repaired?

A.46. No. It was always intended to perform an equivalency analysis to demonstrate the panels' seismic qualification. Until recently Sargent & Lundy believed that Westinghouse's analysis of the Byron main control boards encompassed a review of the DC fuse panels. We recently learned, however, that Westinghouse had not evaluated the DC panels, and Commonwealth Edison requested Sargent & Lundy to perform the appropriate analysis for the panels.

Q.47. Were the DC f[illegible] panels seismically qualified?

A.47. Yes, they were seismically qualified in 1980 by Wyle Laboratories.

Q.48. What was the nature of the seismic qualification?

A.48. As in the case of local instrument panels, the adequacy of a DC fuse panel to carry dead and seismic loads is determined through seismic qualification testing. One of the four DC fuse panels (panel 1DC10J) was seismically qualified by testing at Wyle Laboratories. Both a resonance search test and a "shake table" test was performed on the tested panel.

Q.49. How were the discrepant welds identified on the DC fuse panels dispositioned?

A.49. Our analysis utilized the results of the inspection of the accessible welds on the four DC panels performed in 1981 by Sargent & Lundy Level III inspectors on loan to CECo. 2,170 welds were inspected, and 986 discrepancies were identified. The types of discrepancies identified included lack of fusion, craters, undercut, porosity, underrun, and underlength. In addition to these discrepancies, missing welds were found on one portion of one of the non-tested panels.

Sargent & Lundy performed a comparison of the effective weld of the tested panel to the effective weld of the other three panels in order to determine the equivalency of the panels for the purposes of seismic qualification. The effective weld was determined conservatively by deleting from the total weld that portion of a weld which was deemed to be discrepant. Panels 1DC11J and 2DC11J were found to have weld present throughout the panels and total effective weld greater than that of the tested DC fuse panel (panel 1DC10J). Therefore these panels were determined to be seismically qualified through their equivalency to the Wyle-tested panel. The results of the weld inspection of the panels did not enable a finding of equivalency to be made for panel 2DC10J. The 1981 inspection of panel 2DC10J found that weld is present and in equivalent quantity to that of the tested panel in all but one location of the panel. Missing stitch welds were identified along the length of the cross-braced diagonal angle members located in the center of the panel (Figure 13). Welds are present at the ends of these members.

In order to determine whether panel 2DC10J is in fact equivalent to the Wyle-tested panel for the purposes of seismic qualification Sargent & Lundy developed a finite element model of panel 2DC10J. This model encompassed the as-built condition of the panel, including the missing welds. A computer analysis utilizing this model determined the dynamic characteristics of the panel, and these characteristics were found to be similar to the dynamic characteristics found in the Wyle resonance search test of panel 1DC10J. We also determined that the dynamic characteristics at various instrument attachment locations were similar to the dynamic characteristics at similar locations in the tested panel. From these results I have concluded that panel 2DC10J is equivalent to the Wyle-tested DC fuse panel in terms of seismic qualification.

Because of the missing welds in panel 2DC10J the finite element analysis was also utilized to ensure that the diagonal cross-braced members were not over-stressed and that the welded end connections of the cross-braced members were adequate to transfer design loads. The analysis provided the stresses present at the connections of the panel so that these stresses could be compared to the code-allowable stresses. The analysis showed that the most highly stressed connection was stressed to only 38% of its allowable capacity and thus confirmed that the members and connections could carry design loads within code-allowables.

Q.50. Do you have an opinion concerning the quality of the DC fuse panels supplied to Byron by Systems Control?

A.50. Yes, I have concluded that because the DC fuse panels are capable of carrying design loads, the quality of these panels is adequate.

Q.51. Is work presently being performed on DC fuse panel 2DC10J?

A.51. Yes. The missing stitch welds on this panel are being installed. The decision by Commonwealth Edison to install the missing stitch welds was made prior to Sargent & Lundy's evaluation of the panel.

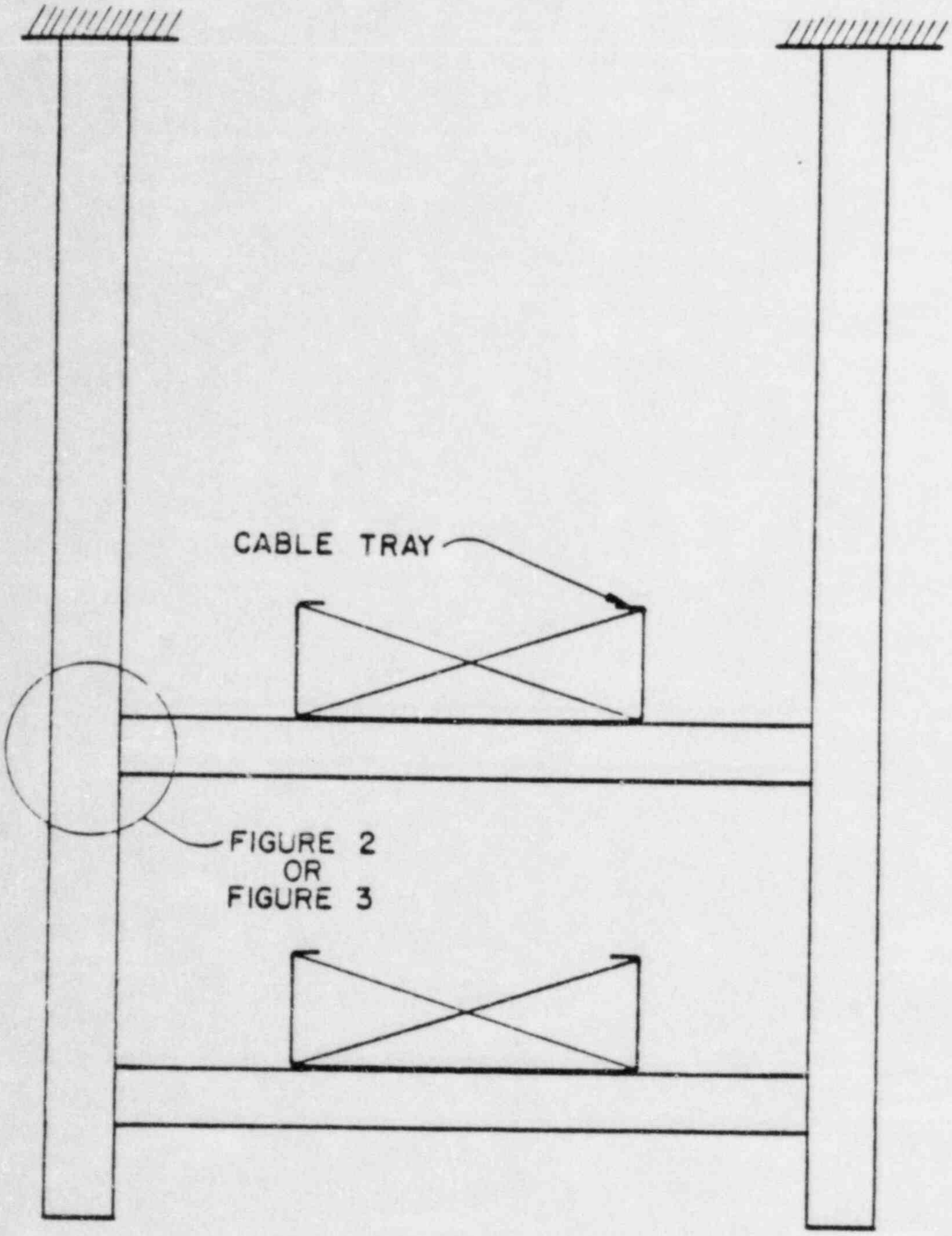


FIGURE 1

SYSTEM CONTROL
CABLE TRAY HANGER

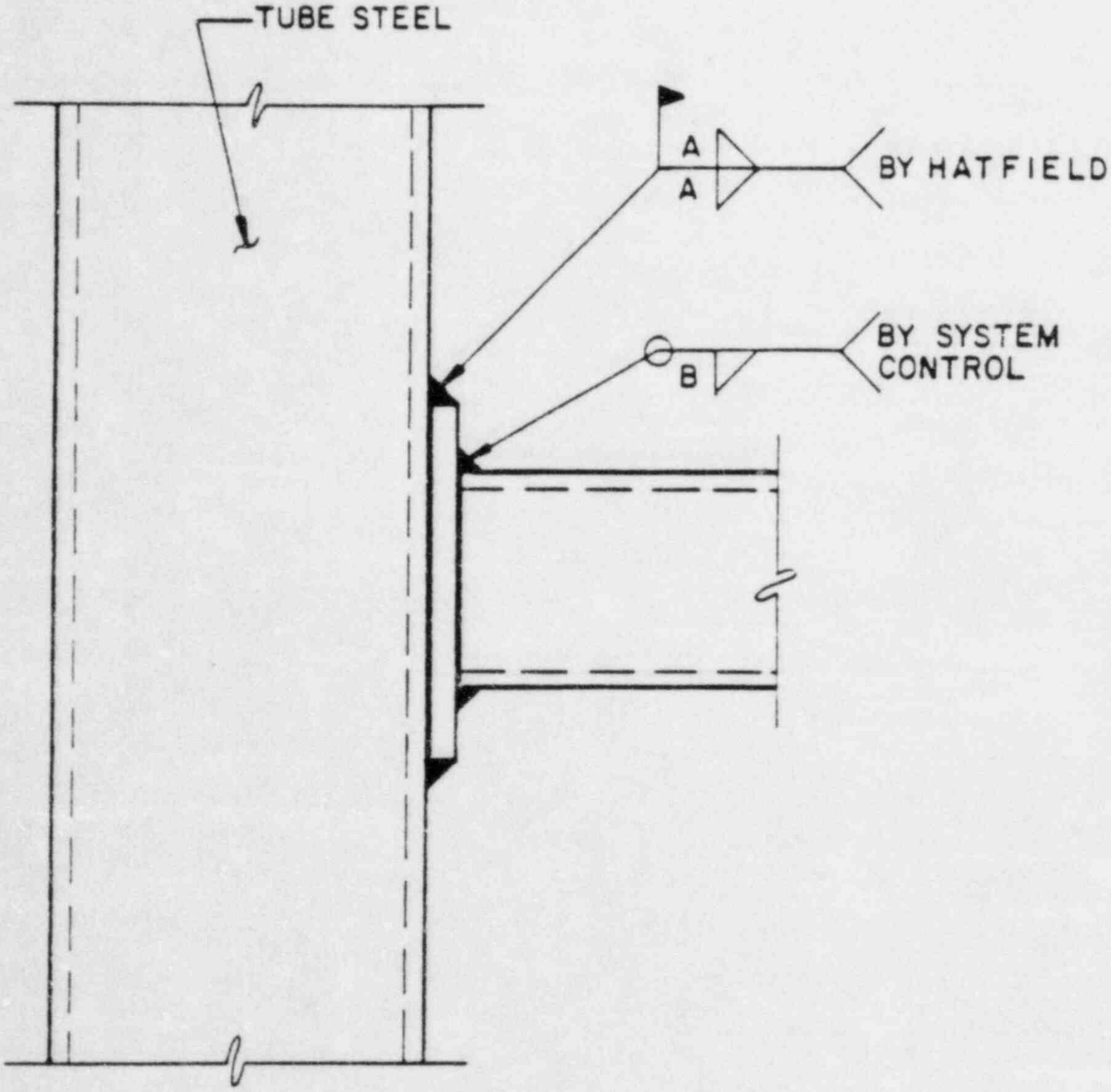


FIGURE 2

SYSTEM CONTROL
TYPICAL CABLE TRAY
HANGER WELDED CONNECTION

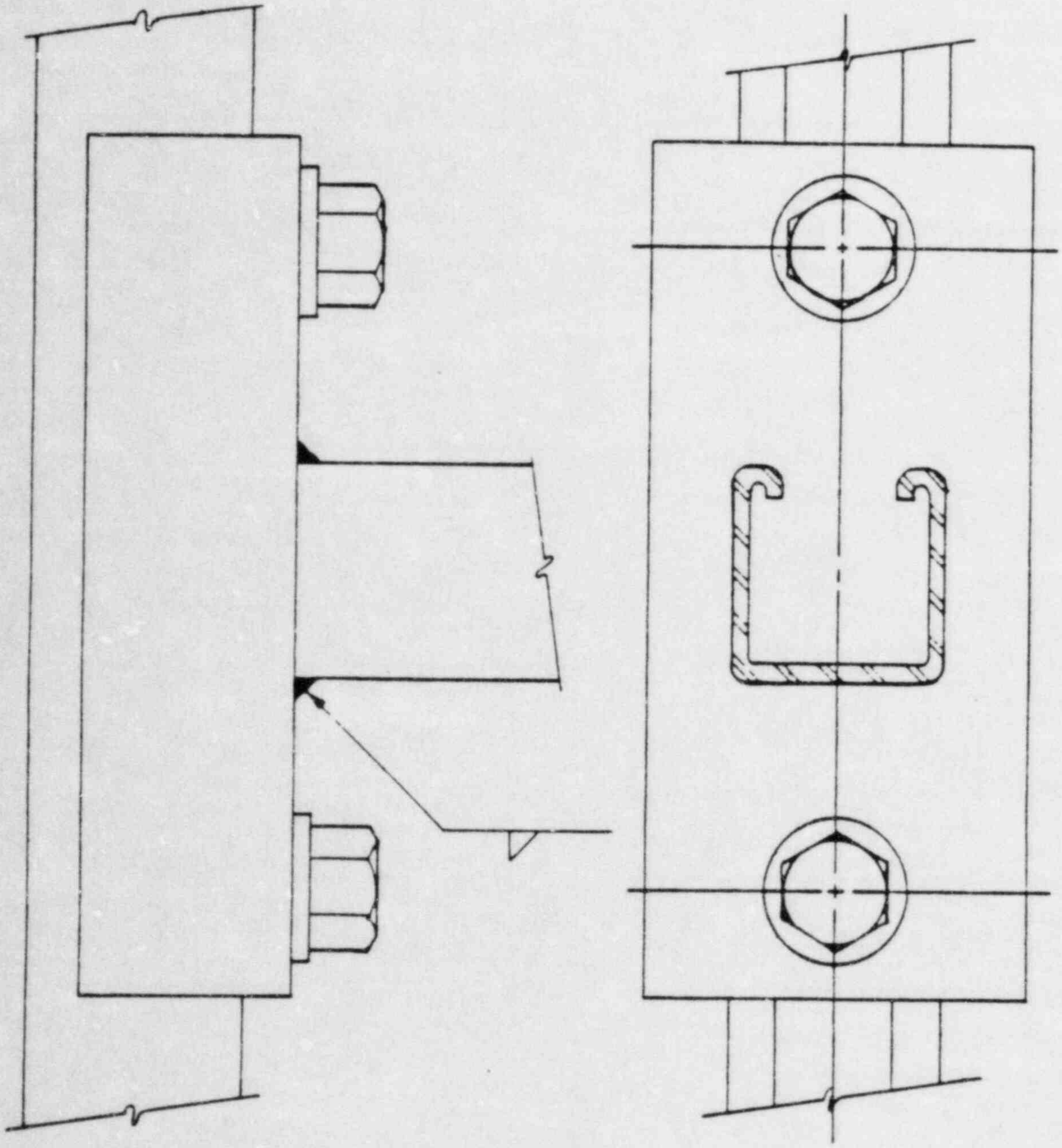


FIGURE 3

SYSTEM CONTROL
TYPICAL CABLE TRAY
HANGER BOLTED CONNECTION - DV8

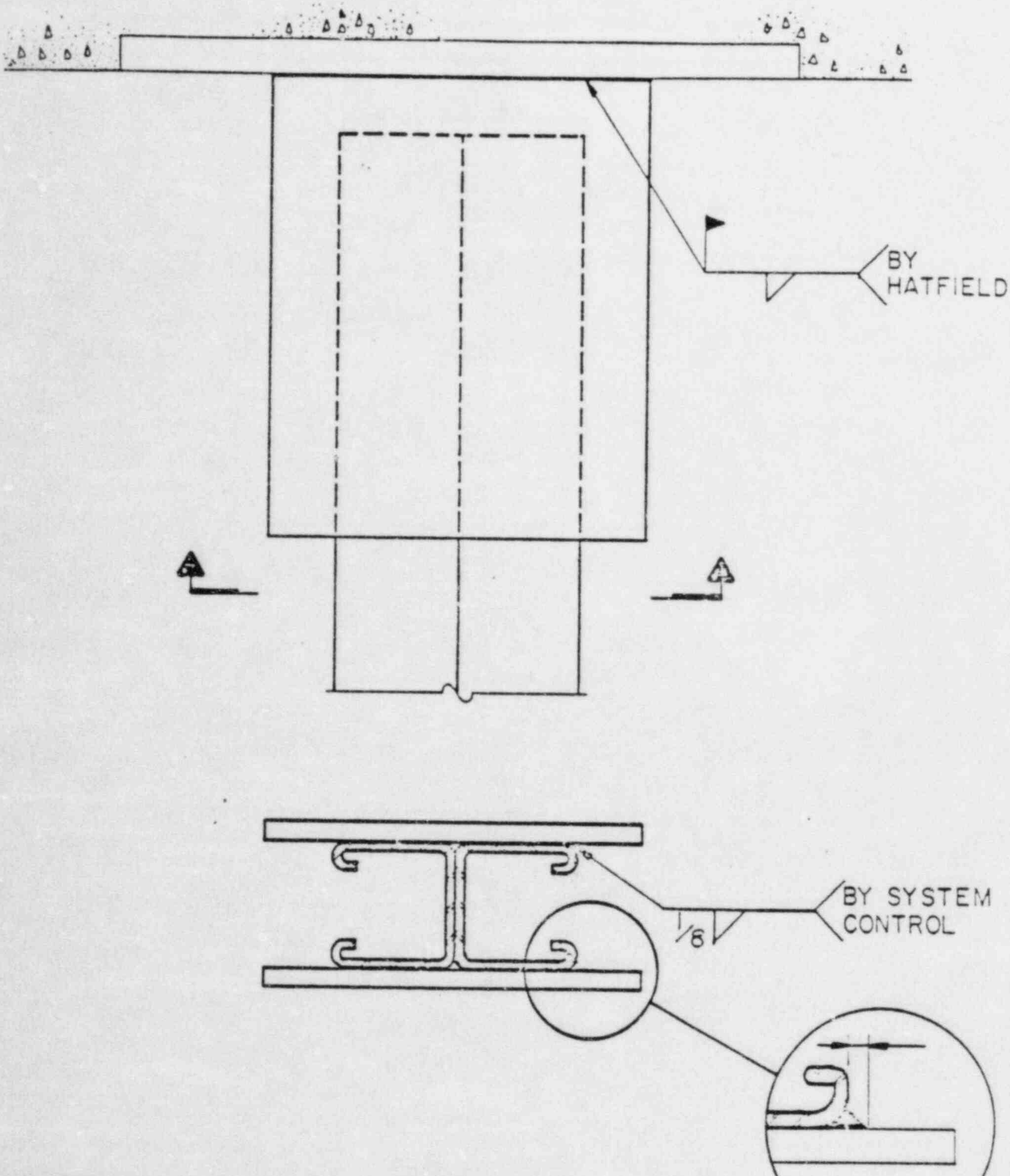


FIGURE 4
SYSTEM CONTROL
HANGER CONNECTION DV2

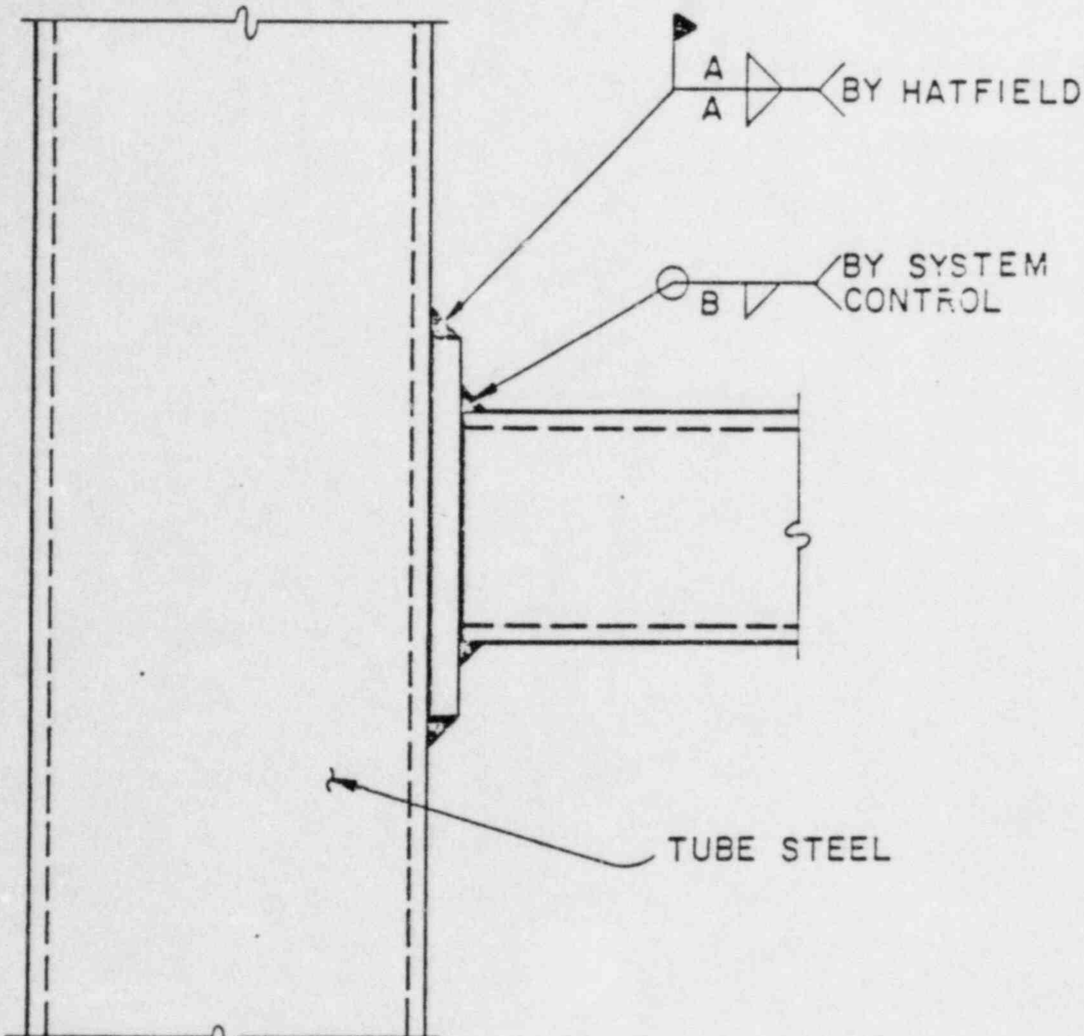
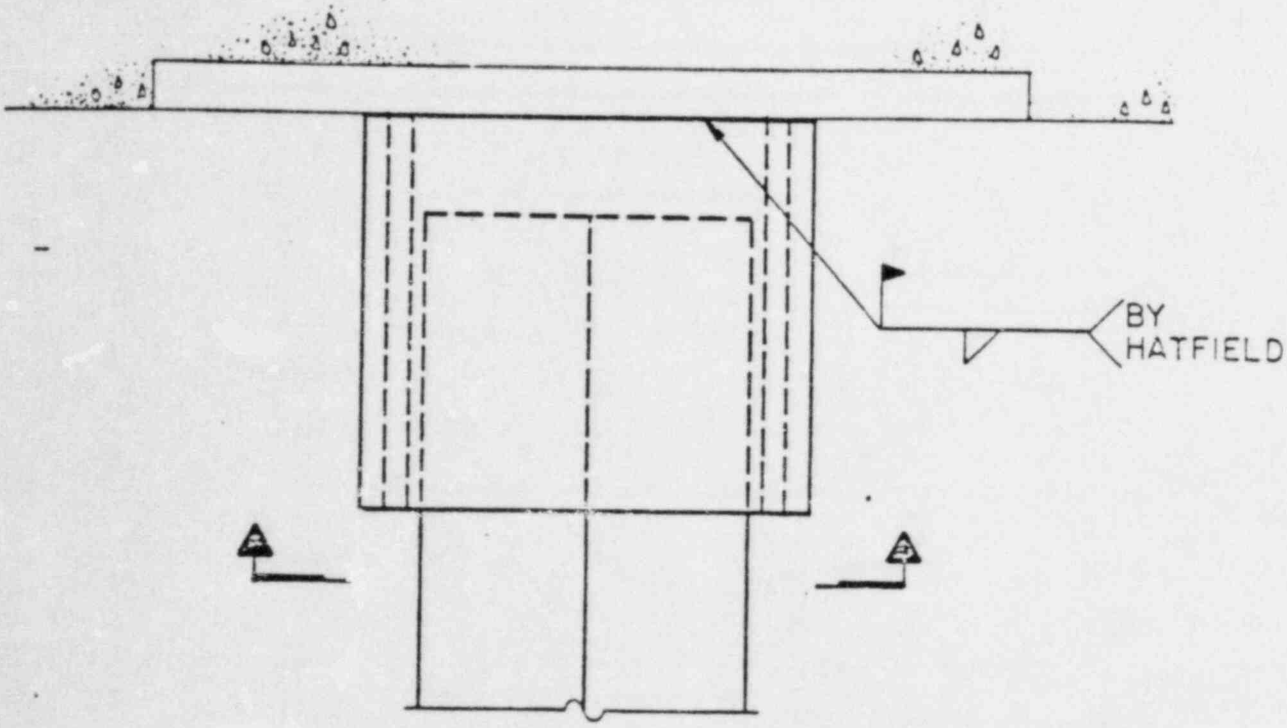


FIGURE 5

DV162



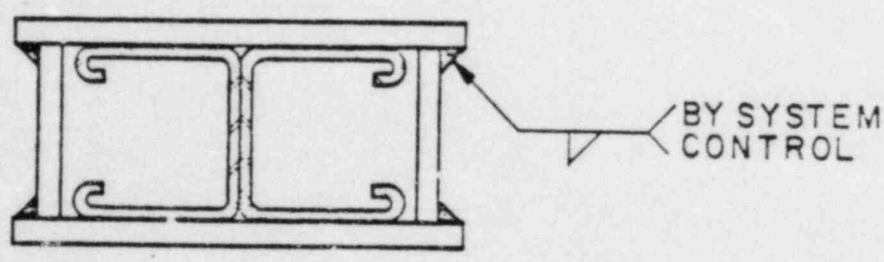


FIGURE 6
SYSTEM CONTROL
HANGER CONNECTION DV120

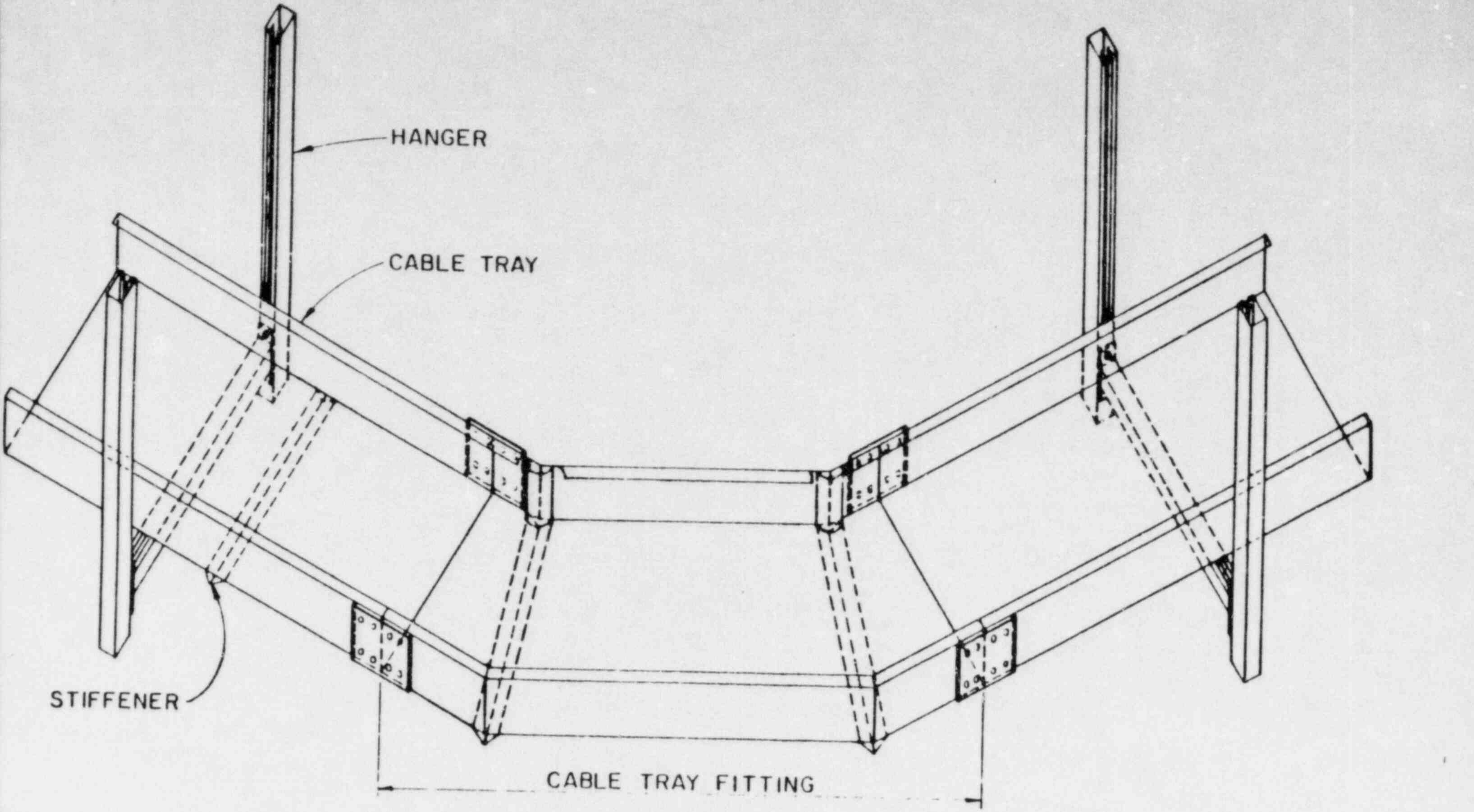
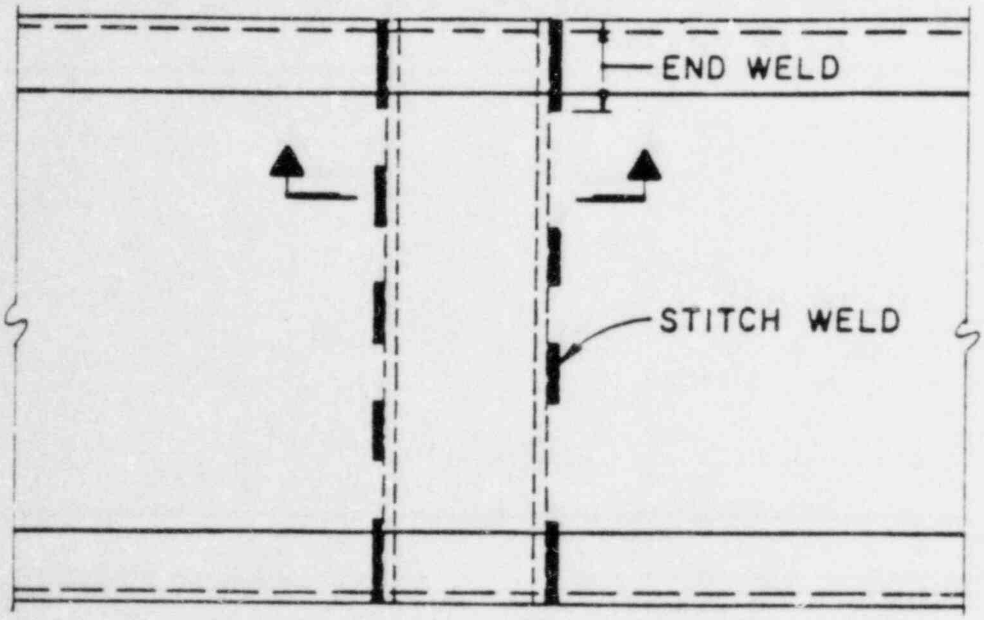
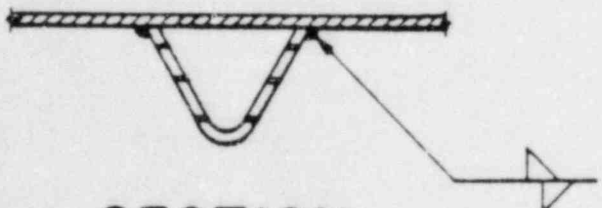


FIGURE 7

TYPICAL CABLE TRAY AND
CABLE TRAY FITTING



PLAN



SECTION

FIGURE 8

CABLE TRAY
STIFFENER DETAILS

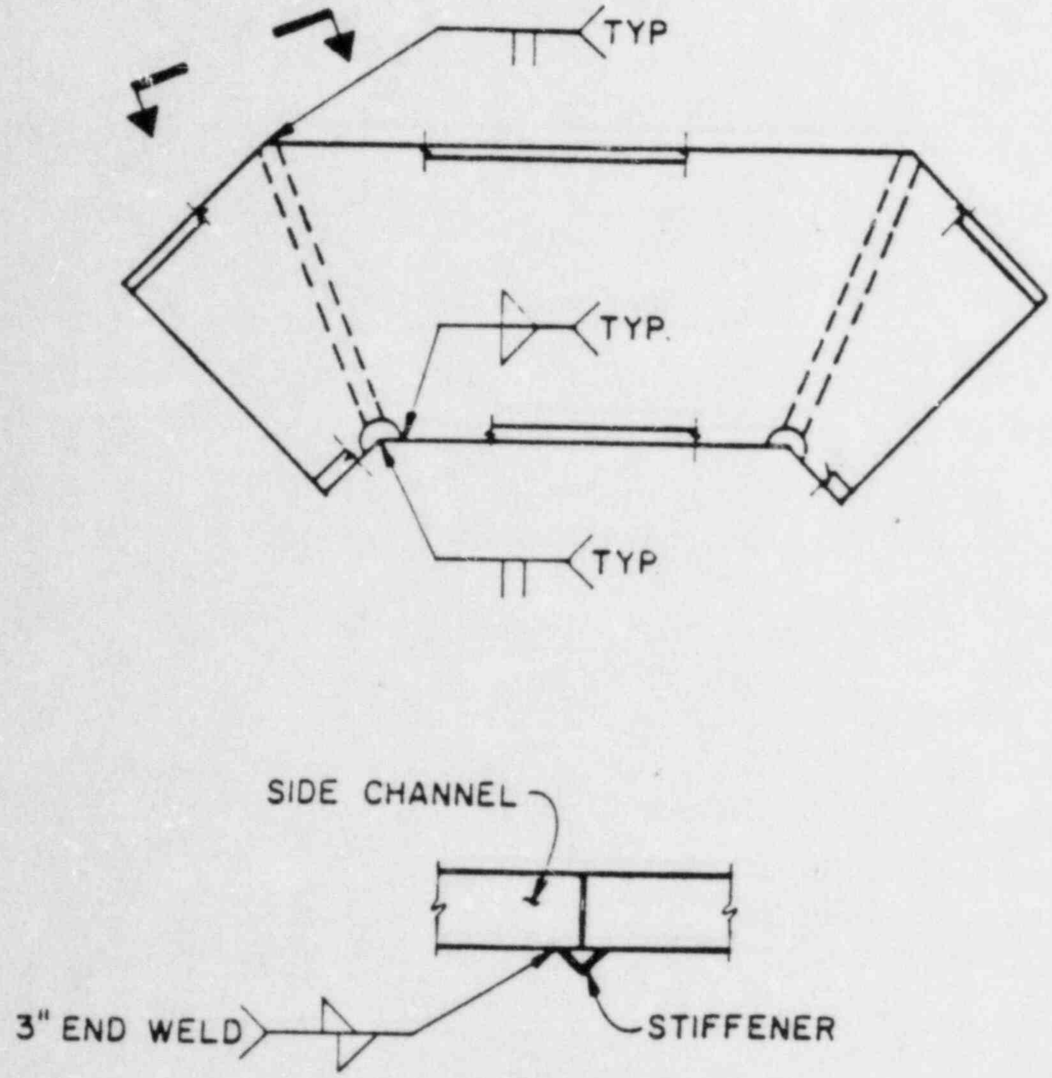


FIGURE 9

TYPICAL CABLE TRAY FITTING
90° BEND

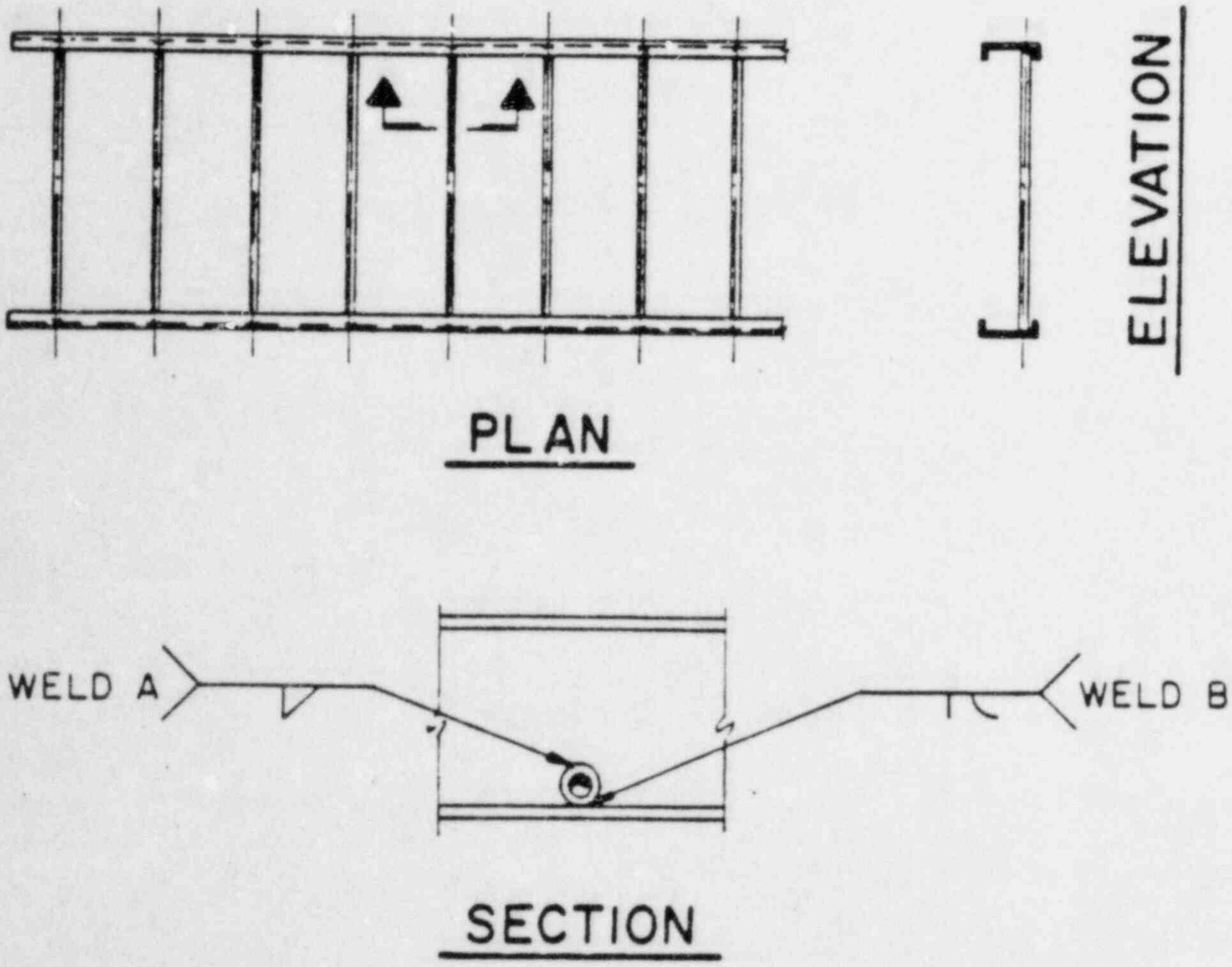


FIGURE 10

LADDER TYPE
CABLE TRAY

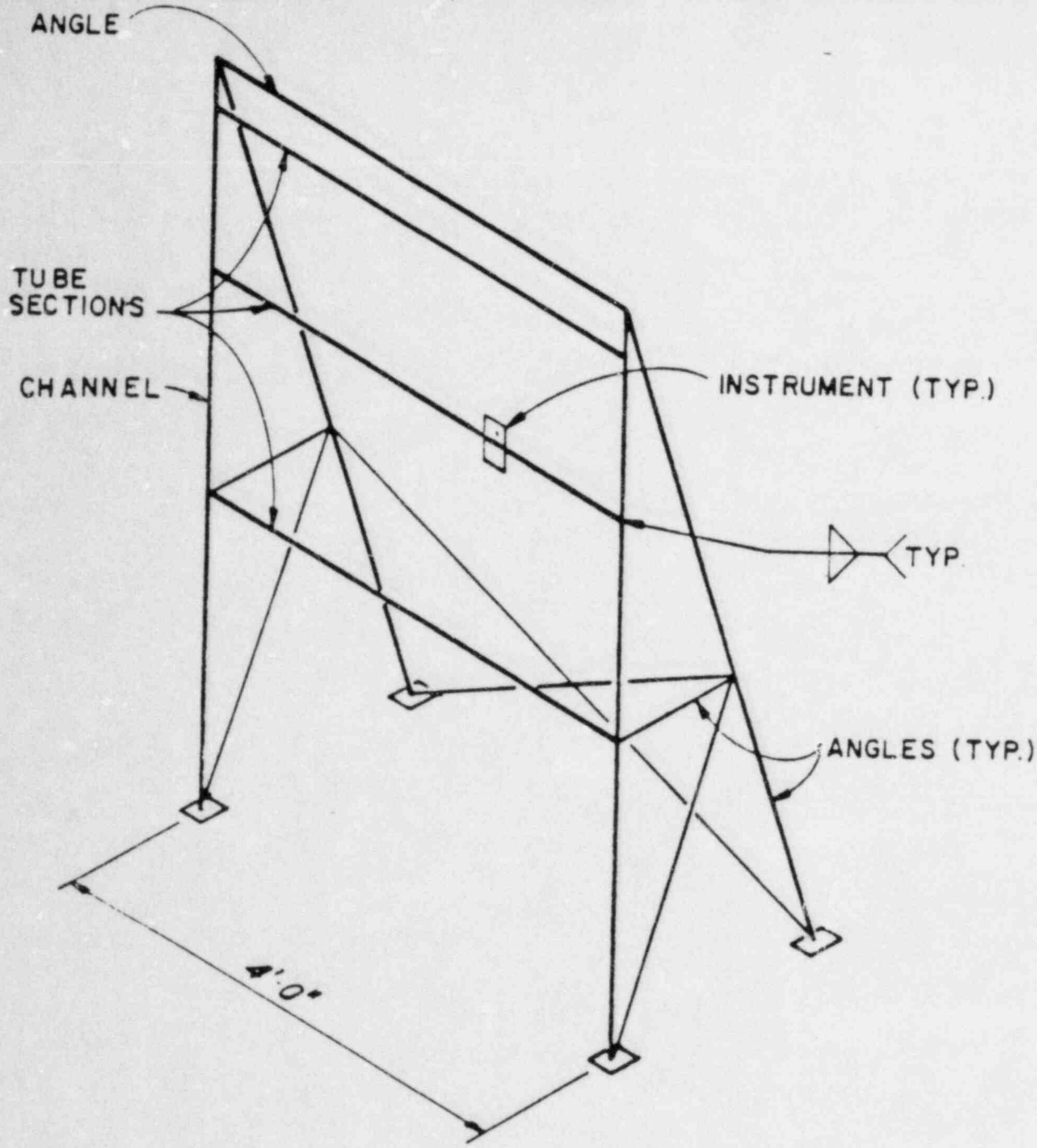


FIGURE 11

LOCAL 4'-INSTRUMENT PANEL

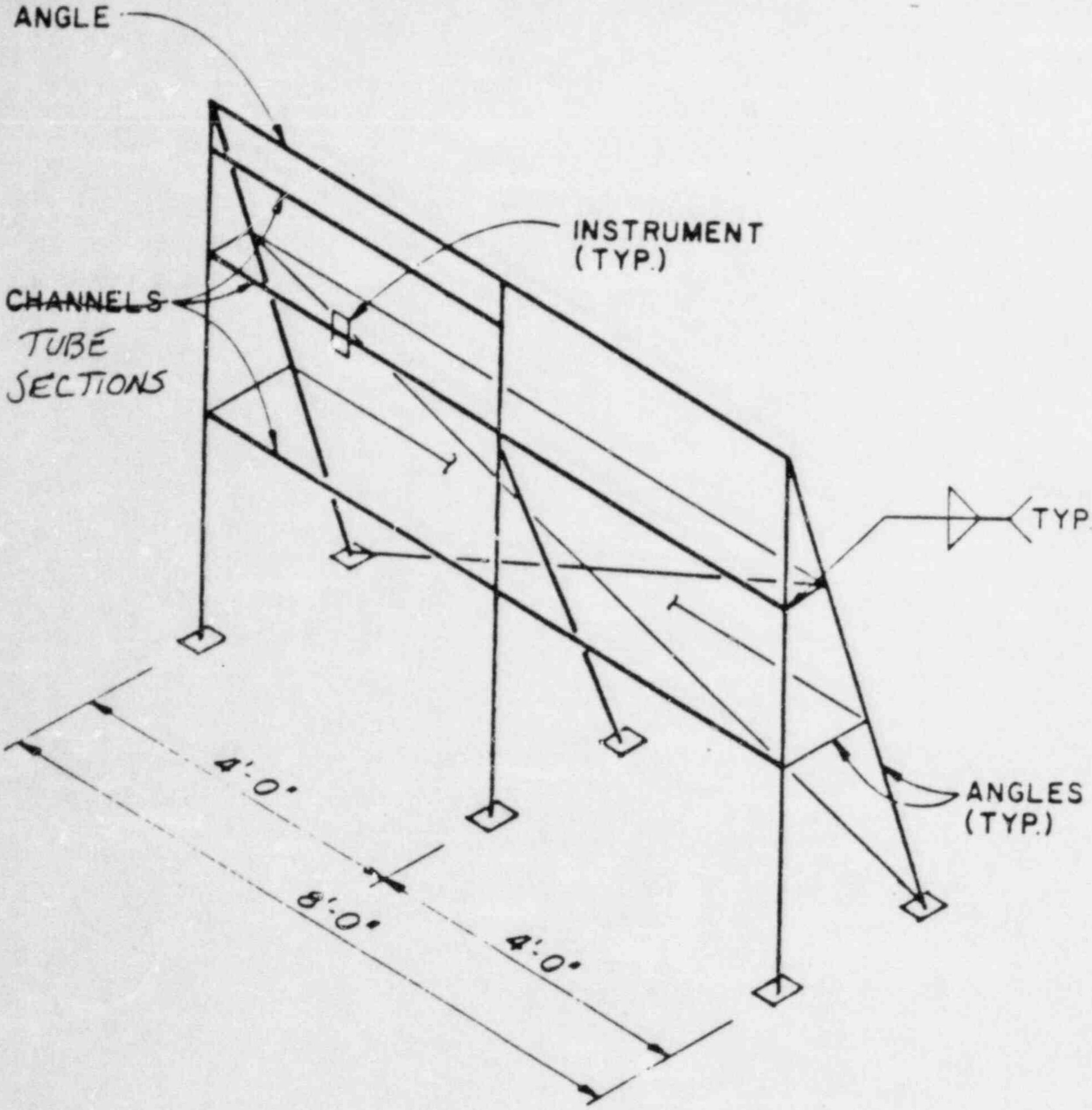


FIGURE 12
LOCAL 8'-INSTRUMENT PANEL

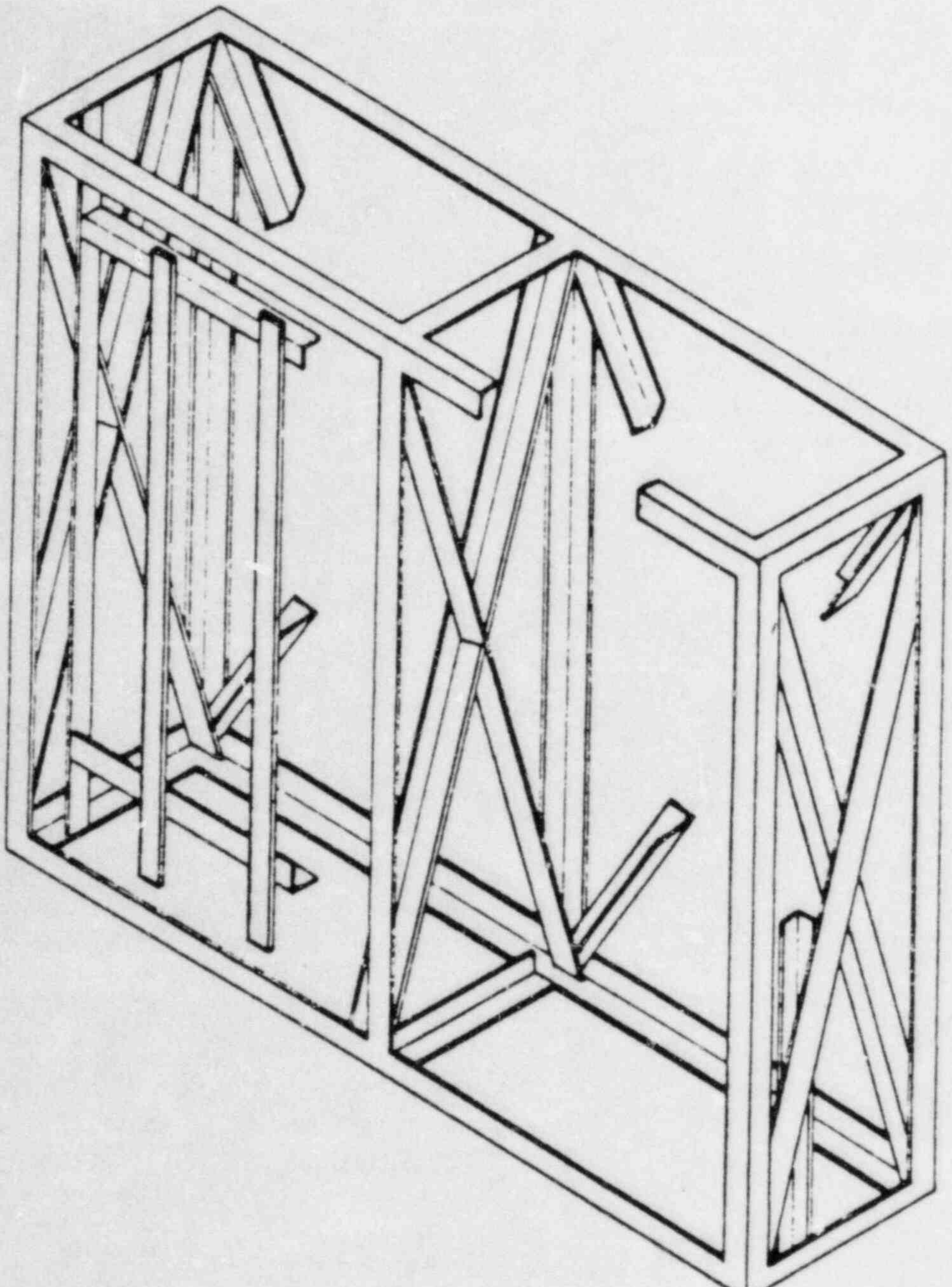


FIGURE 13

DC FUSE PANEL

mm6

BY MR. BECKER:

Q Finally, Mr. Singh, do you have in front of you a document that is six pages long, with a two-page attachment?

A (Witness Singh) Yes.

Q This document is headed Testimony of Anand K. Singh?

A Yes.

Q Did you prepare this testimony?

A Yes, I did.

Q Is it true and correct?

A Yes.

MR. BECKER: Your Honor, I move Mr. Singh's testimony be admitted into the record, be bound into the transcript as if read.

JUDGE SMITH: Are there objections?

MR. CASSEL: No objection.

MR. WILCOVE: No objection.

JUDGE SMITH: The testimony is received.

(Testimony of Anand K. Singh, and attachments, follows;)

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In The Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454-OL
	)	50-455-OL
(Byron Nuclear Power Station,	)	
Units 1 & 2)	)	

SUMMARY OF THE TESTIMONY OF
ANAND K. SINGH
ON CONTENTION 1

I. Anand K. Singh is the Assistant Head of the Structural Analytical Division of Sargent & Lundy.

II. Mr. Singh has applied principles of statistics and probability theory to the results of the engineering evaluations performed by Sargent & Lundy discussed in the testimony of Mr. Kostal. He concludes with a 95% confidence level that in the area of cable tray hanger connections, solid bottom tray stiffener welds and ladder tray weld connections, the work performed by System Control Corporation meets the original design basis with 99% reliability.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of)	
)	
COMMONWEALTH EDISON COMPANY)	Docket Nos. 50-454-OL
)	50-455-OL
(Byron Station, Units 1 and 2)	

TESTIMONY OF ANAND K. SINGH

Q.1. Please state your full name and place of employment for the record.

A.1. Anand K. Singh, Sargent & Lundy, 55 East Monroe Street, Chicago, Illinois.

Q.2. Please describe your job responsibilities.

A.2. I am Assistant Head of the Structural Analytical Division. In this capacity, I supervise and coordinate the work of the Stress and Probabilistic Analysis and the Dynamic Analysis Sections in preparation of analytical studies, special problem analyses, and computer program development.

Q.3. Please describe your educational background and work experience.

A.3. I have a Doctor in Philosophy and a Master of Science degree in Structural Engineering from the University of Illinois at Champaign-Urbana. These degrees were awarded in 1972 and 1970, respectively. I am a registered professional engineer and a registered structural engineer in the State of Illinois. I am a member of the American Society of Civil Engineers (ASCE), and a member of the Seismic Analysis Committee of the ASCE Nuclear Structures and Materials Committee, a member of the Working Group on the Seismic Analysis of Safety of Class Structures of the ASCE Nuclear Standards Committee and a member of the ASCE Committee on Turbine Foundations. I have published numerous technical papers in the area of probabilistic analysis, seismic analysis and dynamic analysis of structures and piping. A list of my publications is attached to my testimony.

I joined Sargent & Lundy in 1972 as a Senior Engineering Analyst. I was responsible for the development and maintenance of computer programs for seismic and dynamic analyses of structures and piping and for performing and/or reviewing seismic analyses of nuclear power plant structures. In 1975, I was promoted to the position of Supervisor of the Dynamic Analysis Section responsible for seismic and dynamic analysis of structures and the development of computer programs for dynamic and seismic analysis. In 1979, I was promoted to the position of Assistant Division Head. In that capacity, I supervise and coordinate the work of the Stress and Probabilistic analysis and the Dynamic Analysis Sections in preparation of analytical studies, special program analyses, and computer program development. In 1980, I was made an associate of Sargent & Lundy.

Q.4. What is the purpose of your testimony?

A.4. The purpose of my testimony is to apply principles of statistics and probability theory to the results of certain engineering evaluations performed by Sargent & Lundy discussed in the testimony of Mr. Kostal, specifically evaluations of discrepancies in cable tray hanger connections, solid bottom tray stiffener welds and ladder tray weld connections.

Q.5. Would you summarize the results of the engineering evaluations to which you are applying your statistical analysis?

A.5. Yes. The results of engineering evaluations performed by Sargent & Lundy demonstrated that none of the 106 Systems Control Corporation (SCC) cable tray hanger connection discrepancies analyzed out of 358 inspected had design significance. Similarly, the engineering evaluations demonstrated that none of the 227 solid bottom tray stiffener weld discrepancies analyzed out of 227 stiffeners inspected or the 199 ladder tray weld connection discrepancies analyzed out of 300 inspected had design significance.

Q.6. Applying a statistical analysis to these results, what conclusions do you reach with respect to the total population of work performed by SCC for these attributes.

A.6. From a statistical standpoint, I conclude with a 95% confidence level that the work performed by SCC for these attributes meets the original design basis with 99% reliability.

Q.7. Please explain the basis for your conclusions.

A.7. The reliability for a work attribute can be defined as the proportion of work items in the total population of work for that attribute which has no discrepancies with design significance. A generally accepted statistical method for calculating such reliabilities is to compute reliabilities at 95% confidence level from the sampled data. Such a reliability represents a conservative estimate of the true reliability. It is conservative in the sense that there is a 95% chance that the true reliability is greater than the estimate. In the case where no discrepant items are observed in a random sample from a large population, the reliability at 95% confidence level can be calculated from the formula

$$R = 1 - \frac{2.9955}{n}$$

where

R = Reliability at 95% confidence level,

n = number of inspections in the random sample.

For cable tray hanger connections, a sample of 358 was reinspected. All the observed discrepancies were evaluated for design significance. As stated in Answer 5, this evaluation showed that none of the observed discrepancies had any design significance. By applying the above formula, this sampling evaluation establishes with 95% confidence that greater than 99% of all SCC cable tray hanger connections in the plant meet the design requirements.

For solid bottom tray stiffeners, all welds on a sample of 227 stiffeners were reinspected. All the observed discrepancies in the sample were evaluated for design significance. As stated in Answer 5, this evaluation showed that none of the observed discrepancies had any design significance. By applying the above formula, this sampling evaluation establishes with 95% confidence that 98.7% of all SCC solid bottom tray stiffeners in the plant meet the design requirements.

For ladder type tray welding, a sample of 300 welds was reinspected. The observed weld discrepancies in the sample were evaluated for their design significance.

As stated in Answer 5, none of the observed discrepancies had any design significance. By applying the above formula, this sampling evaluation establishes with 95% confidence that more than 99% of all SCC ladder type tray weld connections meet the design requirements.

Publications

"A Stochastic Model for Predicting Seismic Response of Light Secondary Systems" (coauthor A. H. S. Ang), Proceedings of the Fifth World Conference on Earthquake Engineering, Rome, 1973

"Influence of Closely Spaced Modes in Response Spectrum Method of Analysis" (coauthors S. L. Chu and S. Singh), Proceedings, ASCE Specialty Conference on Structural Design of Nuclear Plant Facilities, Chicago, Illinois, December 1973

"Stochastic Prediction of Maximum Seismic Response of Light Secondary Systems" (coauthor A. H. S. Ang), Nuclear Engineering and Design 29, pp. 218-230, 1974

"Reliability Assessment of ASME Code Equations for Nuclear Components" (coauthor M. K. Ravindra), Reliability Engineering in Pressure Vessels and Piping, ASME, June 1975

"Seismic Response of Pipelines on Friction Supports," (coauthor J. C. Anderson), Journal of the Engineering Mechanics Division, ASCE, EM2, pp. 275-291, April 1976

"Inelastic Response of Nuclear Piping Subjected to Rupture Forces" (coauthor J. C. Anderson), Journal of Pressure Vessel Technology, ASME, pp. 98-104, May 1976

"A Probabilistic Model for Seismic Analysis of Nuclear Plant Structures" (coauthor S. Singh), Paper K3/3, 4th International Conference on Structural Mechanics in Reactor Technology, San Francisco, California, August 15-19, 1977

"Dynamic Analysis of Piping Systems Using Substructures" (coauthor V. Kumar), presented at the ASME Design Engineering Technical Conference, Chicago, Illinois, Preprint No. 77-DET-144, September 26-30, 1977

"Technical Bases for the Use of the Square Root of the Sum of Squares (SRSS) Method for Combining Dynamic Loads for Mark II Plants" (coauthors S. W. Tagart and C. V. Subramanian), General Electric Company Report NEDE 24010, July 1977

"Dynamic Analysis Using Modal Synthesis," Journal of the Power Division, ASCE, PO2, pp. 131-140, April 1978

"Response Analysis Using Dynamic Influence Coefficients" (coauthors T. P. Khatua, N. A. Holmes and S. L. Chu),

Publications, Continued

Proceedings of the 7th Conference on Electronic Computation, American Society of Civil Engineers, St. Louis, Missouri, August 1979

"Structural Building Response Review" (coauthors T. I. Hsu and T. P. Khatua), NUREG/CR 1423, Vol. II, U.S. Nuclear Regulatory Commission, Washington, D.C., May 1980

"Prevention and Control of Vibrations," (coauthor D. E. Olson), presented at the General Engineering Conference, Chicago, Illinois, March 1980

"Vibration in Power Plant Structures and Piping" (coauthor D. E. Olson), Proceedings of the American Power Conference, Chicago, Illinois, April 1980

"Soil Structure Interaction Using Substructures" (coauthors T. I. Hsu and N. A. Holmes), Proceedings of the ASCE Specialty Conference, Civil Engineering and Nuclear Power, Knoxville, Tennessee, September 1980

"Evaluation of Soil Structure Interaction Methods" (coauthors T. I. Hsu, T. P. Khatua and S. L. Chu), presented at the second ASCE Engineering Mechanics Division Specialty Conference on Dynamic Response of Structures, Atlanta, Georgia, January 1981

"Seismic Analysis - Changing Considerations," Proceedings of the American Power Conference, Chicago, Illinois, April 1981

"An Integrated and Interactive Piping Analysis and Design Information System" (coauthor C. A. Podczerwinski), Proceedings of the General Engineering Conference, Chicago, Illinois, March 1982

"Modeling Considerations for Pool Dynamic Analysis," (coauthor D. C. Gupta), paper to be presented at the International Workshop on Soil Structure Interaction: Practical Solutions for Static and Dynamic Loading, Durkee, India, October 10-14, 1983

"Use of Sampling in Nuclear Power Plant Applications," (coauthors M. Amin and P. Y. Wang), paper to be presented at the ASCE Speciality Conference on Probabilistic Mechanics and Structural Reliability, Berkeley, California, January 11-13, 1984

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MR. BECKER: Your Honor, before I tender the panel for cross-examination, if you would like, I can provide a very brief summary.

JUDGE SMITH: That has been a helpful procedure. I would appreciate it if you would continue doing it.

MR. BECKER: All right.

The panel is going to discuss the adequacy of component supply to Byron by Systems Control Corporation. As the direct testimony indicates, the components supplied by Systems Control to Byron included main control boards, DC fuse panels, local instrument racks, cable trays and cable hangers.

Mr. Maurer works for Westinghouse. He will testify to the evaluations performed by Westinghouse on the adequacies of the main control boards supplied to the site Systems Control Corporation.

Mr. Kostal, who is a partner at Sargent & Lundy, will testify to the evaluations performed by Sargent & Lundy on the remaining components supplied to the site by Systems Control Corporation.

I might note that in their [illegible]mony, both Mr. Maurer and Mr. Kostal conclud[illegible] their professional opinion, the components supplied by Systems Control to Byron are adequate for design use.

Mr. Singh's testimony deals with the statistical

mgc2-2

ramifications of the samples evaluated by Sargent & Lundy for the various systems control components that were evaluated by Sargent & Lundy.

And with that, Your Honor, I tender the panel for cross-examination.

End2MM

SYmgc3-1

CROSS-EXAMINATION

BY MR. CASSEL:

Q Good morning, Mr. Maurer, Mr. Singh and Mr. Kostal. Your analysis focused on one of the various pieces of equipment sent to Byron by Systems Control, namely the main control panels; is that correct?

A (Witness Maurer) It is a group of panels, yes.

Q Can you describe the function of the main control panels briefly?

A Basically, the main control panels house various controls and instruments necessary for operation of the plant.

Q Are they more or less the nerve center of the operation of the plant once it is under operation?

A That is where the plant is controlled, yes.

Q So that defects that interferred with the main control panels to function properly would have very serious safety significance, would they not?

A They may or may not.

Q If they interfere with the ability of the operators to control the plant, for example, in a situation where the emergency core cooling system or some other safety mechanism has to be operated, wouldn't that be a serious safety problem?

A This is getting somewhat out of my area, but there

mgc3-2

are many automatic systems that don't require operator action.

Q So you are not, then, really all that familiar with the safety consequences of particular failures in the main control panels?

A As opposed to concerning the various systems that are involved, electrical systems, no, sir.

Q Mr. Maurer, if I understand your testimony correctly, and I may not, because I do not share anything remotely approaching your expertise in this field, it seems that you did a three-step analysis.

I would like to describe each of those steps and ask you if that is basically an accurate lay understanding of what you did.

It seemed that you first did a detailed computer analysis using finite element modeling techniques to generate the seismic loads and stresses for each structural member of the main control panel; is that correct?

A That's correct.

Q Could you tell us, what is a finite element modeling technique which you used in this step? What does that mean?

A Basically, as relating to structures, which is what my testimony concerns, it involves dividing the structure into discrete members and characterizing those

mgc3-3

members mathematically in the computer for then determining the various loads and stresses in the members.

Q So the purpose of this step of your analysis was to determine the loads and stresses for each member?

A That's correct.

Q Was the second basic step you performed, then, to conduct a visual inspection of the structural welds on the main control panels at Byron?

A Yes.

Q And was the third basic step you undertook a calculation of whether specific welded connections would have sufficient strength to withstand seismic loads?

A We did not look at specific connections. We looked at what we called lower bound weld conditions.

Q Rephrasing the question, then, was the third basic step you took a calculation of whether lower bound weld connections, welded connections, would have sufficient strength to withstand seismic loads?

A Yes.

Q Now are those three steps which we just discussed, are those the three basic steps of your analysis? Have I left out any basic step?

A No. That's correct.

JUDGE COLE: Before we go any further, could you tell me what you mean by "lower bound weld connections"?

mgc3-4

WITNESS MAURER: When we looked at the welds in the control panels at Byron for purposes of our analysis, rather than defining the condition of the weld at each individual connection, of which there are many, we determined a lower bound weld condition with respect to the length of weld that exists at a joint, and also the size of the weld andbthe quality of the weld. And in that way, we could use this lower bound weld condition on each class of structural member in conjunction with the maximum loads which that member would see under a seismic event.

And by performing that calculation, we covered a series of connections, rather than looking at each connection individually.

JUDGE COLE: Okay. So by "lower bound," you mean that you took the weakest condition that you observed, or did you take the weakest five percent?

WITNESS MAURER: Actually, we took -- the condition which we used in our inspection, from a preliminary look at the welds, we determined that it looked like we could use a weld length on each member that was equal to the weld, as if the weld had been placed only on one side of the member -- that is, half of the weld that you could put all the way around.

Secondly, the weld size which we used in our lower bound weld condition was an eighth of an inch. Most

mgc3-5

of the welds which we saw were larger than that, but an eighth of an inch was the lowest that we saw. So the lower bound weld condition which we used, I feel is actually more conservative than any weld we saw in the main control panels.

JUDGE COLE: That's what you mean by "lower bound"?

WITNESS MAURER: Yes.

JUDGE COLE: Okay, thank you. Excuse me, Counsel.

MR. CASSEL: That was helpful. Thank you, Judge.

BY MR. CASSEL:

Q Now these three steps were taken in chronological sequence, were they not? That is, you first did the computer analysis using finite element modeling techniques.

You second did the visual weld inspection, and third, you calculated whether the lower bound welded connections would have sufficient strength to withstand seismic loads; is that correct?

A (Witness Maurer) That's basically correct. The second and third steps were somewhat intertwined, but basically that is correct, yes.

Q And of those steps, your bottom line engineering judgment on the adequacy of the control panels was based ultimately on your third step; is that correct?

mgc3-6

A Not entirely, no, sir. That involves only the welds. The results of the finite element analysis also yields the member stresses and loads, as opposed to the welds connecting those members, which is also taken into account in determining the adequacy of the control panels.

Q I take it, then, that after you completed Step 1, you were able to determine with respect to matters other than the welded connections whether the panels were adequate, and that Steps 2 and 3 were necessary to zero in on the welded connections; is that correct?

A That is correct.

Q And Step 3, which zeroed in on the welded connections, has used Steps 1 and 2, in part as inputs, in order to do the calculation in Step 3; is that correct?

A Yes.

Q So that Step 3 relied, in part, on the outputs of Steps 1 and 2?

A Yes.

Q Now is it correct that in your Step 1 analysis, which I will just for shorthand's sake refer to as the finite element analysis, you assumed that the welds in the main control panels were adequate?

A The construction of the finite element model includes the condition that the joints connecting the

mgc3-7

various members do, in fact, remain joined, yes.

Q So you did assume for your finite element analysis that the welds in the main panels were adequate?

A We did not focus on the welds in the main control panels at that point. It is simply a matter of modeling technique.

Q Well, for whatever reason, you have assumed that the welds in the main panel were adequate for that step in your analysis, correct?

A We had still not gotten to the adequacy of the welds. That is the third step.

Q I understand that. But for purposes of Step 1, did you assume that the welds were adequate?

A We assumed that the joints remained in a fixed condition.

Q Let me refer your attention to page 8 of your testimony, Mr. Maurer. I don't think we have any disagreement here, but I just want to be sure I am clear.

On page 8, lines 2 and 3, you state, and I quote: "The welds in the main control panels were assumed to be adequate for this portion of the analysis," end quote.

Now "this portion of the analysis" that is referred to there is the finite element model step that we've been discussing?

A Yes, sir.

mgc3-8

Q And this statement in lines 2 and 3 of page 8 of your testimony is accurate?

A Yes, I would say so.

Q And was the finite element analysis which you conducted done sometime in late 1982 or early 1983?

A It was done over a period of about two years.

Q A period of about two years?

A Yes, sir.

Q Beginning approximately when?

A Approximately September 1981.

Q Referring your attention to Answer No. 9 on pages 5 and 6 of your testimony, you refer in Answer 9 to an agreement in September 1981 between Edison and Westinghouse that the balance of plant sections could be evaluated as part of the main control board analysis, and then later in the answer you say, "In early 1982, Edison authorized Westinghouse to seismically qualify all control panels in the main control room."

Did your finite element analysis begin before that early 1982 authorization referred to in the answer?

A Yes, it did.

Q Now, Mr. Kostal, on page 13 of your testimony, you discuss a random sample of 358 connections on Systems Control Corporation cable tray hangers, that was analyzed by Sargent & Lundy in 1984; is that correct?

mgc3-9

A (Witness Kostal) That's correct.

Q And for the purposes of shorthand throughout the rest of this examination, gentlemen, I will just refer to Systems Control Corporation as SCC.

Is it correct, Mr. Kostal, that of those 358 connections , 106 had discrepant welds?

A That's correct.

Q And that that included two welds with missing portions?

A That's correct.

Q On page 18 of your testimony, Mr. Kostal, you refer to another sample taken in 1984 of certain -- of 100 highly-stressed cable tray hangers of a certain type; is that correct?

A What it refers to is, there are 100 connections out of a population of more highly-stressed connections relating to a detailed DV-162, if that's what you're referring to.

Q That's what I'm referring to. Is that 100 hangers or 100 connections?

A That's 100 connections.

Q Now out of that 100 connections, is it correct that 59 had weld discrepancies?

A 59 had various degrees of discrepancies, correct.

Q And out of those 59, 50 had discrepancies of well

mgc3-10

size?

A 59 had -- 50 had discrepancies of weld size in portions of the weld. Now you have to understand that the welds that we're looking at have -- there are four welds to each given connection, and across the periphery of these four given welds, there may be an isolated small length of the weld that is undersized, where the other portion of the weld in the same connection could be also oversized. So it's a matter of -- when I say there are 50 connections that are undersized, it is not 50 -- the connection only a portion of which is undersized.

End3SY

Q Turning to page 19 of your testimony, Answer 24, Mr. Kostal, you indicate that in 1977, 100 percent of the SCC hangers onsite at that time were inspected; is that correct?

A That's correct.

MR. BECKER: What page are you referring to?

MR. CASSEL: Page 19, Answer 24.

BY MR. CASSEL:

Q Do you know how many of those hangers were found to have discrepancies?

A (Witness Kostal) Approximately 20.

Q Approximately 20 hangers in that 1977 inspection had weld discrepancies?

A That's correct, in the Initial Inspection Report that we received in 1977.

Q Is that stated in your testimony somewhere Mr. Kostal?

A No, it isn't.

Q And that's 20 out of how many? Do you know?

A Well, you just said 694.

Q Is that 694 in your testimony?

A No. You made that comment.

Q Oh, you must have -- no, I didn't -- we must have a miscommunication here. I don't know how many hangers there were. I'm asking you how many hangers there were --

A Well, back up. You said 694 to start off the last question. You read that in your dispositioning of NCR-105. It's not in here.

Q I'm sorry. I said Answer 24 on page 19.

A Oh, I'm sorry, I misunderstood you.

Q That's okay. I'm going to go back to elocution classes. But now, correcting my elocution, do you know, with respect to answer 24 on page 19, how many hangers were inspected, and of that number, how many were found to have weld discrepancies?

A The initial inspection was approximately 690, of which there were reported approximately 20. The exact numbers I could pull out of the NRC.

Q But you recall those are the approximate numbers?

A That's correct.

Q On page 27 of your testimony, Mr. Kos``l, you referred to an inspection of 227 SCC cable trav stiffeners. For the record, a stiffener is a piece under the tray that basically reinforces the strength of the tray. Is that correct?

A It is a V-shaped piece of sheet metal under the tray which is used to provide additional rigidity to the tray when you're erecting it.

Q Is it correct that out of those 227 stiffeners that were inspected, 227 were found to have weld discrepancies?

A That's correct. Maybe I can clarify it. You know, in a typical stiffener there's about 10 welds. There's welds at the end of the stiffener and there are stitch welds between the stiffener. So when I reported 227, what it refers to is that there's a discrepancy in one of the 10 welds associated with a given stiffener.

Q It could be more than one of the welds associated with the stiffener?

A Could be.

Q So that 100 percent of the stiffeners had weld discrepancies ranging from 1 to some larger number.

A That's correct.

Q Do you know how many welds there were in that population of 227 stiffeners?

A Approximately 2000 plus.

Q And do you know how many of those welds were defective or discrepant?

A No, I don't know the exact count.

JUDGE COLE: Mr. Kostal, in describing the use of the cable tray stiffener, you indicated that its use was to provide rigidity when erecting it.

WITNESS KOSTAL: Well, it can be used in a number of ways. Initially, the industry has placed stiffeners on the bottom of trays like they do in other members made of sheet metal to provide more rigidity to the member when you're trying to maneuver it and install it into the plant.

We initially utilized that as one method of analysis of the cable trays. We can also eliminate it, as I've provided in the testimony, so it wasn't actually needed in terms of the method of supporting those.

JUDGE COLE: Yes, I recall that in your testimony, and I was just wondering if you used the term "used as an aid in stiffening during erection" -- you used that purposely, not to just --

WITNESS KOSTAL: Since the industry fabricates it that way from day one, I mean, it starts out as a component which is nothing more than a piece of sheet metal bent into a channel section, and they provide stiffeners underneath it. And there's a figure in here that would show you that.

JUDGE COLE: Yes, I saw those at the plant Saturday. But are you saying that the purpose of the cable tray stiffeners that we're talking about was for the purpose of stiffening during erection, or was the original main purpose of it to provide stiffening during the normal use of the cable tray?

WITNESS KOSTAL: Oh, it provides stiffening during the normal use of the cable tray, also.

JUDGE COLE: Okay.

JUDGE SMITH: Along that line, as Dr. Cole mentioned, we were at the plant on Saturday and were provided the set of figures attached to Mr. Kostal's testimony, and

Mr. Teutken who conducted the tour pointed out examples, I believe, of every one of the things depicted in your figures.

Intervenors were represented, as was the NRC Staff.

BY MR. CASSEL:

Q Mr. Kostal, on page 32 of your testimony in the bottom three lines, you discuss a random sample of 17 straight sections of ladder tray encompassing 300 weld connections. And then you characterize the type of discrepancies that were found.

Do you know how many of those welds were found to have discrepancies?

A (Witness Kostal) I don't have that number with me right here.

Q Of the 17 straight sections of ladder tray, do you know how many of those straight sections had welds with discrepancies?

A Well, the ladder tray -- if I could clarify, it's just what it says. It's a ladder. So it has approximately 10 rungs or 20 welds per ladder tray.

I'm not sure if every ladder tray had a discrepancy in it. Every ladder tray weld rung had a discrepancy, or didn't have a discrepancy.

MR. BECKER: Just to clarify the record, Mr. Singh's testimony does have the number in it.

JUDGE SMITH: You have no objection to these witnesses consulting for accurate answers, do you?

MR. CASSEL: No, I have no objection.

To save us some time, Mr. Becker, can you indicate where in Mr. Singh's testimony that answer appears?

MR. BECKER: It's between pages 1 and 6. Page 3.

BY MR. CASSEL:

Q Do you have Mr. Singh's testimony there, Mr. Kostel?

A (Witness Kostel) No, but he does.

Q Would you turn to page 3, Answer 5 of Mr. Singh's testimony.

A Yes.

Q Is that the same sample of 300 weld connections that you're discussing in your testimony on page 32?

A That's correct.

Q So that out of those 300 weld connections, 199 discrepancies were found?

A That's correct.

Q Thank you. Mr. Kostal, on page 33 of your testimony in the bottom paragraph you discuss a sample of 10 randomly-selected ladder tray fittings, and you indicate that the welded connections on the fittings were similar to those found on the ladder trays. Do you know how many welds were on those 10 ladder tray fittings?

A 226.

Q And of those, how many discrepancies were found?

MR. BECKER: I'm sorry, can I interject just a moment? 226 connections or welds?

WITNESS KOSTAL: 226 individual connections, compared to 300 individual connections on the straight section.

BY MR. CASSEL:

Q I see. So Mr. Becker was correct in clarifying that it wasn't 226 welds, as I mistakenly suggested, but 226 connections?

A (Witness Kostal) Well, a connection is a weld in this particular case.

Q In this case. I see. Do you know how many of those 226 were found to have discrepancies?

A It was 166.

Q 166 out of 226?

A That's correct.

Q On page 38 of your testimony, Answer 35, Mr. Kostal, you indicate that discrepant welds were found in 1980 on local instrument panels supplied by Systems Control. Do you know approximately how many welds were involved in that inspection?

A No, I don't.

Q Are you aware of the NRC Staff's position that more than 50 percent of the welds inspected in that were

SYmgc4-1

deficient?

A No, I wasn't.

Q Are you aware of this Board's finding from the initial decision that as many as 40 to 60 percent of the welds on SCC local instrument panels were found to be unacceptable at about that time?

A No, I wasn't aware of that.

Q Mr. Kostal, on page 42 of your testimony --

MR. WILCOVE: Excuse me, Mr. Cassel. What page?

MR. CASSEL: Page 42.

BY MR. CASSEL:

Q You discuss an inspection of 1455 welds on local instrument panels; is that correct?

A (Witness Kostal) That's correct.

Q And that inspection was done in 1984?

A That's correct.

Q Were you aware that in early 1980, Commonwealth Edison asked Pittsburgh Testing Laboratories to do a 100 percent reinspection of all SCC local instrument panels already at Byron by that time?

A I am aware they asked them. I'm not sure of the exact date.

Q But you are aware that sometime in that timeframe a 100 percent reinspection of all the local instrument panels from SCC up to that point in time were reinspected?

mgc4-2

A Yes.

Q And are you also aware that following the date, whatever it was, in approximately 1980, Edison asked PTL to do a 100 percent source inspection of all items in subsequent SCC shipments of local instrument panels to Byron; is that correct?

A I'm not aware of the exact wording. I am aware that they did subsequent inspection of work that came out of Systems Control.

Q Do you know whether all the Systems Control panels that were shipped to Byron after the 1980 timeframe were source inspected by PTL?

A I am not sure. It's probably contained in George Marcus' testimony, but I don't know the exact value.

Q Let me just refer your attention to Attachment A of Mr. Marcus' testimony and ask you to take a moment to look at the numbers he provides in the category entitled "Instrument Racks."

(Counsel handing document to witness.)

First of all, Mr. Kostal, instrument racks are the same thing as the local instrument panels that were referred to in your testimony?

A That's correct.

Q And does Mr. Marcus' testimony indicate in Attachment A that all items in local instrument panels

mgc4-3

shipped to Byron after 1980 were source inspected by PTL?

A That is what the Attachment indicates, yes.

Q So, then, of these 1455 welds that were inspected in 1984, all of them should have been the subject of either the 100 percent reinspection in about 1980 or the subsequent source inspection of all items shipped from SCC in this category, namely local instrument panels; is that correct?

A Yes, that's correct.

End4SY

mgcMM5-1

Q And even so, of the 1455 welds, 271 discrepancies were found; is that correct?

A Yes. The majority of which are cosmetic.

Q The majority of which are cosmetic, you said?

A Yes.

Q You indicate that these discrepancies included overlap, craters, undercut, arc strikes and underlength. Do you know how many of the discrepancies fell in each of those categories?

A I don't know the exact numbers, but I know -- no, I don't know the exact numbers.

Q On page 47 of your testimony, you discuss an inspection in 1981 of certain DC fuse panels supplied by SCC; is that correct?

A Yes -- would you repeat the question?

Q Is it correct that with respect to these DC fuse panels inspected in 1981, that out of 2170 welds, 986 discrepancies were found?

A That's correct.

Q And that's not even counting some missing welds that were on those fuse panels?

A That's correct.

Q Do you know how many missing welds or how many welds were missing?

A I don't know the exact number. There were a

mgc5-2

few stitchwelds in a crossbrace within the panel, which is indicated in Figure 13 were missing.

Q Mr. Maurer, at the time that you conducted Step 1 of your analysis, which I am referring to for shorthand as the finite element analysis -- is that a good shorthand for it?

A Yes.

Q At the time you conducted your finite element analysis for Step 1 of your three steps, and you assumed that the welds in the control panels supplied by SCC were adequate, were you aware of any of the problems with SCC welds which Mr. Kostal and I have just been discussing?

A I was aware there were problems, yes.

Q In light of this history of problems with the SCC welds at Byron, do you believe that it is reasonable for purposes of your finite element analysis to assume that the welds in the main control panels are adequate?

A Yes.

Q Why do you believe that?

A Because in the method of conducting the finite element analysis, it is in that way that you determine the loads at the connections in order to evaluate the welds, the specific welds at those connections. It is simply an assumption of fixity at the various joints in the model.

Q Would the outcome of your finite element analysis

mgc5-3

be affected in any way if that assumption were incorrect? The assumption being that the welds are adequate.

A That depends on the results of the analysis of the weld, specifically.

Q Let me try that again. Your Step 1, the finite element analysis, as I understand it, made an assumption, and that assumption was that the welds were adequate.

Was that assumption an input into the finite element analysis step of your three-step process?

A Yes.

Q So it played a function in the analysis. You couldn't have just failed to make any assumption or have any input on the quality of the welds.

A That's true.

Q And the assumption that you made was that the welds were adequate.

My question is, if that assumption were incorrect, are you saying that the inaccuracy of that assumption would not have in any way affected the outcome of your finite element analysis?

A If the third step of our evaluation had shown that the adequacy of those welds -- that those welds were not adequate, then furter work would have been required, yes.

Q Let's not pass yet to the third step of your analysis.

mgc5-4

I take it, then -- at least it seems to be the implication of your last answer, is that the answer is yes, that if your assumption were inaccurate, that that would affect the outcome of your finite element analysis, Step 1 of your three steps.

Am I correct in so inferring?

MR. BECKER: Excuse me, Your Honor. I think the question was asked and answered responsively, and I don't think it's appropriate for Mr. Cassel to ask the same question again, hoping for a different answer.

MR. CASSEL: I'm not hoping for a different answer. I think the answer I got, if I understand it, was yes, that changing the assumption would affect the outcome.

WITNESS MAURER: We have no reason --

JUDGE SMITH: When there's an objection, you should wait until it's been resolved. My memory is, he's asked a distinctly different question. He said, "Let's not proceed to the third element yet."

But then you seemed to have backed up, and you are trying to get an agreement with this witness as to what he meant by his previous answer.

MR. CASSEL: That's right. As I recall it, I had asked him to focus on the first step of the analysis, the finite element analysis. And the question is whether the assumption made in that step of the analysis --

mgc5-5

JUDGE SMITH: The first step?

MR. CASSEL: The first step. If it turns out to be inaccurate, it would have affected the outcome of that first step. And I thought, somewhat indirectly, he wasn't intending to be evasive, but he was giving a full explanation, and I thought his full explanation added up to a yes answer, if I heard him correctly.

MR. BECKER: I think the full explanation ought to stand as is, because I'm not sure the answer -- that is, Mr. Cassel's questioning is trying to place the answers into a first step, second step, third step framework.

Perhaps an appropriate question before seeing if Mr. Maurer could say yes or no or whatever, is to ask Mr. Maurer if, in fact, a one-two-three framework is necessarily the appropriate analytical way in which to view the issue, if we're going to have a clear record.

JUDGE SMITH: Well, he's cross-examining. He has great latitude how he elects to approach it. He might appreciate your advice on it, but it's his judgment to make.

So we will overrule.

BY MR. CASSEL:

Q Do you recall the question, Mr. Maurer?

A (Witness Maurer) Would you please restate it?

Q Yes. What I intended to ask you before, and I think I did, was whether chaning the assumption in Step 1

mgc5-3

of your analysis, that assumption being that the welds were adequate, would affect the outcome of Step 1 of your analysis?

You gave an explanation which I thought was consistent with a yes answer. Is the answer yes?

A If I were to vary the input to the analysis, yes, it would change the results.

Q And one of the inputs was the assumption that the welds were adequate?

A That was one input, yes.

Q Now picking up a cue from your lawyer here, I want to ask a question or two about the relationship of the three steps which we discussed back at the beginning of your testimony.

If I understood you correctly, and I may not have, you were saying that Step 1, the finite element analysis, was both an input to Step 3, which focused on the welded connections, but also if I heard you correctly, it produced some outputs which were independent of Step 3 in the three-step analysis.

Is that correct, and if it isn't, could you explain?

A Yes, that is correct.

Q And what were the outputs produced by Step 1 that were independent of the subsequent Step 3?

mgc5-7

A One output would be the stresses in the various members of the control panels. Also the frequency response of the control panels as a unit.

Q You use the stress output later on in Step 3 in order to determine the strength of the welded connections, did you not?

A Specifically it's the loads that were used, not the stresses.

Q I see. Did you use the stress output in Step 2 or 3 at all?

A No. But let me clarify. The stress output was utilized in Step 2 in determining those areas which require -- which in our view required a higher level of scrutiny of the welds in the inspection.

Q I see. Did you use the stress output of Step 1 for any other purpose?

A No, sir.

Q So the only purpose of the stress -- of obtaining the stress output in Step 1 was to enable you to zero in in Step 2 on which welded connections you wanted to examine visually?

A It's not the only reason, no.

Q What other reason was there?

A To determine the adequacy of those members themselves.

END5MM

T6MM/mm

Q The frequency response you mentioned as another output of step 1, that, too, was an input for step 3, was it not?

A No.

Q It was not necessary to do step 3?

A No.

Q But it was necessary to reach your bottom-line conclusion on the structural adequacy of the main control panel?

A It is not directly necessary for the structural adequacy of panels, no.

Q Was it necessary then for anything in your analysis?

A It is directed towards the adequacy of the equipment mounted on the panel.

Q And part of your analysis was then, that the equipment mounted on the panels was also adequate to withstand seismic stress?

A Yes.

Q Were there any other independent outputs from step 1 that were not merely inputs to step 3, besides stress and frequency response?

A No, I don't believe so.

Q Turning back to the earlier question about whether the assumption regarding the welds would have affected the

mm2

output of step 1, would a change in that assumption regarding the adequacy of the welds have affected the output of step 1 with respect to the stress on the members?

A It may have.

Q And would a change in that assumption on the adequacy of the welds have affected the frequency response outcome in step 1?

A It may have.

Q In step 2 of your analysis, which is the visual welds inspections,that is discussed, is it not, in pages 8 and 9 of your testimony?

A Yes, it is.

Q Now, in answer 13 on page 8 of your testimony, you indicate that the visual weld inspection which you and a certified Level II welding engineer employed by Westinghouse undertook, was a visual inspection, correct?

A Yes.

Q You did not use any nonvisual means to test the adequacy of these welds?

A No.

Q You also state in the next sentence that paint was not removed from the welds.

Were many of these welds painted?

A Yes, they were all painted.

Q This may be outside the area of your expertise, m3

Mr. Maurer, I don't know. Perhaps you relied on the Level II welding engineer who was with you.

Do you know whether a number of the common defects in welds can be obscured or altogether hidden by a coating of paint over top?

A It was the opinion of the inspector who accompanied me that significant discrepancies in the welds would be visible even though the welds were in the painted condition.

Q And do you know what he meant by "significant discrepancies"?

A Bit enough to affect the integrity of the weld.

Q Again this may be outside your area of expertise.

Do you know whether any crack in a weld, however small, is presumed to affect the integrity of the weld?

A I am not sure I understand your question.

Q Again it may be something that you are not the appropriate witness to answer. I don't know. It is really a welding question.

Do you know whether any crack in a weld, however small it may be, may affect the integrity of a weld?

A Because of the materials that we used in the welds, and the base metal for these control panels, which is a very ductile material, it is unlikely that even if a small crack were to exist, it is unlikely that that crack would propagate such that the entire weld would be rendered not

mm4

useful.

Q It is unlikely, but it is possible?

A Yes.

Q Isn't it also possible that paint could have obscured from visual view, a small crack in a weld?

A A small crack, yes.

Q You also state that all accessible welds were inspected.

Do you know approximately what proportion of the welds on the main control panels were not accessible?

A That is stated in my testimony. Approximately 90 percent of those welds in structures of importance, members of importance. Approximately 70 percent of the rest.

MR. BECKER: Are accessible or inaccessible?

WITNESS MAURER: Were accessible.

BY MR. CASSEL:

Q And again when you say here 90 percent of the welds in the most important areas, you determined which areas were most important based in part on the stress output of step 1, is that correct?

A (Witness Maurer) That's correct.

Q Do you know how many welds of what you refer to here as the primary structural welds, of which 90 percent were accessible, do you know how many of those welds were not accessible?

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A The actual number?

Q Approximately, yes.

A No, I don't.

Q In answer 14 of your testimony, Mr. Maurer, with respect to the visual weld inspection, you state in your first point that:

"Overall, the welds were evenly spaced and consistent in length and size."

Does that mean that some of the welds were not consistent in length and size?

A Yes.

Q You state in point four that:

"No significant porosity was observed."

Isn't porosity something which could also be covered up by paint?

A If very small, yes.

Q You also state that:

"No significant undercut was observed."

Isn't undercut something which also could be covered up by paint?

A It is unlikely that significant undercut would be, no.

Q Well, it could be a pretty deep undercut, but not very wide and the paint might cover it on the surface so that you couldn't see a deep undercut, is that correct?

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A It was the opinion of the inspector who accompanied me, that we would see that if it existed.

Q Now further on down in your answer to 14, you say:

"Several welds were added to the unit 2 main control board."

Were those welds supposed to have been there in the first place and you had to put them in, or these were beyond the welds that had been designed into the panels?

A I don't know that those welds were supposed to be there, since we did not have the original design information of welds that were supposed to be there. They were added for consistency with similar members in the unit 1 panel.

end T6

start T7

Q On the bottom of page 9, answer 14, you state that:

"The main control board for unit 1 did have sufficient weld length for all structural members that were inspected."

Were there any structural members that were not inspected?

A There were welds that were inaccessible, yes, as stated previously.

Q I see.

So that is what you meant when you said, "for all structural members that were inspected." YOu were

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referring to the members specifically with respect to the accessible welds?

A Yes.

Q Now, in your three-step analysis, Mr. Maurer, would the dimensions of the control panel, the size of the thing--how high it is, wide and so forth -- would that be an input to any of your three steps?

A Yes.

Q Which of the steps would it be an input to?

A The finite element modeling.

Q Would it also be an input to the third step, or only to the first step?

A It would be an input to the third step insofar as the size of the particular members is concerned. Yes.

Q Are you aware of any problems that SCC has had at Byron, in addition to weld adequacy, that relate instead to accuracy of the dimensions of pieces of equipment supplied?

A No, I am not.

Q Did you measure the main control panels with a gauge or anything to verify that the dimensions were what they were supposed to be?

A We measured general dimensions, yes.

Q Did you measure the general dimensions of all the structural members on the panels?

mm8

A We measured representative structural members. We didn't measure every one.

Q So you measured a sample?

A Yes.

Q Now, if the dimensions which you used as an input to step 1 turned out to be the as-built dimensions, would that deviation affect the output from step 1?

MR. BECKER: Excuse me, before Mr. Maurer answers, I would like to ask for a representation if we are going to have some evidence, some direct evidence pertaining to the dimensions of the main control board.

MR. CASSEL: I have a representation which I will specify in a moment, as soon as I find it, Judge. It is in here somewhere. It is not that specific.

(Pause)

BY MR. CASSEL:

Q You may not have seen this report, Mr. Maurer, I am looking at now, and I will be happy to show you in a moment. But perhaps you know about it. It is the NRC Staff Report No. 84-32 dated July 30th, 1984. It is the one which the NRC counsel distributed to the Parties a couple of days ago on the results of the inspection by Messers. Hayes and Connaughton of the various SCC equipment at Byron.

Have you seen that document at all?

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A (Witness Maurer) No.

Q I apologize. The only copy I have has some markings on it.

MR. WILCOVE: I have a clean copy.

MR. CASSEL: Thank you very much.

(Document handed to Counsel Cassel.)

MR. CASSEL: For the record, I am going to show the witness here a copy of NRC Staff Inspection 84-32. That's the report number, rather, which is the one I described on the record a moment ago.

BY MR. CASSEL:

Q Let me ask you, Mr. Maurer, to examine page 3 of this report and take a moment to read the top paragraph.

(Document handed to witness.)

MR. BECKER: I assume you have no objection if Mr. Maurer reads the bottom of page 2 as well and whatever else is on there.

MR. CASSEL: Oh, take as much time as you like. Sure.

JUDGE SMITH: What was your page reference? It's page 3 of the actual report? There are various coverletters that come before it.

BY MR. CASSEL:

Q Now at the time you did Step 1 of your analysis, Mr. Maurer, were you aware that at least in the view of the

mgc7-2

NRC Staff, SCC's quality assurance deficiencies at Byron have included repeated instances of nonconformance in the areas of weld quality, dimensional accuracy, protective coatings and general workmanship?

A (Witness Maurer) I was not aware of that.

MR. CASSEL: I'm not sure if we got the previous -- did your objection get resolved by my showing him this document?

MR. BECKER: No.

MR. CASSEL: I think we have an objection pending, Judge. I think I had asked Mr. Maurer, if I'm not mistaken, whether a change in the dimensions would have affected the output of Step 1, and I think we are now at Mr. Becker's objection to that question.

MR. BECKER: If I may make a statement, Judge Smith, as is evident from the content of the I&E report that was just shown to Mr. Maurer, there is no specific reference to which components had which particular types of problems identified by the Staff with regard to dimensional accuracy. There is no statement there that has anything to do with main control boards, for example.

So it is our contention that the question to Mr. Maurer is not a proper one, unless Mr. Cassel can represent to the Board that he will be able to connect up, after this cross at some point connect up the fact that

mgc7-3

there were dimensional problems on the main control boards.

MR. CASSEL: Judge, that is a question of, at most, weight and not relevance.

JUDGE SMITH: I think you're probably right. But the answer is going to be -- have very little probitive value, because if this is the only information we have, I don't know what we can do with his answer.

MR. CASSEL: Well, his answer alone to this question may take you a short tippy-toe down the road. But Intervenors have yet to present their direct evidence, and we may very well be tying that direct evidence into even limited points like this on cross.

The burden in this proceeding, as I understand it, is on Edison to show that the plant is safe.

JUDGE SMITH: That doesn't resolve an issue like this. I'm agreeing with you that the answer should be allowed, but I'm also pointing out that there isn't much you can do with the answer.

MR. CASSEL: If that's all I've got on this point, Judge, I'm not going to get very far. But at least it points me down the road.

MR. WILCOVE: Mr. Chairman, a motion to strike can be made a later time if the premise of the question is not established, and that's something that can be done if necessary.

mgc7-4

JUDGE SMITH: Yes. I would think it should be avoided. We should try to resolve it now. But nevertheless, we will permit the answer.

MR. CASSEL: Thank you, Judge.

BY MR. CASSEL:

Q Mr. Maurer, do you recall the question?

JUDGE SMITH: Wait a minute.

MR. MILLER: Judge Smith, the author of this I&E report is present in the hearing room.

JUDGE SMITH: That's a good point.

MR. MILLER: And perhaps could state right now at this point in the record what this meant.

JUDGE SMITH: That's a good observation.

MR. CASSEL: I'd have no objection to that, Judge.

JUDGE SMITH: Mr. Hayes.

MR. MILLER: Mr. Hayes and Mr. Connaughton?

MR. CASSEL: This is the first time we've grabbed some poor fellow right out of the audience.

JUDGE SMITH: Second time.

MR. CONNAUGHTON: The instances you are referring to having to do with dimensionality apply to cable pans. Cable pans are essentially fabricated out of one piece of sheetmetal where it's bent in two places and have been found, from time to time, to be out of square. In no instances did we identify that main control boards or local instrument panels

mgc7-5

were subject to dimensional tolerance problems.

MR. CASSEL: I'll withdraw the pending question to Mr. Maurer on that issue, Judge.

Now that we have the author here on the same issue, rather than me make another question which would be objected to, may I ask Mr.Connaughton what the repeated instances of nonconformance in general workmanship referred to?

MR. CONNAUGHTON: That's kind of a catchall term, which does include things such as dimensionality, handling of the things to make sure that they aren't bent and scratched, that identification numbers are put on straight. Nothing of particular significance.

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MR. CASSEL: By "nothing of particular significance," you mean it didn't refer to any specific thing?

MR. CONNAUGHTON: That's correct.

BY MR. CASSEL:

Q Mr. Kostal, -- excuse me a moment, I have to find the right page here --

(Pause.)

JUDGE SMITH: Well, let's take a ten-minute midmorning break.

(Recess.)

JUDGE SMITH: You may proceed, Mr. Cassel.

MR. CASSEL: Thank you, Judge.

BY MR. CASSEL:

Q Mr. Maurer, there are -- are there seven main control panels at Byron?

A (Witness Maurer) Seven? There are more than that in the main control room.

Q I see. Let me refer you to page 4 of your testimony, Answer 8, you state in the third sentence of Answer 8 that, "The main control board consists of seven separate sections in a U-shaped assembly."

Does that mean that there is a U-shaped assembly with seven sections in the main control room for both units, or is there a separate control room for each unit?

mgc8-2

A The seven sections refer to the main control board for each unit.

Q So there would be fourteen altogether?

A Plus additional panels in the main control room, not part of the U-shaped configuration.

Q I see. And you also indicate in Answer 8 that of the seven main panels, four were designed by Westinghouse and fabricated by Reliance, and three were designed and fabricated by SCC; is that right?

A That's correct.

Q Now your three-step analysis that we were discussing before the break analyzed -- let me backtrack.

Did your three-step analysis that we were discussing before the break analyze the structural adequacy of the entire U-shaped configuration of all seven panels?

A Yes.

Q Did you do a separate analysis for the three panels supplied by SCC?

A Separate in what way?

Q Analyzing the adequacy of the three panels supplied by SCC as opposed to the four panels supplied by Westinghouse or designed by Westinghouse.

A They were treated the same. The analysis focused on all seven panels as a unit, not singling out any particular panel.

mgc8-3

Q Is it possible, then, that SCC panels which might have had less structural integrity were mixed together in your analysis with Westinghouse panels that had greater structural integrity, resulting in a cumulative number for all seven without showing the relative difference between the SCC panels and the Westinghouse panels?

MR. BECKER: Objection, Your Honor. The question lacks foundation. There's been no testimony and there is nothing in the record to indicate that the Systems Control panels lack structural integrity at all.

(The Board confers.)

JUDGE SMITH: What is your response to the objection?

MR. CASSEL: Well, there has been fairly extensive testimony from this witness about some problems with the welded connections on the control panels. There is also a lot of testimony in the record about SCC's problems with welding.

I do not have a complete record of the adequacy of welded connections in the Reliance/Westinghouse panels, but I think we have enough in the record to show that there's an SCC problem on the SCC side of the fence, such that we should be able to witness this question.

It may well be that they were perfectly adequate welded connections on the Westinghouse/Reliance panels that

mgc8-4

were superior to the welded connections on the SCC panels.

MR. BECKER: Judge Smith, the distinction to be drawn, of course -- and it's a distinction drawn in all of the testimony of the panel members -- is between weld discrepancies and structural integrity. The conclusion of each of the witnesses on the various components that they discuss is that they found no design-significant problems, and that's a whole different animal than the weld discrepancies that are discussed by all of them. And I think that this distinction ought to be recognized in the questioning.

JUDGE SMITH: Yes, I think that the difficulty with your question is that you are asking us to go from the specifics of the testimony and the cross-examination and everything and leap over their conclusions and draw our own conclusions, that you have established inferiority of the panels fabricated by SCC. And I don't know that we can do that.

MR. CASSEL: I didn't mean to leap quite that far, Judge, but let me backtrack with a couple of foundation-laying questions here.

BY MR. CASSEL:

Q How many of the seven panels did you examine with your visual weld inspection, Mr. Maurer?

A (Witness Maurer) I personally examined the three

mgc8-5

SCC panels. All seven were examined.

Q You personally only examined the three SCC panels and not the Westinghouse panels?

A As part of our weld inspection, yes.

Q And the same was true of the Level II welding engineer who accompanied you -- that is, he only examined the SCC panels?

A No. He examined all seven.

Q Do you know whether his examination of all seven indicated any disparity in the quality of the welded connections on the SCC panels, as opposed to the Westinghouse panels?

A In general, I would say that he found no significant disparity between the two sets of panels, no.

Q You qualified that statement in two ways. You said "in general" and "significant."

Did he find any disparities between the SCC panels and the Westinghouse panels with regard to the quality of their welded connections?

A I don't know. I can't speak to the specifics of his inspection.

JUDGE COLE: What do you know of his inspection, sir?

WITNESS MAURER: I know that he performed it, and I know the general results that he found no significant

mgc8-6

discrepancies in the welds, that the welds were sound and that they were properly fabricated.

JUDGE COLE: Did he tell you this?

WITNESS MAURER: Yes.

JUDGE SMITH: Your conclusion that the panels fabricated by Reliance Electric Company does not depend, then, does it -- I mean your conclusion that the panels fabricated by Reliance Electric Company were adequate does not depend upon any averaging in your calculations with Westinghouse panels?

WITNESS MAURER: No, sir.

MR. CASSEL: Judge, the Reliance and Westinghouse were the same.

JUDGE SMITH: I beg your pardon?

MR. CASSEL: The Reliance --

JUDGE SMITH: Oh, excuse me. I put Reliance in there when I meant to say SCC. Disregard the question. It's unnecessary.

(Pause.)

BY MR. CASSEL:

Q Is the nature of the analysis in Step 3 of your analysis such that you do not have any separate statements regarding the design margin -- not the design margin -- the as-built margin for seven panels idividually? You only have a single statement concerning the adequacy

mgc8-7

of the strength of all seven together?

A (Witness Maurer) That's correct, yes.

Q And that composite statement for all seven together -- in making that, did you assume the same strength of weld connection for all seven panels, or did you assume different strengths for different panels?

A Let me clarify. The finite element model that we built, which included all seven panels, the four Westinghouse panels and the three SCC panels, modeled the control board configuration in their as-built condition in the control room, which is contrary to what you may be alluding to as a much more realistic situation than if I had looked at panels separately. That is, since they are in actuality connected together, the interaction between panels is included in the analysis.

As far as looking at individual weldments, welded connections, there is no broad assumption of weld condition. We looked at all the welds to determine what the as-built condition was and then used that condition in our analysis, and we showed that it was acceptable with considerable margin.

Q I think you have just discussed Step 1 -- namely, the finite elements part of the analysis.

I was really directing my question to Step 3 of your analysis, which is discussed in Answer 15 on page 10.

mgc8-8

And maybe if you could turn to Answer 15, we could zero in on this.

A What was the page?

Q It's page 10, Answer 15 of your testimony.

You indicate that using -- in the first clause there, minimum values indicated by your visual weld inspection, and then secondly, using the maximum loads as determined by the finite element analysis -- in other words, using Step 2 and using Step 1, I then -- and now we turn to Step 3 -- "calculated whether specific welded connections would have sufficient strength."

Did you have different calculations in this Step 3 for the welds on different panels, or was there a single calculation that applied to every weld on every panel?

A There were a number of calculations, depending on the weld configuration, and they covered not only SCC panels, but also Westinghouse panels.

Q So you would have calculations in Step 3, then, for each panel separately as an input to your composite on all seven together; is that correct?

A Not necessarily. It was not done on a panel-by-panel basis, but rather on a structural member basis.

Q I see.

JUDGE SMITH: Because of the interaction of the

mgc8-9

panels?

WITNESS MAURER: Because of that and because there were many -- most of the structural members are common to more than one of the panels. And we, for a given structural member, say for a channel, we used the lower bound weld condition for any channel that we saw, and also the highest loading for any channel that we saw, irrespective of what panel that occurred in.

MR. CASSEL: I was about to turn to another line of questioning, but if the Judges have any questions on that point, I will pause.

BY MR. CASSEL:

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Q Mr. Kostal, on page 13 of your testimony where you discuss the sample of 358 connections, and you say they were taken from 80 hangers out of a population of 5717 hangers, do you know what the population of welds was on those 5717 hangers?

A (Witness Kostal) I don't know the exact population of welds, no. You've got to go back to page 12.

Q On page 12 is where it indicates that you took 80 out of 5717 hangers, and on page 13, you indicate 358 connections.

Would the proportion be approximately the same?

A What proportion?

Q That is the proportion of welds out of the total

mgc8-10

population of welds on these hangers. Would that be roughly the same as the proportion of 80 to 5717?

MR. BECKER: You are asking about welds, not connections?

MR. CASSEL: Good point. I'm sorry. The 358 connections, would the proportion of that to the total number of connections be approximately the same as the proportion of your hanger sample to total number of hangers?

WITNESS KOSTAL: You've got to give me a second. I've got to figure it out.

(Pause.)

No. Actually we have more connections for the total population than hangers for the total population.

BY MR. CASSEL:

Q What is the total population of the connections?

A (Witness Kostal) Approximately 35,000. So that is a ratio of roughly one percent.

MR. WILCOVE: Mr. Kostal, could I ask you to speak up a little bit, please?

WITNESS KOSTAL: I'm sorry. There's approximately 35,000 connections in a population of 5717 hangers.

End8SY

BY MR. CASSEL:

Q On page 27 of your testimony, where you discuss the 227 stiffeners, cable tray stiffeners which was the sample that was inspected, do you know what the population was from which that sample was taken? Of total cable tray stiffeners? I couldn't find it in your testimony.

A (Witness Kostal) It isn't included. No, I really don't know the exact amount.

Q Do you know the approximate range?

A Let me check my notes.

(Pause.)

No, I don't have that data. You have have to understand, at the time this population was taken we didn't even know at that time what the total population was that was erected in the plant.

Q Ah.

A We were halfway through the fabrication and erection cycle, so I would just be guessing. I don't know.

Q And these 227 stiffeners were taken from 123 cable tray and cable tray fitting sections; is that correct?

A Yes, that's correct.

Q And you also don't know what the population from which that 123 was taken was?

A It's one and the same.

Q The number would be different.

A No, the number would not be different. The number would be exactly the same, which I don't know. It came from the same population.

Q The same population, but the number of cable tray and cable tray fitting sections in the population would be different from the number of stiffeners in the population, which would be larger; correct?

A That's correct.

Q On page 32 of your testimony where you discuss the 17 straight sections of ladder tray that were sampled, do you know what the population was from which that sample was taken?

A It's about 150.

Q And those 17 had about -- well, it says here -- 300 welded connections. Do you know what the population of connections was for those -- from which those 300 were taken?

A They were taken right off of these pans.

Q I understand that, but do you know how many weld connections the 150 straight sections in the population had, approximately?

A Just one second.

(Pause.)

I would say somewhere between 2000 and 2500.

Q And that's based on multiplying an estimate of the number of connections per straight section times the approximate number of straight sections?

A Well, with a little adjustment, because all straight sections do not have 20 welds per straight section. Some are a little shorter, so therefore, we would probably have less than that maximum number,which would have been somewhere around 3000.

Q And on page 33, you discuss the sample of ladder tray fittings, and indicate that 10 fittings was approximately 20 percent of the total fittings

A That's correct.

Q You also told us earlier, I believe,that there were 226 welds on those 10 fittings.

A No, I didn't.

Q I'm sorry, my notes must be incorrect. 226 --

A Oh, I'm sorry, wait. You are correct.

Q All right. If there were approximately 50 total fittings, would one obtain the number of welds by simply multiplying 226 by 5 to get an approximate number?

A About 1000, compared to the sample of 226, or 20 percent.

Q On page 42 where you discuss the inpsection in 1984 of 1400 -- well, let's stop before we get to the 1400. You're discussing there the inspection of welds on certain selected local instrument panels. Do you know what the population of local instrument panels supplied by SCC at

Byron was at that time?

A 76. This is present.

Q I'm sorry, I missed that, then. When you say present you mean today?

A That's only in the plant at the moment. That's the full complement.

Q And do you know what the approximate population of welds on those 76 panels would be?

A No.

Q Would it be approximately proportionate to the ratio between the number of panels examined in the sample, and the number of welds on those panels that were examined?

A No.

Q The number of welds per panel might vary considerably?

A Well, your question said -- we only inspected on some of the panels 10 welds, and on four panels we inspected all. So therefore, it is not a ratio.

Q Oh, I see.

A You could calculate the ratio if you took out the 10 times 13 and subtracted it, and then multiplied that out.

Q To do that, though, you would have to refer to your notes. The numbers to do that are not in the answer here, are they?

A Oh, they're in the answer. You could work it out if you wanted to.

Q Isn't it also the case, Mr. Kostal, that there were large variations in the proportion of discrepancies in SCC-supplied equipment at Byron depending on the particular shipment involved and the particular type of equipment?

A I don't know that answer.

Q Well, for example, is it possible to compare two different samples of cable tray stiffeners which are in your testimony and which I will ask you to take a look at. The first one is the one on page 27.

Now, that one has, if I'm not mistaken -- it was found that out of 227 stiffeners, all of them had one or more defective welds. In seeming contrast -- and this is really the question of whether this is a comparison that can be made -- on page 29 there appears to be another sample of stiffener welds, and this happened to be taken from -- this is Answer 30 on page 29. This happens to be taken from the stiffener welds on 99 cable tray fittings in the sample.

And the fourth line up from the bottom states, "No discrepancies were found in those stiffener welds." Is it fair, then, to say, looking at these two samples, that in one case we had all of 227 stiffeners that had some weld discrepancies, and in another case none of them did?

MR. BECKER: Excuse me. The question is, is it fair to say that. The testimony says that.

MR. CASSEL: No. I want to find out if these two samples are comparable. Are we talking about the same thing.

MR. BECKER: Wait a minute. Before you answer--

JUDGE SMITH: The question about which Mr. Becker commented has been withdrawn. He is correct. The testimony does say that.

MR. CASSEL: I didn't state it as artfully as I should have. I'm merely trying to ask whether we're talking about apples and oranges here, or apples and apples.

In other words, they seem to be stiffeners. They just happen to be two different samples of stiffeners. And in one case, you had all of them discrepant and in another case, none of them discrepant. And I'm asking the witness whether that's a comparison -- whether these two things are comparable.

MR. BECKER: I just want to ask, can Mr. Cassel make the question a little more specific in terms of comparability. It strikes me the question is vague, just saying are the two shipments comparable. In what particular regard?

MR. CASSEL: Well, I'm going back to the early question which the witness said he didn't know the answer to, which was: isn't it the case that there are large variations in the proportion of discrepancies in the equipment supplied by SCC. This appears to be the case of a very large discrepancy, and I'm simply asking the witness whether he sees anything to indicate that these are not comparable situations.

JUDGE SMITH: In that you would not expect one shipment to have none, and you would not expect another shipment to have a large number of discrepancies. Is it comparable in that your expectations would be similar, but the results were different.

MR. CASSEL: That is one way to put the question. Yes, Judge.

JUDGE SMITH: Is that all right?

MR. BECKER: If Mr. Kostal thinks he understands the question --

WITNESS KOSTAL: I understand. First of all, it is not a shipment. Your first question that you asked --

JUDGE SMITH: I used the word "shipment."

WITNESS KOSTAL: No, he used the word shipment, Judge. His question two questions ago asked me the question relative to shipments. So my answer is I don't know what was on the shipments; I only know what was inspected out in the field. So my answer to that was I didn't know, relative to shipments.

BY MR. CASSEL:

Q If we substitute the word "sample" for "shipment", would that --

A (Witness Kostal) What's the question now, then?

Q The question is, going batk two questions now and to rephrase that question, is it the case -- or isn't it the case that there are large variations in the proportion of discrepant welds from one sample of SCC-supplied equipment at Byron to another?

A Well, the welds themselves, one inspection found less defects -- I mean less deficiencies or discrepancies than the other sample did. I mean, that's a true statement.

So I guess I don't know where you're going. A fact is a fact. We took a sample. What we found is what we found. The first sample we took we found what I reported here in 1977. The second sample we took which was in 1980 which was a different sample, we found different things. Still the same type of element.

Q Do you know whether that is at all common of the samples from SCC equipment that had been taken at Byron? Namely, that there are large discrepancies from one sample to the next in the proportion of discrepancies?

MR. BECKER: Your Honor, let me interpose an objection. The answer that Mr. Cassel seems to be getting at is what the testimony is all about in the 50 pages where Mr. Kostal lists all the samples. So I'm not sure it's appropriate to simply grab all that testimony in one bundle and then ask Mr. Kostal to give a quick answer about what is being sought.

JUDGE SMITH: Well, you forced this on him because he's trying to establish a basis for a question which I really didn't think needed so much basis. It was obvious in the testimony that there is a difference.

end 9

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MR. BECKER: I just don't see that Mr. Cassel is asking any question other than, "is there a difference."

JUDGE SMITH: What he is trying to establish is, can the differences serve as a basis of comparison. And that answer seems to elude him and us.

WITNESS KOSTAL: I think I have a way to solve this. We are talking about welds, so in terms of the number of welds -- we were talking in one sample of 227 stiffeners, not welds. Here we are talking about welds and fittings.

So, I think we have a relative consistency if we get from welds to welds to welds, rather than from a stiffener total element compared to how many welds are in the stiffener.

BY MR. CASSEL:

Q All right. But on that basis, the sample on page 27 says that out of 227 stiffeners, every one of them had one or more discrepant welds.

Whereas the sample on page 29 says that out of all the stiffeners in that sample, none of them had any discrepant welds.

So, doesn't that give us a basis to compare stiffeners to stiffeners?

JUDGE SMITH: Wait a minute, is that question possible?

mm2

WITNESS KOSTAL: The trouble is, I don't remember exactly how many stiffeners are on these fittings.

JUDGE SMITH: Why don't you simply explain to the witness where you are going. Maybe if you place it in context --

MR. CASSEL: Sure.

BY MR. CASSEL:

Q I am just simply trying to find out whether the data in your testimony supports or doesn't support the suggestion that there were large variations in the quality of the equipment supplied by SCC to Byron for whatever reason.

All we know from your testimony is that there were variations in the samples.

A (Witness Kostal) I can answer that question. There is not large variations in the quality.

Q Large variations in the number of discrepant welds. Let's define quality in that sense.

A That's not a way you would define quality.

Q I'll ask you about discrepant welds, then. Is it not the case that there were large variations, for whatever reason, in the percentage of discrepant welds in different equipment sent at different times to Byron by SCC?

MR. BECKER: Objection. That one has been asked

mm3

and answered. That one began with Mr. Kostal talking about shipments. So I think we should stay away from shipments and talk about samples.

BY MR. CASSEL:

Q Let's try it with samples and then go to the next question, because we don't --

JUDGE SMITH: Are these samples of shipments?

MR. BECKER: No, I don't believe so, your Honor.

WITNESS KOSTAL: They are samples of things that are in the plant erected, or on the site. They are not samples of shipments at all.

BY MR. CASSEL:

Q Let's start with the stiffeners example. We had two different examples of stiffeners; one of them, every stiffener had at least one discrepant weld. And in another one, no stiffener had a discrepant weld.

Is it not the case, then, we have a large variati in the proportion of stiffeners in two samples of stiffeners supplied by SCC that had weld discrepancies?

A (Witness Kostal) Let me clarify. Maybe I can explain this a little easier.

The original NCR 105 written in '77, did not address stiffeners per se. We were looking at fittings, we were looking at anything relative to fittings; side welds or stiffener welds.

mm4

The specific instance which is addressed in the NCR 529 only deals with fittings. Okay. So as a result, it is not quite the same inspection. I mean, we are not looking in the 105 for just fittings -- just stiffeners, excuse me.

So, there aren't that many stiffeners involved in these particular fittings, I think.

(Witnesses Kostal and Singh conferring)

Mr. Singh pointed out a good point to me. The original 105 dealt with weld quality in terms of procedures, in terms of the welders being qualified for the procedures. Whereas the later NCR dealt with the inspections of the individual stiffeners for length and spacing. That was the original issue.

Q So you are suggesting, perhaps, it is not apples and apples to compare the 1977 sample of stiffeners with the --

A I think that is correct.

Q And you stated that because the purposes of the inspections in each case were different?

A Yes, sir.

Q But isn't it in fact the case that whatever the purpose of the 1977 inspection discussed at page 29 of your testimony, in fact stiffener welds were inspected as part of that inspection?

A That's correct. There were some stiffener welds

mm5

inspected.

Q Just some? In other words --

A Well, everything that was on the ones that were inspected, yes.

In 99 fittings, all the stiffeners were inspected.

Q All right.

And they were inspected for weld defects, including lack of fusion, porosity, missing welds and the normal attributes or defects that a weld inspector would inspect for?

A That's my understanding.

Q Isn't it also the case that the 1981 sample of 227 involved an inspection of the welds on all 227 stiffeners for the same types of discrepancies?

A That's correct.

Q So that regardless of the differences of purpose of these two inspections --

A Done by two different people.

Q -- done by two different people -- we nonetheless have one sample of stiffener where 100 percent of the stiffeners had one ore more discrepant welds, and another sample where none of them had any discrepant welds.

A Let me clarify. I think you have got to go back and look at, when 105 was done -- this was done seven years ago -- they were looking at whether or not the welds were

mm6

qualified. And they weren't looking to the same level of scrutiny on these particular weld elements as they are today or in the later NCRs.

So, the purpose of the inspection was, in my eyes, different.

Q So different that in 1977, assuming that the stiffener weld quality itself was identical from the two different samples, you are suggesting that the entire variation between zero percent and 100 percent could be explained by differences in the --

A I can't explain it --

MR. BECKER: Please let Mr. Cassel finish the question.

WITNESS KOSTAL: I'm sorry.

BY MR. CASSEL:

Q I think you knew where I was going.

The question is simply whether you are suggesting that the entire variation between the percentage of discrepancies found in the two samples was attributable to the fact that it was a different inspector, and one of them was applying more rigorous scrutiny than the other?

(Panel conferring)

A (Witness Kostal) I'm sorry, would you repeat the question.

Q Sure.

mm7

Are you suggesting that the entire difference in these two samples of stiffeners -- the difference between zero percent in one case and 100 percent in the other, was attributable to the fact that different people did the inspections and applied differing levels of scrutiny?

A I'm not suggesting anything. The facts are purely the facts.

What I received -- excuse me, what Sargent and Lundy received when they received NCR 105, was an inspection report which contained all the data from that inspection report.

Subsequently we received an NCR 529 which also contained data from that Inspection Report.

Why there is differences in them, I can't -- I really don't know the differences.

Q Fine.

Are all the samples of SCC equipment which were taken at Byron and supplied to Sargent and Lundy, listed in your testimony?

A Those that were requested for engineering disposition, I believe that is true.

end T10

Q Just to take one example, Mr. Kostal, in the sample on page 13, which again is the 80 hangers, with 358 SCC shop-welded connections, do you have any basis for knowing whether those 80 hangers included representative

T11 MM

mml

samples from each of the shipments of hangers from SCC's facilities to the Byron site?

A No, I can't tie that together. That is a representative of all the components that are in the plant today. That is what the 80 hangers and 358 connections represent.

Q That sample was taken by -- according to page 12 of your testimony -- using a list of random numbers.

Do you know what numbers that refers to?

A Random numbers.

Q You mean numbers identifying particular welds?

A No, every hanger is numbered.

Q I mean particular hangers, I'm sorry.

A All a random list of numbers is, is just that. It is a random list of numbers which is used to select then from the total population of hangers. A given hanger to go out into the field and inspect. We numbered all hangers, we took this random list of numbers, we took X number, the first number we started with in going through, and we took that particular corresponding hanger.

Q On page 30 of your testimony, Mr. Kostal, in the bottom line you referrec to redundant load paths.

Just for the record to be clear, would you describe what you mean by a redundant load path?

A I think it would be easier if we looked at the

mm2

figure which is provided, Figure 7. This particular figure --

Q For the record, that is Figure 7 attached to your prefiled testimony?

A Yes, sir.

Q Now, if we are looking at this figure right above the word -- okay. If you are looking at the figure, there is dotted lines which represent the stiffener underneath the pan. There is vertical welds that connect the various side sections of the pan together, and there are what I would call curve bent plates which are also attached in the area where these vertical welds are.

So, what I mean by redundancy is that in transferring loads, let's say across a given location where you have a vertical seam weld, you could either transfer the load through that vertical seam weld, or you could transfer the load through the stiffener weld. Those are two alternate load paths.

Or, you could transfer the load through the bent plate through one side above a vertical section to another side of a vertical section.

That is what I mean by redundant.

JUDGE SMITH: Does that say each one is capable of transferring the load?

WITNESS KOSTAL: That's correct. Any one of them

mm3

could transfer the load. They all three happened to be there.

BY MR. CASSEL:

Q And in this particular portion of your testimony you are making the point that whatever discrepancies there may be in SCC fitting welds at Byron, those fitting welds -- this is on page 30, the bottom paragraph -- are not required to meet structural load requirements because they are alternate load paths?

MR. BECKER: Could I have the question again, please?

MR. CASSEL: Sure.

BY MR. CASSEL:

Q In this particular context of your discussion of redundant load paths, you are making the point, are you not, that whatever discrepancies there might be in SCC fitting welds, that doesn't matter because the fitting welds themselves are not necessary to carry the structural load, because they are an alternate load path that can do that?

A (Witness Kostal) That's not what it is saying. What it is saying is there are various ways to carry the load. You can carry them with any one of the three elements I indicated before.

Q What is the sentence --

MR. WILCOVE: Was Mr. Kostal finished?

MR. CASSEL: I'm sorry.

mm4

WITNESS KOSTAL: I'll stop.

BY MR.CASSEL:

Q Please finish your answer if there was anything you wanted to add to it.

I was going to ask you about that sentence there in the paragraph on page 30.

A (Witness Kostal) You go to the next question.

Q I, perhaps, have misunderstood that sentence in the paragraph on page 30 that begins "In June 1984. . ."

A Okay.

Q Are you not saying that fitting welds don't matter because there are alternate load paths available?

A What I am saying is that if there wasn't a fitting weld, a vertical fitting weld we could carry the loads through other means in these particular locations. That is what I am saying.

Q In other words, the fitting weld is just not necessary?

A That's correct. We could eliminate that fitting weld and still carry the load.

Q And one of the alternate ways that the load would be carried would be stiffeners, right?

A Or the bent plate.

Q Or the bent plate.

And earlier in your testimony I think you had

mm5

indicated that stiffeners were unnecessary because there were alternate load paths to carry the load that they are intended to carry.

A That is in a different portion of the particular cable tray. That was on a straight section cable tray.

Q Oh, I see. So that when you testified that the stiffeners are just simply not necessary for any load carrying function, that statement was limited to the particular sections that were being examined in that context, namely straight sections?

A I think I had better clarify a few points.

The cable pans are made up of pan sections with stiffeners. When you have a straight section it spans between two hangers. If it spans between two hangers, the pan by itself without stiffeners can carry the load.

It is like this table, okay. Let me give you an example. This table here, if I put -- well, whatever is on this table, there are side members on this table. If I took the side members off, the top of this table will still carry the loads to the legs of the table. By providing the side members, it is another way to carry the load. Rather than carry them through membrane action of the top of the table, I can now transfer the loads from the center of the table to the side members of the table. That is another load path to carry the loads.

mm6

In looking at the pan with stiffeners, the stiffeners can -- they provide a function when they are present. They can carry loads. But, we could design them without it.

Now it is pretty tough to erect these things if you don't have stiffeners.

Okay. Now when you get into the fitting section, the only question that is of concern is the vertical welds where you change directions. And when you are changing directions at that location you need some element to carry the load across that direction.

You can use one of three elements. You can either use the vertical side welds, you can use the bent plate, or you could use the stiffener. We found no case where we had a combination of a missing vertical weld and any defect within the stiffener. In fact, we found no case where we had a missing vertical weld.

JUDGE COLE: So you have maintained your redundancy?

WITNESS KOSTAL: That's correct.

BY MR.CASSEL:

Q Basically in this situation you have got three redundancies.

MR. BECKER: Two redundancies.

MR. CASSEL: You have got three load paths, two

mm7

redundancies.

(Laughter)

BY MR. CASSEL:

Q Aren't there at least two ways in which you could wind up with less than enough capacity? One is this -- let me backtrack.

We are talking about, there is one situation here where you describe where there is only one redundancy.

A (Witness Kostal) Maybe we could stop all the questions if I tell you we have already inspected all of them and they are out in the field.

Q You already inspected all the --

A Vertical seam welds and they are all there.

Q All of the fitting welds?

A We inspected all of the fitting welds that were addressed in this testimony and they are all present.

end 11

Q So when you testify on page 31 that all 90° fittings will be inspected, you are now telling us that that inspection has been accomplished?

A That's correct.

Q When you say that all the fitting welds have been inspected, do you mean only the outside fitting weld of a 90° fitting, or do you mean all the fitting welds, not limited to that?

A Just what it says on page 31.

Q Namely, the 90° fittings have been inspected.

A All 90° fittings on the outside fitting welds. yes. The seventh line from the bottom of that first paragraph.

Q But you're not -- or are you testifying that all the other fitting welds have also been inspected?

A They don't need to be inspected because there, we don't need that weld at all.

Q The reason you don't need it is because you have two redundancies.

A No, we don't need it because we don't need any redundancies in those other locations.

Q Doesn't your sentence on the bottom of page 30 state --

A Can I clarify? I think it would be easier if I just clarify it for you.

Q I'd like your clarification, but just let me ask the question, because I think the two are related. The bottom of page 30, in the last three lines you state, "Fitting welds are not required to enable fittings to meet load requirements due to the existence of redundant load paths."

A Right.

Q My question is really, aren't you saying there that the reason you don't need the fitting welds is because of the existence of the redundant load paths? Please give your clarification.

A That's correct in this instance.

Q In this instance?

A Right.

Redundant load paths can also be taken if you look at the structure in a slightly different way.

Q Let's turn to page 14 of your testimony, Answer 22. You're talking here about an analysis of certain hangers which contained the three welds found to have the greatest reductions in load capacity in your sample of the 358 connections.

Is this answer, then, discussing three hangers, three different hangers, or do these three welds appear on two hangers?

A No, three different hangers.

Q In the last sentence in the first paragraph of

Answer 22 you state that each connection in these hanger assemblies was mapped. And it goes on to say, ...and all identified weld discrepancies were incorporated into your computer model.

Does that mean, then, that with respect to these hangers, all of the connections on the hangers, not just the one that was found to be -- to have the greatest reduction in load capacity, but all the connections on the hanger were examined and, in fact, the welds were mapped for all the welds on the hanger.

A That's correct. That's all the connections that are welds performed by Systems Control and welds performed by Hatfield, because there are two welds on every connection.

Q And then in the bottom paragraph on page 14 you indicate that your analysis redistributed the loads among the hanger connections to reflect the presence of the weld discrepancies.

A That's correct.

Q Do you know whether this same technique -- that is, looking at all the welds and connections on a hanger, mapping all of them and then redistributing the loads among the connections to reflect discrepancies, was used in the Sargent & Lundy engineering analysis of the discrepancies identified in the Reinspection Program?

A Let me state two things. First of all, we didn't sy4

have to use this technique at all. Every discrepancy we found in the 358 we analyzed and showed that there was no significance without using this technique.

This technique was only used at my request, so that when I came up here I could be able to discuss intelligently what the effect would be if we look other discrepancies into account on a given hanger. Techniques available to be used, not only for this work but the work that was done on the Reinspection Program. It could be used anytime.

Q And without doing this analysis, you wouldn't know what the effects on the whole member of a single weld discrepancy would be; correct?

A That's not true. I already answered the question by saying that the defects that we had, all 358, had no discrepancies that affected any other portions of the hanger.

end 12

SYmgc13-1

Q Then why was it necessary to redistribute the loads among the hangers to reflect the discrepancy?

A The whole purpose was, it wasn't needed. As I said, the whole purpose in doing this is to show that an individual connection weld discrepancy has very little effect on the integrity of the entire hanger assembly.

Q Well, when you say you redistributed the loads, did you just make an assumption that all the load went to the other ones, or did you determine --

A Now every single element has flexibility. It has a certain amount of ability to give, just like a rubber band. If you pull on it, it will move.

So all we did was model the individual flexibilities of every member and each connection. So we took and modeled the connection flexibility of what was present.

Q But when you did that, you had a weld map for each weld on the connection and on the hanger, for that matter.

A That's correct.

MR. WILCOVE: Mr. Kostal, I think often you're quicker than I am in anticipating where the question is leading, and then you respond. The trouble is, at that point, I haven't heard the whole question, and it takes me a little bit longer to assess the answer. So if you could wait until Mr. Cassel finishes his question, it would be easier.

mgc13-2

WITNESS KOSTAL: Oh, okay.

BY MR. CASSEL:

Q And as part of this analysis described on the bottom of page 14, did you take into account the specific characteristics of each of the welds on the entire hanger that were reflected in the weld maps that you had obtained for each of those welds?

A (Witness Kostal) That's correct.

MR. CASSEL: Could I have just a minute or two, Judge. I think I'm about through.

(Pause.)

BY MR. CASSEL:

Q Mr. Kostal, on page 8 of your testimony --

A (Witness Kostal) Before we get there, I would like to expand on one point, so that the Judges understand this.

This analysis, what it basically showed is that we could take a factor of three times -- more than three times as much load that exists on this than what it was originally designed for. So in comparing it to how we normally would do a design, it showed that there are tremendous margins in these hanger assemblies in order to accomodate any kind of discrepancies that may occur. This was just one particular analysis for three different hangers which had the largest weld discrepancies, and even with the largest weld discrepancies, we could still show that it had the capability of taking three times the original design loads required for this hanger assembly.

Q And when you say the largest weld discrepancies, you mean the largest discrepancies --

A Found in the 358.

Q Turning to page 8 of your testimony, you are discussing the definition of "design significance." About two-thirds of the way down in your Answer 17, you say the code writers typically attempt to obtain a margin of approximately two.

By your use of the word "typically," do you mean to suggest that the amount of the margin varies among sections within the codes?

A Well, it varies depending on the particular design application. The range is -- well, let's say it's about 1.7. In fact, we can go up to 3 and greater. So I am just giving you a rough average as to what it typically is.

Q It can go up to three or even greater? What can it go down to?

A Well, I would probably say that the lowest is about 1.6.

Q And in the codes you are discussing there, is
e of the codes you are referring to the ASME Code?

mgc13-3

largest weld discrepancies, we could still show that it had the capability of taking three times the original design loads required for this hanger assembly.

Q And when you say the largest weld discrepancies, you mean the largest discrepancies --

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A Well, it varies depending on the particular design application. The range is -- well, let's say it's about 1.7. In fact, we can go up to 3 and greater. So I am just giving you a rough average as to what it typically is.

Q It can go up to three or even greater? What can it go down to?

A Well, I would probably say that the lowest is about 1.6.

Q And in the codes you are discussing there, is one of the codes you are referring to the ASME Code?

mgc13-4

A No.

Q What codes are you referring to there?

A I'm referring to structural codes, AISC, AISI.

Q It doesn't refer, then, to the AWS Code? The AWS Code simply wouldn't be applicable under this, or would it?

A Oh, no, this is AWS.

Q It covers AWS?

A AWS is welding.

Q So the answer to my question is, it does cover --

A Your original question referred to the ASME Code.

Q Right. And then I asked another question about AWS. I think you said you did cover AWS.

A Right. It covers AWS, right.

Q Thank you.

On page -- going back to page 14 of your testimony, Mr. Kostal, this analysis of the 358 connections, in that regard, are you familiar with the discussion of that analysis in NRC Report 84-32, which is the one that was just distributed within the last couple of days to the parties.

A I read that document.

Q You have read that document. Do you happen to have a copy with you? I think there's one up there at the table.

Would you turn to page 9, please?

mgc13-5

MR. CASSEL: It is under the July 30th cover letter, Judge.

BY MR. CASSEL:

Q On page 9, I will read you two sentences and ask if you agree with them, or if subsequent events have mooted them. They are the last two complete sentences on page 9, referring to the evaluations of the 80 hangers, which I think is the same 80 hangers discussed on page 14 of your testimony.

Quote: "The evaluations did not apply to worst observed reduction in hanger connection strength caused by discrepant and/or missing welds to the most highly-stressed connections in the plant. The Licensee therefore did not satisfactorily demonstrate that all hangers in the plant were acceptable. The Licensee's corrective actions for cable pan hanger weld discrepancies are considered ineffective," close quote.

First of all, is that referring to the same 80 hangers that are discussed at page 14 of your testimony?

A (Witness Kostal) That's correct.

Q Do you agree with those statements in the NRC report?

A No. I only agree with the first sentence.

Q You agree that you did not apply the worst observed reduction in hanger connection strength to the most

mgc13-6

highly-stressed connection in the plant?

A That is a correct statement. And may I clarify?

Q You certainly may.

A We didn't feel we had to, since we captured highly-stressed elements -- highly-stressed connections in the population of 358, greater than 40 of them, and we didn't have the worst reduction of weld quality due to missing portions of welds.

JUDGE SMITH: Is that a partial qualification?

MR. CASSEL: I'm sorry, Judge. Is what a qualification? Did you say qualificat on?

JUDGE SMITH: He said he did not apply reduction in strength caused by missing welds. But your answer did not include discrepant.

WITNESS KOSTAL: May I clarify? The word really should be "missing portion of weld." We define the welds for the entire connection. You may have on four welds within a connection -- you may miss one side of it. That can be defined as either a missing weld out of four welds or a missing portion of an entire weld.

JUDGE SMITH: That wasn't my concern. I thought you made that clear. My concern was, you dropped in your answer a part of the finding, in that the finding was, "The evaluation did not apply the worst observed reduction in hanger connection strength caused by, one, discrepant

mgc13-7

and/or, two, missing welds." And your answer addressed missing or incomplete, and you did not address discrepant. And I was wondering if that was a qualification.

WITNESS KOSTAL: Okay. The discrepancies found in the highly-stressed connections within the 358 were reviewed and found not to have design significance.

The way this is worded, it implies that the missing portion of weld and the reduction associated with that was then applied to the most highly-stressed weld that didn't have this particular defect. And we didn't do that.

MR. BECKER: Excuse me, Judge. If I can interject, Mr. Kostal, what was the worst observed reduction in hanger connection in that sample?

WITNESS KOSTAL: A missing portion of a weld.

MR. BECKER: Thank you.

BY MR. CASSEL:

Q Well, there are a couple of elements here in this statement in the NRC report. One is the worst observed reduction, and that, you're saying, was the missing weld; is that correct?

A (Witness Kostal) The same missing portion of weld.

Q Missing portion of weld. And you did not -- well, let me compare that to the statement on page 14 of

mgc13-8

your testimony.

In the middle of the page, you indicate that you analyzed the hangers which contained the three welds found during the evaluation to have the greatest reductions in load capacity. Those three welds are not the welds, portions of which were missing, or are they?

A Yes, sir, they are.

Q I see. So in terms of taking the worst observed reduction, you did analyze the worst observed reduction, but you analyzed it in the context of the particular hanger on which it happened to be located, rather than another hanger which would have been the most highly-stressed hanger in the sample?

A That's correct, because that discrepancy did not exist in the other highly-stressed element -- in the other highly-stressed connection in the hanger.

Q This was only a sample of 80 out of 5700 hangers. Isn't it possible that a combination of your worst observed discrepancy and your most highly-stressed hanger could have appeared in the 5600-plus welds that were not captured in your sample -- 5600-plus hangers that were not captured in your sample?

A We didn't find it.

Q You didn't find it in your sample.

A That's correct.

mgc13-9

(The panel of witnesses confers.)

(The Board confers.)

BY MR. CASSEL:

Q Did you want to add anything to your last answer? While the Judges are conferring, why don't you?

A (Witness Kostal) Maybe I canclarify where we're at on this issue, since there was a difference of opinion between the Staff and, in this particular case, Commonwealth Edison and Sargent & Lundy.

In order to address the issue of the missing welds and the greatest weld quality reduction in highly-stressed hangers, we have embarked on another program, just to avoid this whole problem. And what we are basically doing right now is, we are inspecting the most highly-stressed hangers in the plant that could not accomodate this worst weld quality reduction, to determine whether or not there is any presence of a missing weld.

That program is ongoing. It's approximately 30 percent complete, and to date, we have not found -- and we have inspected over 660 highly-stressed hanger connections, and we have not found any missing portions of welds to date. That will be complete over the next week to two weeks.

MR. BECKER: I might note for the Board that that is the subject of Mr. Kostal's testimony in Question and Answer 27.

End13

BY MR. CASSEL:

Q Do you know what company is conducting that inspection?

A (Witness Kostal) It's my understanding that Daniels is providing that inspection. Their Level III inspectors are providing that inspection.

Q Do you how many, approximately, Daniels construction personnel are involved in these examination?

A No, sir.

Q Do you know whether prior to doing these inspections, they were required to take a certification test --

MR. BECKER: Objection, Your Honor. Mr. Kostal testified they're Level III inspectors. This is getting beyond the bounds, I think.

BY MR. CASSEL:

Q Do you know whether any of these Daniels inspectors have been retested within the last two weeks for the purpose of ascertaining their qualifications to do these inspections?

MR. BECKER: Your Honor, I have to interpose an objection before Mr. Kostal gets the question. As in the earlier situation with the dimensional problems on the NRC report, I interposed an objection for lack of foundation unless Mr. Cassel represents that he can somehow connect this up with evidence that somehow this issue of qualification of

Daniels Level III inspectors has some effect on the inspections they're conducting of those systems control hangers.

MR. WILCOVE: I think that objection is well taken.

MR. CASSEL: Well, there's no question -- there are two objections. I think I heard one was foundation and the other was relevance. There's no question of the relevance. He's suggesting himself that to clear up an NRC finding on the adequacy of the safety significance, it has been necessary -- well, whether it's necessary or not they are, in fact, conducting this inspection.

With regard to foundation, I'm trying to find out whether the witness has any information that would clarify for me whether some information that's been brought to our attention relates to this issue. I don't know whether it does or not.

If the witness doesn't know the answer to the question I pose, then he's not going to be helpful on that point.

JUDGE SMITH: I think you're fishing. So what is the information that you have?

MR. CASSEL: We've received an anonymous -- or not an anonymous -- we've received an allegation from an alleger who does not wish to be identified that -- let me just take a moment to make sure I state it correctly.

Counsel for Intervenors conferring.)

MR. CASSEL: Judge, I can answer the question but before I answer it, let me be quite candid that the information we have received is somewhat sketchy, and if I were to state it, obviously on the record here it would be somewhat adverse to the company. I myself would think that is something that they really ought not to be subjected to on the record until we have taken some discovery to pursue it any further.

I don't think the question I asked this witness would come up with information that would be unfair to them, but -- I mean, I could ask the question --

JUDGE SMITH: Well, let's approach it this way. You have, in your view, sufficient grounds to ask the question; not the premise, but to ask the question. The question being as the question that you received. What is your point?

You're trying to establish -- you asked a question which included as the premise that the Daniels Level III inspectors were not properly certified. Is that where we were?

MR. CASSEL: No, I don't think the premise would be that precise. It would simply be whether there has been any retesting of whatever Daniels employees are doing these inspections during the last two weeks.

JUDGE SMITH: Well, where did the recertification get in? Where did the issue of qualifications get into it?

MR. CASSEL: Well, I'm not sure whether it's recertification or certification in the first instance.

JUDGE SMITH: Well, that concept just didn't spring into my mind at this moment; it came up earlier through you.

MR. CASSEL: That's right, and I'm saying I may have misspoken. I'm really trying to zero in on the question of whether this witness knows whether the Daniels employees who are doing these inspections were tested within the very recent past for the purpose -- for some purpose related to preparing them to do these inspections.

JUDGE SMITH: All right, ask that question.

BY MR. CASSEL:

Q Did you hear the question, Mr. Kostal?

A (Witness Kostal) Give me your exact question.

Q Do you have any knowledge of whether the Daniels employees who are doing the inspections to which you just referred have been tested or retested concerning their capabilities relative to the inspections in the recent past?

MR. BECKER: Now let me just get a clarification. Mr. Cassel uses the term "capabilities related to their inspection." I think the record should be clear that Mr. Kostal has testified that the inspection is that they are looking for missing portions of welds. If the question assumes that, if that's a premise of Mr. Cassel's question, then fine.

MR. CASSEL: We may need the witness to help clarify the premise. Let me ask a preliminary question that will clarify it.

BY MR. CASSEL:

Q Is the inspection solely to look for missing portions of welds, or also to look for cracked welds, for example?

A (Witness Kostal) Missing portions of welds and cracked welds.

Q And cracked welds. Anything else?

A No, sir.

Q All right. With that --

A I mean, you or I could do that.

Q Maybe you can.

(Laughter.)

So clarified, do you have any knowledge of such testing?

A What I have knowledge of is that we wrote a procedure, a very short, simple procedure as to what they were to inspect for, and that procedure was used to instruct all the people that are doing these inspections. I'm at least aware of that.

Q But beyond that, you have no knowledge concerning whether they were tested on that procedure, or anything else relevant to their ability to do this inspection?

A No.

(Pause.)

Q Let me ask this general question, Mr. Kostal. You discussed a number of safety -- excuse me -- of analyses of the design significance of discrepancies found in various samples throughout your testimony. The NRC finding that we just discussed was a finding with respect to the particular sample involving the 358 connections.

Do you know whether, in the other samples discussed in your testimony Sargent & Lundy did apply, for purposes of its analysis, whatever the worst observed discrepancy in that sample was to whatever the most highly stressed memeber in the sample was?

A (Witness Kostal) Yes, we did. It's in the testimony.

Q You did it in the others but you didn't do it in this particular one?

A That's correct.

JUDGE COLE: Why didn't you, sir?

WITNESS KOSTAL: Well, I was debating whether or not I was going to expand on that. You know, some of the elements -- obviously, we have a lot of different components here, the majority of which are fairly lowly stressed. I mean, they have tremendous margins of safety in them to cope.

And where it was very -- it was just more expeditious and simpler for us to just take the worst weld quality reduction factor and apply it across the whole population because it was just a simple calculation to make. We didn't have to spend much time doing that.

So where it was so obvious, we did that particular analysis. And there are a number of cases where it's extreme'y obvious; the local instrument panels where we have margins of safety of 8, 10, 12 times what we need to have, the DC fuse panels where we have margins of safety of 2½, 3 times the worst particular weld discrepancy that we need to have, and in the ladder trays where we have tremendous margins.

So in those cases, it was just -- it was a much more expeditious method of disposition and a concern that was discussed with the NRC Staff. And that's why we did it.

end 14

T15 MM/mm

JUDGE COLE: I guess I still don't understand that.

If you were to have applied that conservative approach to take the worst discrepancy found and apply it to the most highly-stressed weld, that would have resulted in an overstressed condition, is that correct?

WITNESS KOSTAL: No. I'm not saying it would. What it would amount to, we would have to do a lot of additional engineering analysis to determine if, in fact, it would or would not.

JUDGE COLE: So, rather than do that what you are currently doing is reinspecting all of the highly-stressed welds to make sure that that worst condition doesn't exist in a highly-stressed situation?

WITNESS KOSTAL: That's correct. We haven't found it today, we didn't find it when we did the samples.

JUDGE COLE: And you are 30 percent along in that?

WITNESS KOSTAL: Yes, we are about 30 percent into it. We expect to sample somewhere around 3000, and we finished 600.

JUDGE COLE: You say sample 3000?

WITNESS KOSTAL: Not sample, we will inspect 3000.

JUDGE COLE: Is that 100 percent?

WITNESS KOSTAL: That is 100 percent of all the highly-stressed hangers.

mm2

JUDGE COLE: Okay.

So any hangers that are not included in your population that you are sampling, or that you are inspecting, would be able to withstand the worst condition that you found in your inspections?

WITNESS KOSTAL: That's correct.

BY MR. CASSEL:

Q On page 40 of your testimony --

JUDGE SMITH: Mr. Cassel, do you want to give us another estimate of how long you have to go in your cross-examination?

MR. CASSEL: Judge, I was just picking up a couple of odds and ends. I think I only have one or two left.

BY MR. CASSEL:

Q On page 40 of your testimony, the top paragraph, the last sentence -- and we are discussing local instrument panels here fabricated by Systems Control -- the last sentence states that these panels were seismically qualified as long as their fabrication was accomplished in conformance with the same fabrication drawings and specifications as that used for the fabrication of the tested panel.

Do you have any basis for knowing whether that was, in fact, the case?

A (Witness Kostal) Sure, we inspected them all and found tha they all worked.

mm3

JUDGE SMITH: Had you deposed Mr. Kostal?

MR. CASSEL: No, Judge. We would have --

JUDGE SMITH: Your cross examination for the last hour and a half sounds more like a deposition than it does a cross examination.

MR. CASSEL: Well, it is unfortunate that some of this has to be information gathering, Judge, but we were not permitted an opportunity to cross examine any witnesses other than the certain number we asked for on the date when I became involved in the case.

MR. MILLER: Excuse me, Judge. That really --

JUDGE SMITH: Proceed with the cross examination.

MR. MILLER: That is not correct. All he had to do is ask, and he never did.

JUDGE SMITH: Just proceed with the cross examination. As a matter of fact, disregard my remark.

(Pause)

MR. CASSEL: I was righter than I thought, Judge. I only have one question left, and I have already asked it.

I have no further questions of the witnesses.

JUDGE SMITH: What are your requirements, Mr. Lewis?

MR. WILCOVE: I will be doing the cross.

I think it would take under fifteen minutes. I can go now or after lunch, whatever the Board's pleasure is.

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JUDGE SMITH: We might as well break now.

JUDGE COLE: Fifteen minutes?

MR. WILCOVE: I think.

(Laughter)

JUDGE SMITH: We will return at 1:30.

(Whereupon, at 12:20 p.m., the hearing was recessed to resume at 1:30 p.m. this same day.)

end T15

T16 MM/mm

AFTERNOON SESSION

1:35 p.m.

JUDGE SMITH: Proceed.

Whereupon,

K. T. KOSTAL

B. F. MAURER

A. K. SINGH

resumed the stand and testified further as follows:

CROSS-EXAMINATION

BY MR. WILCOVE:

Q Mr. Kostal, I am going to start with you. The first question goes to your question and answer 22 on page 14.

The question is whether the analysis you are discussing in this answer is a linear or nonlinear analysis.

A (Witness Kostal) It is a linear elastic analysis.

Q And turning now to page 21 of your testimony. In the second paragraph you discuss the computer analysis of three hangers. And you state that none of the connections or members exceeded the allowable stress.

Was this a code allowable stress, or a material certification allowable stress, or something else?

A Code allowable stress.

Q For the record I don't think we have yet defined which code this is. Could you tell us?

mm2

A In these particular hangers it would be the AISC Code.

Q That stands for?

A American Institute of Steel Construction.

Q And then we will turn to page 23 of your testimony, question and answer 27.

There you discuss your commitment to inspect other connections for missing portions of welds.

My first question is, what was the capacity reduction that was found when a missing portion of a weld was applied to one of the highly-stressed connections? What was the worst capacity reduction that you came up with?

MR. BECKER: Excuse me, Judge Smith. Can I get a clarification?

You are asking the worst level of reduction applied to the highest-stressed connections?

MR. WILCOVE: That's right.

MR. BECKER: I guess my impression of the testimony was that hasn't been done.

But Mr. Kostal hears it, if he thinks he can answer --

WITNESS KOSTAL: I think what you are referring to is in the 358 connections, the worst weld quality deficiency -- discrepancy, excuse me, was a missing portion of weld. And what was the reduction in capacity of the

mm3

connection associated with the missing portion of a weld, compared to the capacity if the weld had been totally present.

The reduction from a total weld to a missing portion of weld in the connection was 53 percent.

BY MR. WILCOVE:

Q You did clarify my question. I appreciate that.

And, am I correct that the next step was to divide the connections into those which would meet that -- meet or exceed that reduction if there was a missing portion of a weld, and then those connections where that 53 percent level would not be reached if a portion of a weld were missing.

MR. BECKER: I'm sorry, Mr. Wilcove, can you restate the question. I am not sure I followed it.

BY MR. WILCOVE:

Q I'm sorry, I misstated my question.

The connections were then divided into two categories, am I right, those that would be able to withstand that strength reduction and those that would not?

A (Witness Kostal) That's correct.

Q In making that division, were the design loads utilized, or the actual loads utilized?

A Actual loads that exist in each of the cable trays as applied to each of the hangers.

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Q And were the categorizations based on the code allowable strengths or the actual material tested strengths?

A They are based on the real properties that exist.

Q Mr. Kostal, on page 43 of your testimony, you discussed -- Question and Answer 41, you use the term "total effective weld."

Could you define that for us?

MR. BECKER: What page are you at, Mr. Wilcove?

MR. WILCOVE: Page 43, Question and Answer 41.

WITNESS KOSTAL: In this context, what it refers to is the effective total quantity of weld, including size and length, as compared to the weld associated with the test panel. Let me give you an example.

We have a weld that is a fillet weld, a quarter of an inch by three inches long. That's in the tested panel. When we went out and inspected, we may have had a fillet weld that was three-eighths of an inch in size, but only two inches long. You would still have the same total effective weld in that particular instance.

BY MR. WILCOVE:

Q Mr. Maurer, just one question for you. On page 10 of your testimony, Question and Answer 15, the first sentence, you use the phrase "using minimum values for weld length and size, which were indicated as a result of our

mgc16-2

visual inspection."

Does that mean discounting the portion of a weld where a discrepancy is present?

A (Witness Maurer) Yes.

MR. WILCOVE: That's all I have, Mr. Chairman. And, Dr. Cole, it's well under fifteen minutes, I believe.

JUDGE COLE: Very good.

BOARD EXAMINATION

BY JUDGE COLE:

Q Mr. Maurer, on page 9 of your testimony, someplace on that page, you talk about the adding of welds in the last paragraph on the page, second sentence in the last paragraph on the page. You say, "In addition, several welds were added to the Unit 2 main control board to assure that sufficient weld length existed for all members.

Who did that? Was that done under your direction?

A (Witness Maurer) I directed that it be done. It was done by Hatfield welders.

Q The principal reason for all of this inspection and analysis is to make sure that the Systems Control supplied components were able to withstand a seismic load; is that your understanding, sir?

A That's correct.

Q Now on page 10 of your testimony, Mr. Maurer, and on page 39 of Mr. Kostal's testimony, each of you

mgc16-3

refers to natural frequences. And I believe in your testimony, Mr. Maurer, you indicate that the natural fequency of most -- of the main control board and most of the control panels do not have natural frequencies below approximately 25 hertz.

And I believe, Mr. Kostal, on page 39 of your testimony, I believe you calculated, in the second paragraph on that page, that test determined that the natural frequency of the four and eight-foot panels is greater than 33 hertz.

And both of you, then, conclude that because of that, there will be no dynamic amplification of the floor seismic load. And I guess -- I don't think the record reflects why that is so.

And so I'm going to ask you to explain why you can make that transition to say, because they are greater or lesser than a certain frequency, why we can say we will get no amplification of the seismic loading transmitted through the floors? Could either one of you or both of you explain that?

A The input for the seismic analysis that we performed is a response spectra. We do a response spectra type input. The response spectra --

MR. MILLER: Could you speak up, Mr. Maurer? We're having trouble hearing you.

WITNESS MAURER: I'm sorry.

The response spectra is, in general, a representation of the level of input that one would expect, versus frequency.

BY JUDGE COLE:

Q That's from the safe shutdown earthquake?

A (Witness Maurer) Yes, sir.

The floor spectra for the main control room at Byron peaks at -- I'm not sure of the exact numbers; it's somewhat less than 20 hertz -- and comes down close to the zero period acceleration, which indicates after 25 hertz, about 25 hertz, which indicates that the predominant energy being input at that point from the earthquake is in the range of less than 25 hertz.

And as I have said here, for structures that have fundamental frequencies greater than 25 hertz, they will not see that excitation at the same frequency, and so will respond essentially as per instructions and will not see an amplification.

Q How far away do the two frequencies have to be before you can make that kind of statement? You indicated that the frequency that will be transmitted as a result of teh safe shutdown earthquake through the floors of the building will be something less than 20 hertz, and the natural frequency of the equipment is above 25, and Mr. Kostal

mgc16-5

made a calculation somewhere around 32 or 33.

How far apart do those have to be before you can make a statement that there is not going to be any amplification, or it's not going to go into what we call resonance frequency?

A It's hard to give a number. You look at the relative -- you look at the ratio of the resonant frequency of the structure that you have, versus the input resonant frequency.

A (Witness Kostal) I would like --

Q Dr. Singh is going to answer. I was wondering how long he was going to keep quiet.

(Laughter.)

A He can answer better than any of us, since this is his area of expertise more than any of us.

Q Please feel free to educate me, Dr. Singh.

A (Witness Singh) The reason this rigid frequency is critical, when you talk about earthquake excitation, the ground motion has a range of frequencies inherent in it. And these frequencies, if they are in the range of the structural frequencies, get amplified as you go up in the structure.

Now there are two aspects to this problem. One is what you are saying, how close this frequency has to be to the structure frequency, so that it is not critical.

mgc16-6

Now in our analysis, what we do is, we analyze the structure to the incoming ground motion and compute floor response spectra. So any amplification of this ground motion which is due to the structure is inherent in the floor spectra, which we generate and which we give to the equipment qualification people. So that portion, how far the ground motion frequencies have to be separated from the structure frequencies -- Answer: We have included that, and that's not the criteria. The criteria which is mentioned in this testimony is, when it comes to the equipment, the equipment is in the flexible range or the amplification range of the motion. Then the equipment itself amplifies that response. In other words, you would have to a dynamic analysis of the equipment to capture the effect.

However, if the frequency is above 33 or above 25, you are in the rigid range, whereby you can do a static analysis and get the same -- get the response, because the equipment is not amplifying. It's in a rigid zone. There is no amplification, because the input had no frequency in that area.

And that's the aspect that these gentlemen are trying to point out.

Q All right, sir. But you are referring to or you state that it's in the rigid zone. But how do you identify

mgc16-7

the rigid zone?

A The rigid zone, the way it is identified is -- and this goes back to the definition of the SSE, which in the case of Byron is the Reg Guide 1.60 spectra -- if you look at the spectra, it had beyond 33 hertz, which means for frequencies 33 hertz and above, it has no frequency, and this is based on empirical studies of past earthquakes, which have shown that as the frequency goes up, the energy content goes down. So the 33 hertz is established based on past practice, and that is the design basis for Byron, which means that if you have any equipment which has frequencies greater than 33, by definition there cannot be any amplification, because the incoming ground motion has no frequency content in that.

Now the change from rigid to flexible is a gradual one and so close enough to 33, in this case 25, it's still very little frequency content, very little energy, so there's no amplification.

Q All right, sir. That's fine.

How do you determine the natural frequency of equipment or structures?

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A I guess this is where his finite element model comes in. You can use a test frequency. You can use a finite element to find frequencies of the structure or the equipment.

Q Can you determine -- I believe you did measure it by a shaker test; is that correct, sir?

A (Witness Maurer) There were shaker tests performed for the purpose of the number that you refer to. The results came from the modal analysis, using our finite element model.

A (Witness Kostal) Maybe I can clarify. Where the original dynamic characteristics of the panel come from it's called a resident search test. You shake the thing. You put accelerometers on it, and it tells you, based on this accelerometer, where the peak is off of a plot, and when you look at this plot, it will tell you from this test where the natural frequency of that particular piece of equipment is from the test.

Q So you can do it experimentally?

A Oh, definitely. It's done from a test. You could also do it analytically.

Q I was just going to get to that. You can do it by a paper analysis of the structure, can you not, sir?

A Correct.

Q Did you do that, or did you do it experimentally?

mgc17-2

A (Witness Maurer) Actually we did both. The analysis for the actual as-built structure in the control room was done using computer analysis. However, when we constructed the computer analysis, we utilized the test results from an actual main control board section which we tested in the lab to compare with the results of our model to assure that our model was giving us the proper natural frequencies.

Q And they compared favorably?

A Yes, they did.

JUDGE COLE: Thank you very much. That's all I have.

JUDGE SMITH: Dixon?

BY JUDGE CALLIHAN:

Q Dr. Singh, you appeared before this Board about a week ago, the 26th or 27th of July.

A (Witness Singh) That's correct.

Q In connection with evaluations, let's say, of the reinspection program.

In your work presented today, are there significant differences now than what was discussed during your earlier testimony?

A When you say "significant differences" --

Q In methodology and applications.

A No. The methodology for computing these

mgc17-3

reliabilities is identical to what was said last time. But the items are different.

Q Oh, yes. But basically -- there are basic similarities?

A That's correct.

Q Is either of the other two gentlemen on this panel congnizant of the disposition of these, in some cases, appreciable number of discrepancies that were observed in welds and that sort of thing?

A (Witness Kostal) In the reinspection program?

Q No. In what you are reporting today.

A I'm familiar with everything that Sargent & Lundy did.

Q What was done about the discrepancies?

Let me back up. When you speak of discrepancies, what was the origin of the information that led to that classification as a discrepancy?

A All the discrepancies were reported to -- were found as a result of inspections. They were found and reviewd -- I'm not sure of the very early ones, but I know in the later ones in the last two to three years, they have all been reviewed by Level III inspectors, and we have for each of those discrepancies a weld map associated with those discrepancies. And in each case where we have these weld maps -- and it's defined in my testimony -- and in each mgcl7-4

case we took those weld maps, those portions of the weld which were identified as discrepant, we conservatively deleted that portion from the weld in calculating the remaining properties of that weld.

Given those remaining properties, we analyzed that remaining weld to determine whether or not it could indeed accomodate the loads that it was intended to be able to accomodate. And in each case, we were able to show that in no instance did any weld where there were discrepancies -- there were no instances where they couldn't -- they didn't have the capacity to carry their intended loads.

Q We discussed this at some length last week on the reinspection program, and many of the quote, "raw data" discrepancies -- I'll define "raw data" as that which comes from the inspector, which I presume from your opening remarks just now -- most of those discrepancies were disposed of by an engineering evaluation of some kind, and I interpret what you say now to be a similar practice in these instances.

A Yes, sir.

Q Picking up a question of Mr. Cassel's earlier about welds and paint, and, I think, both of you gentlemen referred to that topic, at any rate, in your respective testimony, you responded that you put confidence in your

mgc17-5

Level II or III -- the inspection engineer who went along with you.

Do you share that confidence, that there were no cracks buried beneath the paint?

A Let me clarify for mine. In the case of the 80 hangers, all the paint was taken off. In the case of -- there's a number of NCRs indicated in here, and I can go over them. But in the NCR-850, which is the 80 hangers, all the paint was taken off. In the NCR relating to NCR-893, which is a specfic type of condition, all the paint was taken off, and for other NCRs, the paint was taken off.

The only area that the paint wasn't taken off was in the stiffener welds to the bottom of the cable trays that I am aware of.

Q Mr. Maurer, can you comment, supplementing?

A (Witness Maurer) No, except that I do have confidence in the inspector who accompanied me, that if any significant discrepancies were there, they would have been seen.

A (Witness Kostal) I didn't answer your direct question. I've got to answer that. I'm sorry.

I have definite confidence in the quality of the inspectors that were doing this work.

Q What makes you think he was so correct?

A Excuse me?

mgc17-6

Q What makes you think he was so correct?

A I went out and looked at the welds myself in a number of instances where we observed discrepancies. I've looked at them in Byron and I've looked at them in other places throughout my career, and I believe that they were properly dispositioned in terms of what was r ported.

Q Excuse me. Are you back on the paint problem or my earlier question?

A I was on your general question regarding the inspections and the results of the inspections that were given to us.

Q I haven't quite turned loose the paint problem yet. I'm sorry. I thought you were coming back to it.

A Oh, I'm sorry.

Q Well, then, your answers cosistently are that you relied on your companion inspecto-, and you had confidence in him, and that's your answer.

A (Witness Maurer) Yes, sir.

A (Witness Kostal) Yes, sir.

Q Mr. Kostal, you make some reference about what I will term safety factors in codes, and you have a statement in your testimony someplace to the effect that, by a d large, people who write codes throw in a factor of -- I'll t e 2, although I'm sure there are bounds on it.

What codes have you found this to be in, in what

mgc17-7

class of codes? Are you using American National Standards, for example?

A These are the codes that we as structural engineers use. I have mentioned two, which are the American Institute of Steel Construction, which is basically the code we design all structural components to; the AISI, which is the American Iron and Steel Institute, which is basically the code we use to design cold form, light gauge sheetmetal; the AWS Code being another code that we use for welding.

These are the primary documents that are used for steel type structure design.

Q So if I may characterize, your reference is in your testimony quite properly, but I'm not quite clear on the codes to which you refer which are used in structural work, and you do not intend that to be a general statement for the codes as they come down the road.

A I think it's inherent in all codes that are developed, whether or not they are for steel structures or whether or not they're for concrete structures. The purpose of the code in determining margins, code margins I should call them, is to take into account the work quality that you would generally associated with a given entity -- for example, structural steel. The quality of that product is fairly consistently determined. There's mgc17 3

not too much they can do wrong with producing structural steel when you test it. So therefore the allowables for structural steel and the margins, as they exist, are not as great as they are, for example, for welding.

In welding, we have higher margins associated within the codes. To give you an example, in welding you generally only are allowed to use 30 percent of the ultimate capacity. That is your code allowable -- 30 percent of the ultimate capacity. Whereas in structural steel, you are allowed to use generally about 67 to 70 percent of the allowable capacity.

Now the difference is basically because of the ability to produce consistently, time after time, a perfect weld. So the code knows you can't do that. So they automatically account for what would be normal construction, installation defects or deficiencies, as we are, in this case, calling them.

End17MM

19fls.
No 18.
It died.

JUDGE CALLIHAN: Thank you very much.

JUDGE SMITH: Do you have questions on the Board questions and the other cross examination before we go to redirect?

MR. WILCOVE: I don't have any, Mr. Chairman.

MR. CASSEL: I was thinking this was going to come later, Judge. Let me just check a second.

I have no questions.

JUDGE SMITH: Mr. Becker?

MR. BECKER: Could I just have a moment, Judge?

(Pause.)

REDIRECT EXAMINATION

BY MR. BECKER:

Q First of all, Mr. Kostal, in your testimony, Mr. Cassel asked you about the PTL inspection of local instrumentation panels. It would be page 42 of your testimony. And as Mr. Cassel's questions pointed out, a certain number of discrepancies were found during the reinspection of the local instrument panels conducted recently.

Do you have an explanation, Mr. Kostal, for the reason that discrepancies were identified recently after PTL had performed 100 percent reinspections a couple of years ago?

A (Witness Kostal) Yes. I think they occurred for a variety of reasons. First of all, welding and inspecting of welding is a very subjective type inspection. Each individual person inspects slightly differently. In particular, when the items are more costmetic in nature.

I think -- at least this is my feeling. I think in looking at these inspections today, we're looking at them in as conservative a way as we possibly can, and I think the inspectors are documenting everything that they could possibly find.

Whereas, in the normal inspection, as I believe was performed years ago, they didn't document every minor or in ignificant cosmetic discrepancy because that was just not the normal practice to do. And I think those are the two key elements, in my eyes, as to why we have a difference between inspections done a few years ago compared to inspections done in today's atmosphere.

Q Mr. Kostal, moving on to the analysis performed by Sargent & Lundy on three hangers, the analysis that was performed subsequent to the initial review of the sample of 80 hangers -- first of all, I'm not sure it's clear on the record. Mr. Kostal, what was the reason the analysis of those three hangers was performed by Sargent & Lundy?

A Well, the most honest reason is because I was going to come up here and testify and I wanted to have in the back of my mind -- well, not in the back. I wanted to have available to me what would be the results of such an evaluation if given the question. That's the real reason it was done in the first place. It wouldn't have been done if I wasn't coming up here to testify. That's as honest an answer as I can give.

Q I'm assuming you're going to continue to give honest answers.

(Laughter.)

Why wouldn't you have done the analysis if you hadn't been coming here today?

A Well first of all, in each and every connection we did the analysis with the discrepancies, and we did show that with the discrepancies, none of them were design-significant.

Q And in doing those analyses of connections, the analysis was performed on each individual connection that included a discrepant weld?

A That's correct. There are 358 analyses. Oh, excuse me, there's 106 analyses because those were the only discrepant connections. All the other connections were found to have no discrepancies whatsoever on them.

Q All right. And to clear up a possible vague area on the record, in discussing your analysis of the three hangers in which you expanded beyond the individual connection and examined all the connections, both Systems Control and

Hatfield, within the hanger -- and I refer in particular to the bottom of page 14 of your testimony -- you used the term that the analysis "redistributed the loads."

Now my question, Mr. Kostal, is given the fact that it's your testimony that each connection was reviewed individually, was capable of carrying its design load, what do you mean by the term "redistributed" in this context?

A I guess I have to clarify a little bit. The redistribution is very minor in the sense that the connections are modeled very accurately regarding their characteristics. They have a certain flexibility associated with them. But the change in characteristics accounting for the discrepancies was extremely minor in nature.

Therefore, the load distribution, or the loads that were originally designed in the connection to the loads that existed after the analysis -- they were almost equal.

What normally happens is when you make a connection -- when first you design it, you consider it a rigid connection. That is the worst assumption you can make.

With a rigid connection when you do the analysis, it sees the greatest amount of loads. Now, when you take into account the weld discrepancies, or you take into account the actual physical characteristics of the connection, they're not perfectly rigid, nothing is perfectly rigid.

So if I take into account the less perfectly rigid connection, you will relieve some of the load because it won't pick up as much load. A rigid connection gives you the bounding loads; a less rigid connection gives you a lower value of loads. That's what I'm referring to when I talk about redistribution. There's a slight change in load. And I guess if I had to put it in the context of numbers-- let's say the original load was 1000 pounds. The modified load, in this case -- for convenience, I don't have the numbers, but I'd say it would be like 950 pounds. So it's very close.

Q Mr. Kostal, again, to clarify what might be a possible confusion on the record that emerged during some of the questioning, in general, referring to your testimony as a whole, when a discrepancy was identified and was then evaluated, and the new capacity of the connection -- that is, the capacity encompassing the discrepancy -- was evaluated, was the discrepancy evaluated against the design capacity of the particular connection at issue? Or the actual load, the actual capacity of the connection?

A In all this work in my testimony, it's against the original design loads.

Q The design load.

A That's correct.

Q In response to questioning I think from Mr. Wilcove you used the term "actual material properties." I believe you used it in discussing the ongoing inspection of systems control hangers. What do you mean by the term "actual material properties"?

A For all these hangers we have all the material certs for all the hangers. We utilized those material certs. Those material certs provide you the actual capabilities or the actual capacities for all the material that's in the hangers.

JUDGE COLE: You used the term certs.

WITNESS KOSTAL: It's nothing more than a test to determine the actual characteristics of the material compared to the minimum characteristics of the material.

JUDGE COLE: So those are test results?

WITNESS KOSTAL: These are test results.

BY MR. BECKER:

Q Mr. Maurer, let me refer you to page 8 of your testimony. And as Mr. Cassel pointed out, near the top of that page you used the phrase that, the welds in the main control panels were assumed to be adequate for the finite element analysis. The analysis that Mr. Cassel has used the shorthand term of "first step" to describe, can you please explain what you mean by the phrase "the welds were assumed to be adequate for the analysis"?

A (Witness Maurer) What this means in the context of the construction of the finite element model is that at all locations in the model where various members are joined, where they come together, in the model it's assumed that these joints remain connected; they remain continuous and able to transmit loads one to another.

JUDGE COLE: So you assumed them to be rigid?

WITNESS MAURER: In essence, yes, we do.

BY MR. BECKER:

Q What was, then, the purpose of Step 2? You've got your Step 1 analysis; what is the purpose then of doing the actual inspection? How does that relate to the analysis?

A (Witness Maurer) The purpose of the inspection was to determine the actual condition of the as-built welds in the control panel. That is, the actual good weld length-- you know, the length of good weld -- and the actual weld size.

Q Did the results of your inspection cause you to use any different assumptions than you had originally with regard to your finite element analysis?

A No, they didn't. In fact, the results of the final step, the weld evaluation, not only supported the assumption that we used in building the finite element model but also demonstrated that there is significant margin in the assumption that we used.

MR. BECKER: One moment, Judge Smith.

(Pause.)

I have no further questions.

BOARD EXAMINATION -- Further

BY JUDGE CALLIHAN:

Q Mr. Maurer, this assumption of essentially a rigid weld for your finite element analysis, does that bring in a priori a bit of conservatism?

A (Witness Maurer) How do you mean?

Q On the basis of a remark made a while ago that the rigid weld bears the greatest load.

A Yes, yes, it does. When you have a welded connection, inherent in that connection is a certain flexibility which comes from the actual weld itself.

Q That's a bit conservative. Maybe not a whole lot, but at least in the right direction.

A Yes. When you do assume that that joint is fixed, then you do add some conservatism to that analysis. Yes.

JUDGE CALLIHAN: Thank you.

BY JUDGE SMITH:

Q In that a flexible joint transfers load.

A (Witness Kostal) That's correct.

Q But in a system where you assume rigidity, the other connections are not transferring load to other --

A Let me explain where the load is going. The load goes back into the member, so it doesn't go into another connection.

Q I understand, thank you.

BY JUDGE COLE:

Q You used the model to determine what the maximum loads would be principally at the joint, is that correct?

A (Witness Maurer) Yes, sir.

Q And then you took a look at the welds and then, knowing what the maximum load applied to the welds is, you then made your calculations to determine whether they would withstand those kinds of loads. Is that, in effect, what you did in your three steps?

A That's correct.

JUDGE COLE: Okay, thank you.

JUDGE SMITH: Mr. Cassel?

CROSS ON BOARD EXAMINATION

BY MR. CASSEL:

Q Mr. Kostal, in response to one of Mr. Becker's questions, you stated what your beliefs are concerning why the welds which had previously been inspected by PTL nonetheless contained some discrepancies. And you referred to a practice of -- it wasn't normal for inspectors to record minor insignificant discrepancies. Have you been employed as an engineer at Sargent & Lundy for a good many years?

A (Witness Kostal) That's correct.

Q Have you been employed at all in the inspection business?

A No, but I've been around the arena of welding for the years that I've been with the firm.

end 19

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Q Are you aware that the 100 percent reinspection done by PTL was not the normal, ordinary QA inspection, but was a reinspection done in order to resolve an issue raised by the original inspection concerning SCC discrepancies?

A What are you referring to now?

Q The same PTL reinspections of the SCC-supplied local instrument panels at Byron that we were discussing in your previous answer.

A Okay, the instrument panels. You are referring to the PTL inspection done of the original work coming out of the shop from Systems Control?

Q I am referring to the PTL 100 percent reinspection that was done because it had originally been discovered that better than 50 percent of the welds in the local instrument panels had discrepancies.

A Okay. That I am not aware of. I don't know where the 50 percent comes from. I know that they reinspected all the local instrument panels.

Q When you discussed, Mr. Kostal, the question of redistributing the loads, you indicated that the redistribution was very minor.

Were you referring to the redistribution in the particular hangers that were examined in your analysis discussed in your testimony?

mgc20-2

A That's correct. The load that would be in the connection and the amount that now would be in the member.

MR. CASSEL: I have no further questions, Judge.

JUDGE SMITH: Any further questions?

MR. WILCOVE: Just one question.

RECROSS EXAMINATION

BY MR. WILCOVE:

Q Mr. Maurer, let's say that when you did Step 3 of the analysis of the main control boards, you had found a weld which showed a significant reduction in capacity. You could then have redone your finite element analysis, plugging into that analysis the reduced capacity of the weld, couldn't you have?

A (Witness Maurer) What we would have done in that instance, since what we assumed for the -- well, not assumed -- what we used for our lower bound weld condition when we did our weld evaluation was a lower bound on all the welds that we saw. If it did happen that we found a connection that did not have sufficient capacity, the first thing we do is go back to the plant and find out the exact amount of weld that is there, which would be greater than that that we assumed in the analysis.

Q If you had found, let's say, a joint that had invalidated your finite element results, what would

mgc20-3

you have then done?

A The model can certainly be revised to incorporate the differing conditions.

Q And would you have done so?

A Yes, sir.

MR. WILCOVE: No more questions.

JUDGE SMITH: You may step down, gentlemen.

(Panel of witnesses excused.)

JUDGE SMITH: Do we have a panel or an individual?

MR. GALLO: The next witness is Mr. Johnson. Could we go off the record?

(Discussion off the record.)

JUDGE SMITH: Back on the record.

Mr. Johnson, would you stand and accept the oath?

Whereupon,

LOUIS D. JOHNSON

was called as a witness on behalf of the Applicant and, having been first duly sworn, was examined and testified as follows:

MR. GALLO: Judge Smith, if I could, I have a brief summary of the witness' testimony.

Mr. Johnson is an employee of Torrey Pines Technology, which is a division of GA Technologies, located in the San Diego area. Mr. Johnson and people under his

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supervision and direction performed a third-party review of the hardware furnished by Systems Control with respect to the Byron Station.

The purpose of the review performed by Mr. Johnson and his people was to determine the adequacy of this hardware, and I should mention it's the safety-related hardware that has been previously testified to by the previous panel -- that is, the main control boards of which there were twelve, DC fuse panels of which there were four, local instrument panels of which there were 76, cable tray hangers of which there were approximately 5500, and finally cable trays, which were not counted -- a large number.

Now Mr. Johnson's review through his organization consisted of a combination of what I will call elements. First, they gathered the data and records involving this hardware and reviewed the appropriate documentation with respect to it. Essentially, they conducted a document review of the specifications and other pertinent information surrounding the delivery of this hardware and the inspection of this hardware.

Secondly, they conducted an engineering evaluation of the hardware. And by that, I mean they closely reviewed the entineering analyses performed by Sargent & Lundy, as testified to here today by Mr. Kostal; the engineering

mgc20-5

evaluation of Westinghouse, as testified to here today by Mr. Maurer; and the evaluations performed by Wyle Laboratories, in particular the resident tests and the shaker table tests that also were testified to here today by Mr. Kostal.

Finally, as a third element of this third-party review, Mr. Johnson and his people conducted certain inspections themselves of the hardware.

On the basis of these collective reviews, they made a final evaluation and concluded that the hardware that has been the subject of this proceeding today were adequate to meet design requirements or design loads.

And with that, I would now like to ask Mr. Johnson a few preliminary questions and offer his testimony into evidence after doing that.

DIRECT EXAMINATION

BY MR. GALLO:

Q Mr. Johnson, do you have before you -- well, first of all, let me ask you your name, full name, and by whom you are employed?

A My name is Louis D. Johnson. I'm employed by Torrey Pines Technology.

Q Do you have a document before you entitled "Testimony of Louis D. Johnson"?

A Yes, I do.

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Q Is that the testimony that you prepared for this proceeding?

A Yes, it is.

Q Mr. Johnson, certain corrections were made off the record to this testimony on pages 17, 28 and 32. And is the testimony that we have just referred to, with those corrections, accurate and complete, to the best of your knowledge and belief?

A Yes, it is.

MR. GALLO: Your Honor, at this time, I would like to introduce into evidence the testimony of Mr. Johnson and have it bound into the transcript as if read.

JUDGE SMITH: Are there objections?

MR. CASSEL: No objection.

MR. WILCOVE: No objection, Mr. Chairman.

JUDGE SMITH: The testimony is received.

(The prepared testimony of Mr. Louis D. Johnson follows.)

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MR. GALLO: Mr. Johnson is available for cross-examination.

End20SY

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UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In The Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454-OL
	)	50-455-OL
(Byron Nuclear Power Station,	)	
Units 1 & 2)	)	

SUMMARY OF THE TESTIMONY OF
LOUIS D. JOHNSON
ON CONTENTION 1

I. Louis D. Johnson is the Manager of Projects for Torrey Pines Technology.

II. Torrey Pines has performed a third party review of the components supplied to Byron by Systems Control Corporation. This review encompassed Systems Control main control boards, DC fuse panels, local instrument panels, cable trays, and cable tray hangers.

III. Torrey Pines' review was performed in accordance with a program plan which encompassed a number of different review tasks.

IV. Mr. Johnson first describes the Torrey Pines review of the Systems Control-supplied main control boards. Data pertaining to this component was gathered and reviewed by Torrey Pines personnel, and Torrey Pines performed a partial inspection of one of the main control boards supplied to Byron. Based on his evaluation of all the data reviewed by Torrey Pines, Mr. Johnson concludes that the safety-related main control boards are adequate for design use. This conclusion is based on the seismic qualification and analysis of the boards, the non-significant nature of the weld discrepancies identified on the main control boards, the existence of redundant load paths in the structures, and the design margin which characterizes the construction of the main control boards.

V. Mr. Johnson then describes the Systems Control-supplied DC fuse panels. Data pertaining to this component was gathered and reviewed by Torrey Pines personnel, and Torrey Pines performed a partial inspection of one of the DC fuse panels. Based on his evaluation of all the data reviewed by Torrey Pines, Mr. Johnson concludes that the DC fuse panels are adequate for design use. This conclusion is based on the seismic qualification of the panels, the equivalency of the panels for seismic qualification purposes that can be derived from the nature of the weld discrepancies identified by Torrey Pines, the existence of redundant load paths in the structures, and the design margin which characterizes the construction of the DC fuse panels.

VI. Mr. Johnson's testimony then addresses the local instrument panels supplied by Systems Control. As with the other components, data pertaining to this component was gathered and reviewed by Torrey Pines personnel, and seven panels were partially inspected by Torrey Pines. Based on his evaluation of all the data reviewed by Torrey Pines, Mr. Johnson concludes that the safety-related local instrument panels are adequate for design use. This conclusion is based on the seismic qualification of the panels, the equivalency of the panels for seismic qualification purposes which was evident through a review of the weld discrepancies identified by Torrey Pines, the existence of redundant load paths in the structures, and the design margin which characterizes the construction of the local instrument panels.

VII. Mr. Johnson's testimony then addresses the Systems Control-supplied cable tray hangers. Data pertaining to the cable tray hangers was gathered and reviewed by Torrey Pines personnel, and Torrey Pines selected 11 hangers for inspection. Based on his evaluation of all the data pertaining to the Systems Control hangers, Mr. Johnson concludes that these components are adequate for design use. This conclusion is based on the results of Sargent & Lundy's evaluation of the connections inspected in the sample of 80 hangers, the results of Torrey Pines' own inspection of hangers, the results of inspections performed over the years by Industrial Contract Services, Peabody Testing Service, and Pittsburgh Testing Laboratory, the existence of redundant load paths in the structures, the design margin which characterizes the construction of the hangers, and the utilization of standardized design criteria (in the form of enveloping seismic spectra) in the design of cable tray hangers.

VIII. The final portion of Mr. Johnson's testimony discusses the Systems Control-supplied cable trays. Data pertaining to the cable trays was gathered and reviewed by Torrey Pines personnel, and Torrey Pines inspected six cable trays. Based on his evaluation of all the data pertaining to the Systems Control cable trays, Mr. Johnson concludes that the cable trays are adequate for design use. This conclusion is based on the results of Sargent & Lundy's evaluation of cable tray stiffener welds, the results of Torrey Pines' own inspection of cable trays, the results of the inspections performed over the years by Industrial Contract Services and Pittsburgh Testing Laboratory, the existence of redundant load paths in the structures, the design margin which characterizes the construction of the cable trays, and the standardized design criteria (representing worst case loading conditions) utilized in the design of cable trays.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	)	
	)	
COMMONWEALTH EDISON COMPANY	)	Docket Nos. 50-454-OL
	)	50-455-OL
(Byron Station, Units 1 and 2)	)	

TESTIMONY OF LOUIS D. JOHNSON

Q1. Please state your name.

A1. My name is Louis D. Johnson.

Q2. By whom are you employed?

A2. I am employed by Torrey Pines Technology, a division of GA Technologies located in San Diego, California.

Q3. Please describe Torrey Pines Technology.

A3. Torrey Pines Technology ("TPT") is the Division of GA Technologies Inc. through which GA's extensive engineering and scientific resources are offered to industry. The scope of these services is individually tailored to meet each customer's special needs which may vary from individual consulting with one of our technical experts to large service contracts for complete engineering or R&D programs.

GA Technologies Inc. has been actively engaged in the nuclear power industry since 1965 and is one of the largest privately owned centers for diversified energy research, development, and engineering in the world. Our activities have centered around the creation of advanced systems of power generation and energy conversion. Our facilities encompass nearly one million square feet of office space and include engineering, sophisticated test facilities, precision manufacturing installations, and advanced technology laboratories.

GA Technologies employs approximately 1,725 people of which 859 are degreed professionals, including 435 with advanced degrees. Many of the technical staff are recognized leaders and experts in their field. They have authored numerous technical books, hundreds of papers and filed more than 400 patents. The staff is highly experienced in the nuclear field and has extensive background in water cooled nuclear power plant work. Attachment 1 to my testimony lists Torrey Pines Technology's resources for application to engineering services projects. Attachment 2 presents TPT services provided to utilities.

Torrey Pines Technology has successfully performed independent review contracts with Southern California Edison Company for the San Onofre Nuclear Generating Stations Unit 2 and 3, Long Island Lighting Company for the Shoreham Nuclear Power Station, Arizona Public Service Company for Palo Verde Nuclear Generating Station Units 1, 2 and 3, Louisiana Power & Light for the Waterford Steam Electric Station Unit 3, and Public Service Company of Indiana for the Marble Hill Nuclear Generating Stations Unit Nos. 1 and 2. In addition, TPT has completed an independent management review for Cincinnati Gas and Electric Company on the W. H. Zimmer Nuclear Power Station. An independent design review of Limerick Generating Station Unit 1 is in process for Philadelphia Electric Company.

Q4. What is your position at Torrey Pines?

A4. I am Manager of Projects for Torrey Pines Technology.

Q5. Please describe your educational and employment background.

A5. I have a bachelor's degree in mechanical engineering and am a registered professional nuclear engineer in the State of California. I have been working in the nuclear industry for 22 years and have worked on nuclear power plants for the past 10 years. (My resume is appended to my testimony as attachment 3.) The last five years have been with Torrey Pines Technology providing engineering services to over 35 nuclear power plants. Among other efforts, we have conducted seven independent reviews of nuclear power plant activities. In 1982 and 1983 I was project manager on the independent construction review of the Shoreham Nuclear Power Station. The Shoreham review was structured to provide a basis for judging the adequacy of the safety-related construction of the plant. This was accomplished by reviewing the programs used to control construction for the plant (including the quality assurance program), by reviewing the implementation of those programs in the actual construction, and by inspecting the constructed items in the field to determine if they complied with the design documents. Review items were selected to be representative of various levels of complexity, types of hardware, interface relationships, and features important to the safety of the plant. Items selected for review included safety-related mechanical and electrical components, controls, piping, cabling, and structures. The installed hardware was inspected in varying degrees of detail to confirm that the actual hardware met the requirements specified in the various construction control documents. Complete auditability was maintained in the review process, and independence protocols were utilized.

As a company, GA Technologies is completely familiar with nuclear plant quality assurance requirements both from its role as a nuclear plant vendor and from TPT's services to nuclear utilities. I have been involved in application of quality assurance disciplines throughout my nuclear industry experience, first in aerospace and then in nuclear plants. The use of statistical analyses as one of the quality assurance tools has been part of this experience, along with the use of engineering judgment in the implementation and evaluation of statistical methods and as a basis for reaching conclusions where statistical methods do not completely apply. This use of engineering judgment was applied in the Shoreham construction review and has been applied in the current Systems Controls Corporation hardware review effort.

Q6. What is the scope of your testimony?

A6. My testimony will describe the third party review effort by TPT relating to the adequacy of Systems Control Corporation safety-related hardware provided to the Byron Station. This review encompassed Systems Control main control boards, DC fuse panels, local instrument panels, cable trays, and cable tray hangers. My testimony both describes the work performed by Torrey Pines and sets forth the professional judgments I reached as a result of our review.

Q7. How did Torrey Pines become involved with the work performed by Systems Control Corporation at the Byron Station?

A7. TPT was contacted by Mr. Michael Miller of Isham, Lincoln & Beale and representatives of Commonwealth Edison during early May 1984. My understanding is that Edison and its counsel desired that an outside entity with a broad background in nuclear power station design and construction examine the work performed for Byron by Edison's vendor Systems Control Corporation ("SCC") and provide testimony as an expert witness in this proceeding. A program plan for the third party review effort subsequently was prepared for and approved by Mr. Miller.

Q8. Did Torrey Pines perform any work in connection with the Byron Station prior to its involvement with Systems Control?

A8. Yes. As a consultant to Isham, Lincoln & Beale, I was personally involved, along with Mr. R. Leary, in providing third party review comments on the draft report relating to the Byron reinspection program, primarily with respect to presentation of statistical results. Neither of us were involved in the reinspection effort or the final published report.

Q9. What is the purpose of Torrey Pines' examination of the work performed by Systems Control at Byron?

A9. The purpose of the TPT examination is to provide a third party opinion on the adequacy of the safety-related SCC hardware at Byron. "Adequacy" in this context refers to the capability of SCC safety-related hardware to accept design loads (stresses) without exceeding code-allowable stresses. A number of discrepancies had been identified with Systems Control-supplied components during the course of construction at Byron. Consequently, various reinspections were performed and both Sargent & Lundy and Westinghouse performed engineering evaluations to determine the adequacy of the Systems Control hardware at the site. Review by Torrey Pines of the records and analyses pertaining to the SCC components, supplemented by appropriate additional inspections and evaluations, was designed to provide an additional expert judgment on the adequacy of Systems Control work.

Q10. What equipment has Systems Control supplied to Byron?

A10. SCC supplied safety-related main control boards, DC fuse panels, local instrument panels, cable tray hangers, and cable trays for the Byron plant.

Q11. What are the design specifications for the Systems Control equipment?

A11. Sargent and Lundy design specification F/L 2788 provides requirements for main control boards and DC fuse panels, specification F/L 2809 provides requirements for local instrument panels, and specification F/L 2815 provides requirements for cable tray hangers and cable trays.

Q12. What are the functions of the various components supplied to Byron by Systems Control?

A12. SCC main control boards provide a supporting structure for plant equipment in the main control room (instruments, gauges, alarms, switches, status indicators, etc.). The DC fuse panels are cabinet-type structures located in the Auxiliary Building battery rooms which contain fuses and relays which protect the DC system.

Local instrument panels provide in-plant supporting structures for instrumentation transducers and other control-related equipment. Cable tray hangers provide supporting structures for cable trays, which are used to route and protect electrical cables within the plant.

Q13. Please describe the program undertaken at Byron by Torrey Pines to review the work performed by Systems Control.

A13. Torrey Pines prepared a program plan which delineated the scope and nature of the work that TPT was to perform. The following is an excerpt from the summary paragraph of the TPT program plan:

> This program plan has been developed to provide the basis for an objective assessment of the adequacy of all safety-related hardware supplied by Systems Control Corp. (SCC) for the Byron station. This program will be performed by Torrey Pines Technology, a division of GA Technologies Inc., for Isham, Lincoln & Beale. The program is organized into six tasks, as follows:
>
> Task A Data Collection
> Task B Records Review
> Task C Engineering Evaluation
> Task D Inspection
> Task E Discrepancy Documentation
> Task F Evaluation and Report
>
> . . .

> CECo has implemented a program of inspections, tests and analyses, to demonstrate that the SCC hardware is acceptable. Torrey Pines Technology will review that work and will perform additional inspections and analyses, as deemed necessary, to enable TPT to draw defensible conclusions regarding the adequacy of SCC hardware.

The complete program plan is appended to my testimony as Attachment 4. A summary of efforts in each task is presented below (each task was performed for each type of component reviewed):

Task A - Data Collection

This task was designed to identify and assemble all available records such as purchase specifications, drawings, procurement documents, material receiving reports, nonconformance reports, inspection records, letters and memos, which provide information on acceptability of System Control Corporation items. Records generated by System Control Corporation were not reviewed.

Task B - Records Review

This task was designed to review available records on SCC items and evaluate the degree to which these records provide objective evidence of acceptability of SCC hardware at Byron.

Task C - Engineering Evaluation

This task evaluated the technical basis used to substantiate acceptability of SCC items supplied for Byron Units 1 and 2. Where required, independent analyses were performed to confirm validity of the engineering approaches.

Task D - Inspection

This task identified SCC-supplied hardware items for reinspection to verify accuracy of inspections. Samples of hangers, cable trays, main control boards, DC fuse panels, and local instrument panels were identified for reinspection.

Task E - Discrepancy Documentation

When a difference between an observed condition (document or installed hardware) and a required condition was perceived by an inspection team or document investigator, that difference was recorded on a TPT Discrepancy Report (DR) to document the fact that a difference was observed. Each DR was reviewed by a supervisor for accuracy and clarity of criteria and observed condition. In addition, the supervisor coordinated his review with a review by the cognizant CECo or S&L engineer to ensure the accuracy of the DR.

Torrey Pines Technology personnel arrived at the Byron site May 22 to start record identification efforts and at the Sargent and Lundy offices in Chicago to start review of engineering analyses on May 29. Peak effort involved 16 men, leading to completion of site inspection efforts on June 22. A total of 17 man-months' effort was expended on the project through June 1984.

Personnel used for the third party review effort were either qualified inspectors or degreed engineers with experience in the fields of structural analysis, nuclear system design, quality assurance, statistics, mechanical systems, and project management. Lead personnel on the project had previous experience in independent review projects for Torrey Pines Technology. While this effort was a third party review rather than a review meeting NRC criteria for an independent review, the independence of the project personnel was verified in that no one on the TPT team or any of their relatives had previously worked for Commonwealth Edison Company or on the Byron plant, and no one had financial interest in Commonwealth Edison Company.

Q14. Please describe the Systems Control-supplied main control boards at Byron.

A14. The 12 main control boards supplied by SCC are located in the Byron main control room. They are closed cabinet-type structures that are used to mount various types of instrumentation (gauges, status indicators, alarms, switches, etc.) on the front face with access to the instruments and electrical terminations from the back of the control board. The cabinet-type structures involve a number of structural steel connections to form the structure and utilize two to six welds on each connection.

Q15. Please describe Torrey Pines' review of the Byron main control boards.

A15. Safety-related main control boards for the Byron plant were identified from Material Receiving Reports and the S&L Master Document List. S&L design specification F/L-2788 and the related purchase order 207534 were obtained. Requirements relating to configuration, testing, seismic loading, and welding were derived from drawings, procedures, and the specification document. Documentation of main control board inspections by Pittsburgh Testing Laboratory, Westinghouse, and CECo, including related memos and letters, NRC inspection reports, etc., were obtained. Seismic test reports from Wyle Laboratories and seismic analysis reports from Westinghouse were also obtained.

Procurement and receiving records were reviewed for adequacy.

Inspection documentation was reviewed to determine the extent and precision of the inspection records. Nonconformance reports and associated documentation also were reviewed.

The seismic qualification test results of Wyle Laboratories (required by the procurement specifications) also were reviewed. The seismic qualification test is conducted to demonstrate that a component is capable of accepting design seismic inputs. No structural damage was observed after the test at Wyle Laboratories. Torrey Pires also reviewed the seismic analysis of the main control boards performed by Westinghouse to verify the boards' structural adequacy (in response to Edison Byron NCR 544 on main control board welds).

Torrey Pines selected one main control board that had been previously inspected for reinspection of 68 welds. The inspection showed discrepancies that were comparable to discrepancies identified in previous weld inspections on main control boards. Discrepancy report 007 was prepared to document the discrepant welds.

Q16. What is your professional judgment of the adequacy of the main control boards supplied to Byron by Systems Control?

A16. Based on evaluation of all data reviewed by TPT, it is my judgment that the safety-related main control boards are adequate for design use.

Q17. What are the bases for your opinion?

A17. First, Torrey Pines reviewed the tests and analyses performed on the main control boards by Wyle Laboratories and Westinghouse. Four of the 12 boards were tested by Wyle to cover all main control board configurations. The boards were mounted on a shaker table and subjected to a sine sweep to establish resonant frequencies, and then subjected to operating basis earthquake (OBE) and safe shutdown earthquake (SSE) seismic inputs as specified. The tests demonstrated that the boards were capable of carrying seismic loads without structural damage.

After weld discrepancies on main control boards were identified, Westinghouse performed a seismic analysis of the as-built conditions of the main control boards, in order to determine the ability of the entire population of boards installed at Byron to meet seismic load requirements. Westinghouse utilized its WECAN computer code to determine forces and moments in control board joints under the SSE seismic input loading. These forces and moments were then converted to stresses in as-built welds at the joints to confirm adequate design margin in the as-built main control boards.

In reviewing the work performed by Wyle and Westinghouse TPT examined the seismic excitation spectra used in both the seismic qualification testing and the seismic analyses. The bases for validity of the Westinghouse computer model for application to the Byron main control boards was reviewed and determined to be sufficient. Location of peak stresses from the analysis was determined, and the evaluation of design margin in the as-built welds was verified to be proper and conservative.

After reviewing the tests and analyses of Wyle and Westinghouse Torrey Pines has concluded that the work was properly done. Having concluded that the tests and analyses were performed in appropriate fashion, TPT has concluded that the test and analysis results indicating the capability of the main control boards to carry design seismic loads are valid.

Second, the welds on the main control boards, even though AWS D1.1 discrepancies have been identified, are structurally adequate. Inspections performed by Pittsburgh Testing Laboratory in 1980 and 1982, and Westinghouse inspections performed in 1983, found weld surface quality discrepancies which have been demonstrated by Westinghouse's seismic analysis to not have design significance. In addition, Torrey Pines' inspection of a main control board to AWS D1.1 criteria (except for length and size, because the length and size criteria could not be identified for all welds in the pertinent specifications), confirmed that the weld discrepancies were non-significant. TPT inspected 68 welds on main control board 2PM01J, and found 20 to have discrepancies. The discrepancies included underfill, craters, and boxing. These discrepancies were similar to those identified in the earlier PTL and Westinghouse inspections of the boards.

Third, our review of the main control boards led us to conclude that the structures have redundant load paths available and do not depend on single welds or single weld connections for structural integrity. Typical connections in main control board construction involve two to six welds, and loads are shared between multiple connections within the structure.

Fourth, a generic factor which exists for each of the components supplied to Byron by Systems Control is the design margin which characterizes the components. Significant design margin is an expected condition on sheet metal weldments, such as those on the main control boards, since standard material sizes and configurations are used which result in such a margin. This general condition was confirmed by TPT with regard to the main control boards through our review of the Westinghouse seismic analysis, which shows minimum design margins of approximately 1.25 even after discrepant welds are taken into account.

Q18. Please describe the Systems Control-supplied DC fuse panels at Byron.

A18. The four DC fuse panels supplied by SCC are located in the Auxiliary Building battery rooms, near the control room. They are closed cabinet-type structures that are used to mount fuses and relays related to protection of the DC system. The cabinet-type structures involve a number of structural steel connections to form the structure and utilize two to six welds on each connection.

Q.19 Please describe Torrey Pines' review of the Byron DC fuse panels.

A.19 The DC fuse panels for the Byron plant were identified from material receiving Reports and the S&L Master Document List. S&L design specification F/L - 2788 and the related purchase order 207534 were obtained. Requirements relating to configuration, testing, seismic loading, and welding were derived from drawings, procedures, and the specification document. No weld inspection records were identified. The Wyle Laboratories seismic qualification test results (required by the procurement specifications) were reviewed. No structural damage was observed after the test at Wyle Laboratories.

TPT selected welds on one DC panel for inspection. A small number of discrepancies were identified (documented on Discrepancy Report 007) that were similar to weld discrepancies identified on other SCC-supplied hardware.

Q.20 What is your professional judgment of the adequacy of the DC fuse panels supplied to Byron by Systems Control?

A.20 Based on evaluation of all data reviewed by TPT, it is my judgment that the DC fuse panels are adequate for design use.

Q.21 What are the bases for your opinion?

A.21 First, Torrey Pines reviewed the seismic qualification testing performed by Wyle Laboratories on the DC fuse panels. An as-built panel was subjected to a sine sweep to establish resonant frequencies, and then subjected to OBE and SSE seismic inputs as specified. The testing was properly performed, and no damage to the panel resulted. Therefore, we have concluded that the DC panels have been demonstrated by appropriate testing to be able to carry design seismic loads.

Second, we have concluded that the population of the four DC fuse panels can be deemed to be seismically qualified through the equivalency of the non-tested panels to the tested panel. This conclusion derives from the results of our inspection of a non-tested DC panel, panel 2DC10J. We inspected 47 welds on the panel, identifying three discrepancies. These discrepancies were relatively minor, consisting of two underfill discrepancies and one instance of a crater. Based on the non-significant nature of these discrepancies we have concluded that the non-tested DC panels at the site can be deemed to be equivalent to the tested panel for the purposes of seismic qualification.

Third, we concluded from our review of the DC fuse panels that the structures have redundant load paths available and do not depend on single welds or single weld connections for structural integrity. Typical connections on DC panels involve two to six welds, and loads are shared between multiple connections within the structure.

Fourth, a generic factor in the construction of the DC panels is the design margin which characterizes the construction of the panels. Significant design margin is an expected condition on sheet metal weldments, such as those on the DC fuse panels, since standard material sizes and configurations are used in the construction of the panels.

Q.22 Does your answer to Question 21 encompass the recent evaluation of DC fuse panels performed by Sargent & Lundy?

A.22 No, it does not. Sargent & Lundy has recently performed a seismic qualification equivalency review of the DC fuse panels by evaluating inspections of welds on each of the panels. Torrey Pines is reviewing the results of the inspections of the panels and Sargent & Lundy's evaluation. If our analysis of the evaluation of the DC panels leads me to modify my conclusion on the panels, I will appropriately supplement my testimony.

Q23. Please describe the System Control-supplied local instrument panels at Byron.

A23. The 76 local instrument panels supplied by SCC are located throughout the plant. They are open structures of welded steel channel construction, four feet or eight feet in width, that provide a mounting location to properly support instrumentation (transducers, etc.) used to monitor and control equipment located near the panels. The structures involve a number of connections to form the structural framework and utilize two to six welds on each connection. The total number of panels is divided almost equally between the four foot and eight foot panels.

Q24. Please describe the Torrey Pines review of the Byron local instrument panels.

A24. Safety-related local instrument panels for the Byron plant were identified by material receiving reports and the S&L Master Document List. S&L specification F/L 2809 and related purchase order 219596 were obtained. Requirements, inspections, and tests were derived from F/L 2809, the SCC QA manual, and SCC drawings. Documentation of local instrument panel inspections by PTL was obtained. CECo inspection records and associated NCRs were obtained. Seismic test reports by Wyle Laboratories were also obtained.

Procurement and receiving records were reviewed for adequacy. Inspection documentation was reviewed to determine the extent and precision of the inspection records. Inspection records were available on all 76 local instrument panels. Nonconformance reports and associated documentation were reviewed. The Wyle seismic qualification test results (required by the procurement specifications) were reviewed. No structural damage was observed after the testing at Wyle Laboratories.

Torrey Pines selected welds on seven local instrument panels for reinspection of the as-built condition. Four of the panels had weld discrepancies similar to the discrepancies identified on other SCC-supplied hardware. Discrepancy reports 004 and 006 were prepared to document the discrepant welds. Total weld length on one of the four-foot panels inspected was found to be approximately 353 inches, even though the pertinent design drawing only required approximately 250 inches of weld, and even though the PTL inspector who had inspected the panel documented a weld length much below the amount found by TPT. Discrepancy report 001 was issued to document this weld length discrepancy.

Q25. What is your professional judgment of the adequacy of the local instrument panels supplied to Byron by Systems Control?

A25. Based on evaluation of all data reviewed by TPT, it is my judgment that the safety-related local instrument panels are adequate for design use.

Q26. What are the bases for your opinion?

A26. First, Torrey Pines reviewed the seismic testing performed on the local instrument panels by Wyle Laboratories. A four foot and an eight foot panel were selected for testing. The panels were subjected to a sine sweep to establish resonant frequencies. Both panels exhibited minimum resonant frequencies in excess of the 33 Hz cutoff frequency for significant dynamic amplification. The 8 foot panel was then conservatively selected for a seismic qualification test using the SSE seismic inputs. Seismic qualification testing of the panel demonstrated that the panel is capable of carrying design seismic loads.

Torrey Pines concluded that the Wyle tests were properly performed. Therefore, we also have concluded that the local instrument panels have been demonstrated by appropriate testing to be able to carry design seismic loading.

Second, based on our inspection of local instrument panels we have concluded that the Byron population of panels is seismically qualified through the population's equivalency to the panel tested by Wyle. We inspected portions of seven local instrument panels, including the eight foot panel seismically qualified by Wyle (panel 1PL54J). The panels selected for inspection represented a cross-section of the panels at the site, encompassing the variables of time of fabrication, type of panel (4 foot or 8 foot), inspection location (site or Systems Control), and plant location. Each of these panels, as well as all of the other panels supplied to the site, previously had been accepted by Pittsburgh Testing Laboratory to the requirements of AWS D1.1

The Torrey Pines inspection identified 17 weld discrepancies in the 205 welds inspected. Eight of the discrepancies were located on one of the panels (the Wyle-tested panel), with the rest of the discrepancies distributed on three of the other six panels. Discrepancies identified were generally non-significant and included weld surface discrepancies such as porosity, craters, and overlap.

Because of the similarity of the weld discrepancies identified during our inspection of the local instrument panels with the discrepancies identified on other Systems Control components, discrepancies which have been analyzed to be structurally non-significant, we concluded that the discrepancies on the local instrument panels also are not structurally significant.

Therefore we believe that, notwithstanding the weld discrepancies which exist, the population of local instrument panels at Byron is sufficiently equivalent to the panel seismically qualified by Wyle Laboratories to justify applying the results of the Wyle testing to the overall population. Moreover, the greatest number of discrepancies found during the TPT inspection of the local instrument panels was on the eight foot panel that had been tested by Wyle; this fact further adds to my confidence that the non-tested local instrument panels at Byron can be deemed to be equivalent to the tested panel for the purposes of assessing seismic load capability.

Third, we determined through our overall review of the local instrument panels that the components have redundant load paths available and do not depend on single weld connections for structural integrity. Typical connections involve two to six welds, and the loads are shared between connections within the structure.

Fourth, a generic factor which exists for the local instrument panels supplied to Byron by Systems Control, as well as for the other components supplied by

SCC, is the design margin which characterizes the construction of the panels. Significant design margin is an expected condition on sheet metal weldments, such as those on the local instrument panels, since standard material sizes and configurations are used in the construction of the panels.

Q27. Does your answer to Question 26 encompass the recent evaluation of ~~performed~~ local instrument panels performed by Sargent & Lundy?

A27. No, it does not. Recent inspections have been performed on 17 local instrument panels by Sargent & Lundy inspectors on loan to Commonwealth Edison. Four panels were completely weld mapped, and ten weld connections were inspected on each of 13 panels. These inspections are an outgrowth of the Torrey Pines inspection, and were undertaken in order to confirm the equivalency, for seismic qualification purposes, of the overall population of local instrument panels with the Wyle-tested panel. The inspections were undertaken because the presence of discrepancies in the panels inspected by TPT raised the possibility that the as-built conditions of the non-tested panels might be sufficiently different from the condition of the tested panel that the seismic qualification test results for it cannot be extrapolated to the panel population as a whole. Torrey Pines is reviewing the inspection results. If our evaluation of this recent review leads us to modify our conclusion on local instrument panels, I will appropriately supplement my testimony.

Q28. Please describe the Systems Control-supplied cable tray hangers at Byron.

A28. Cable tray hangers are used in the plant to provide structural support for cable trays. They are welded structures of steel and unistrut elements. Detailed hanger configurations are usually prepared by combining standardized steel and unistrut elements with standardized connection details to form the specific hanger design.

Q29. Please describe the Torrey Pines review of the Byron cable tray hangers.

A29. Material Receiving Records and a Hatfield Electric Company computer listing were used to identify the roughly 5500 safety-related cable tray hangers supplied by SCC. S&L specification F/L 2815 and purchase order 200038 were obtained. SCC weld procedures and hanger drawings were identified. Inspection records prepared by Industrial Contract Services, Peabody Testing Service, Pittsburgh Testing Laboratory, and CECo were obtained for review, along with associated NCRs, NRC inspection reports, applicable memos, letters, and engineering analyses of discrepant conditions.

Procurement and reviewing records were reviewed for adequacy. Inspection documentation was reviewed to determine the extent and precision of the inspection records. Nonconformance reports and associated documentation were reviewed. This review included NCR's 813, 772, 893, and 407 relating to specific DV connections in hanger assemblies. The S&L analyses of discrepant hanger welds identified through inspection of a sample of 80 hangers were reviewed and independent calculations were made to confirm the accuracy of the results.

Torrey Pines selected welds on eleven hangers for inspection of as-built weld conditions. A weld discrepancy was noted on one hanger. Discrepancy report 009 was generated to document the discrepant weld (undersize). Discrepancy report 002 was prepared to document a non-specified weld on cable tray hanger "fingers".

Q30. What is your professional judgment of the adequacy of the cable tray hangers supplied to Byron by Systems Control?

A30 Based on evaluation of all data reviewed by TPT, it is my judgment that the safety-related cable tray hangers supplied by SCC are adequate for design use.

Q31. What are the bases for your opinion?

A31. First, Torrey Pines concluded that the results of Sargent & Lundy's evaluation of the sample of 80 hangers, encompassing 358 connections, provide valid demonstration of the adequacy of the Systems Control cable tray hangers. S&L randomly selected from the plant's hanger population the 80 hangers that were inspected, and all AWS D1.1 weld discrepancies were subjected to engineering evaluation by S&L. The 358 total connections inspected included 44 connections that were deemed by S&L to be highly stressed according to plant design. 106 connections were identified to have weld discrepancies, and each was evaluated by Sargent & Lundy and found to be adequate to carry design loads.

Torrey Pines concluded that Sargent & Lundy's evaluation was performed in proper fashion. The sample of hangers and connections was sufficiently large to support the conclusions reached with regard to hanger adequacy, both in terms of engineering judgment and in terms of a statistically-based judgment (the sample of 358 connections establishes with 95% confidence that there is at least 99.4% reliability that all Systems Control hangers are adequate). Independent calculations of hanger load capacity by Torrey Pines, which focused on the highly stressed connections, confirmed the S&L results. In Torrey Pines judgment, therefore, the hanger evaluation performed by Sargent & Lundy indicates the adequacy of the hangers.

Second, our conclusion of the validity of the Sargent & Lundy evaluation is further supported by the results of our inspection of Systems Control hangers. TPT inspected 11 hangers selected to encompass variables of (1) hangers in the sample of 38 analyzed by Sargent & Lundy to be adequate with reduced margins, (2) hangers with weld detail DV-162, as addressed in Edison Byron NCR 893, and (3) hangers judged to be sensitive to inadequate or missing weldments based on a qualitative failure modes and effects analysis by TPT that identified hanger geometries that would be most sensitive to weld discrepancies. Six of the 11 hangers had been inspected, found to have weld discrepancies, and evaluated as part of the sample of 80. We found only one discrepancy on the 11 hangers inspected, an instance of undersize under the criteria of AWS D1.1. This discrepancy was identified on one of the five hangers that had not been within the sample of 80. We have investigated the differences between our inspection results and those of the S&L inspectors (on loan to Commonwealth Edison) who had identified the discrepancies, and our conclusion is that the discrepancies themselves are sufficiently minor that the differences in inspection results are attributable to both the subjective nature of visual weld inspection and the apparent conservatism which was exercised by the S&L inspectors. The results of our inspections of hangers confirmed our judgment that the discrepancies that exist on Systems Control cable tray hangers are not structurally significant, and they do not compromise the ability of the hangers to meet design load requirements.

Third, this conclusion finds further support in the results of the hanger inspections performed over the years by Industrial Contract Services, Peabody Testing Service, and PTL. Although these inspection results do not provide a complete inspection history of Byron cable tray hangers, their significance in terms of our conclusions regarding hangers is that the weld discrepancies identified by each of these agencies generally involved weld surface quality, and such discrepancies were subsequently determined by Sargent & Lundy to not have design significance. Likewise, the types of discrepancies identified on the nonconformance reports which pertained to specific types of connection details (for example, DV-2, DV-162) were determined by S&L to be non-significant.

Fourth, we determined through our overall review of the cable tray hangers that the components have redundant load paths available and do not depend on single welds for structural integrity. As with the other Systems Control components supplied to Byron, typical connections in hanger assemblies involve two or more welds, and loads are generally shared between multiple connections within the structure.

Fifth, just as in the case of the other Systems Control components supplied to the site, the design margin which characterizes the basic construction of the hangers provides further illustration of the adequacy of these components. Significant design margin is an expected condition on sheet metal weldments, such as those on the cable tray hangers, since standard material sizes and configurations are used to construct the hanger assembly.

Sixth, standardized design criteria, in the form of enveloping seismic spectra, are applied in the design of cable tray hangers. These criteria represent worst case loading conditions for a given elevation within the plant. The existence of such design criteria, which result in significant design margins, has been confirmed by the various evaluations of the Systems Control hangers which have demonstrated adequate design margins even after weld discrepancies are taken into account.

Q32. Please describe the System Control-supplied cable trays at Byron.

A32. Cable trays are used to support and protect electrical cables in the plant. The majority of the cable trays are constructed of sheet metal steel with a channel cross section that is 1-2 feet wide with 4-6 inch high side panels. V-shaped sheet metal sections ("stiffeners") are welded to the bottom of the trays to provide additional stiffness. A small percentage of cable trays are open on the bottom, utilizing pipe sections to form the cable support members (these trays are commonly called "ladder" trays). Straight and angled sections (called "fittings") of solid-bottom cable trays and ladder trays are joined together to form a continuous cable tray system that is supported by cable tray hangers.

Q33. Please describe Torrey Pines' review of the Byron cable trays.

A33. Safety-related cable trays for the Byron plant were identified from S&L specification F/L 2815 and purchase order 200038. SCC weld procedures and drawings for cable trays were obtained for review along with available inspection records from CECo, Hatfield Electric Company, Industrial Contract Services, and PTL. Associated NCRs, NRC inspection reports, applicable letters and memos, and engineering analyses of discrepant conditions were obtained for review.

Procurement and receiving records were reviewed for adequacy. Inspection documentation was reviewed to determine the extent and precision of the inspection records. Discrepancy report 003 was prepared to document the lack of inspection records on most cable trays. Nonconformance reports and associated documentation were reviewed. S&L analyses of discrepant cable tray welds were also reviewed.

Torrey Pines selected welds on six cable trays for inspection of the as-built condition. The weld discrepancies that were identified were similar to previously identified, non-significant discrepancies. Discrepancy report 008 was prepared to document the discrepancies.

Q34. What is your professional judgment of the adequacy of the cable trays supplied to Byron by Systems Control?

A34. Based on evaluation of all data reviewed by TPT, it is my judgment that the safety-related cable trays supplied by SCC are adequate for design use.

Q35. What are the bases for your opinion?

A35. First, Torrey Pines concluded that the results of Sargent & Lundy's evaluation of cable tray stiffener welds provide valid demonstration of the adequacy of Systems Control cable trays. In response to Edison

Byron NCR 529 an inspection of 123 cable trays, encompassing 227 stiffeners, for weld length and spacing was performed. S&L evaluated the discrepancies identified during this inspection, and concluded that each of the stiffeners had weld in excess of minimum design requirements. Sargent & Lundy also reviewed these same stiffeners for weld quality, as documented in Edison Byron NCR 707. Although each stiffener had a weld discrepancy of some kind, S&L found that the discrepancies were minor and that each stiffener weld was capable of carrying design loads. Torrey Pines reviewed the evaluations performed by Sargent & Lundy and concluded that the approach taken by S&L to show structural integrity of the cable tray hangers was conservative and was accurately performed.

Second, our conclusion of the validity of the S&L evaluation is further supported by the results of our inspection of System Control cable trays. Because of the similarity of cable tray configurations TPT selected only six cable trays for inspection, five of which had been determined to have reduced weld margins in S&L evaluations related to Edison Byron NCRs 529 and 707, and one of which had no previous inspection record. 50 of the 104 stiffener welds inspected by

Torrey Pines had minor discrepancies per AWS D1.1 criteria. 45 of these discrepancies related to length of the stiffener welds. Two weld cracks (one longitudinal crack and one transverse crack on stiffener end welds) were identified on separate stiffeners. Based on the S&L analyses of the cable trays we determined that the discrepancies were not significant. The results of our inspection of cable trays thus confirmed our judgment that the discrepancies that exist on System Control cable trays are not structurally significant and they do not compromise the ability of the trays to meet design load requirements.

Third, this conclusion finds further support in the results of the cable tray inspections performed over the years by Industrial Contract Services and PTL. Although these inspection results do not provide a complete inspection history of Byron cable trays, their significance in terms of our conclusions regarding hangers is that the weld discrepancies identified by each of these agencies generally involved weld surface quality, and such discrepancies subsequently were determined by Sargent & Lundy to not have design significance.

Fourth, we determined through our overall review of the cable trays that the components have redundant load paths available and do not depend on single welds for structural integrity. As with the other Systems Control components supplied to Byron, typical connections in cable tray assemblies involve two or more welds, and loads are generally shared between multiple connections within the structure.

Fifth, just as in the case of the other Systems Control components supplied to the site, the design margin which characterizes the basic construction of the cable trays provides further indication of the adequacy of these components. Significant design margin is an expected condition on sheet metal weldments, such as those on cable trays, since standard material sizes and configurations are used to construct the tray assembly.

Sixth, standardized design criteria are applied in the design of cable trays that represent worst case loading conditions. The existence of such design criteria, which result in significant design margins, has been confirmed by the various evaluations of the Systems Control cable trays which have demonstrated adequate design margins even after weld discrepancies are taken into account.

Q.36 Does your answer to Question 35 encompass the recent evaluation performed on cable ladder trays by Sargent & Lundy?

A.36 No, it does not. Recent inspections have been performed on 17 ladder cable trays and 10 ladder fittings. Torrey Pines is reviewing the inspection results and S&L's evaluation of the results. If our evaluation of this recent review leads us to modify our conclusion on cable trays, I will appropriately supplement my testimony.

ATTACHMENT 1

The technical resources of GA Technologies Inc. are available through its Torrey Pines Technology engineering services division. General areas of expertise are as shown in the following listing:

STRUCTURAL ENGINEERING
- Building, Structure, Concrete Design
- Seismic Design

PIPING AND HANGER DESIGN
- Code Stress Analysis

STRESS ANALYSIS
- Static and Dynamic
- System, Component, Part
- Simple to 3D Finite Element

SAFETY ANALYSIS
- Accident Evaluations
- Probabilistic Analyses
- System Functional Evaluations
- Reliability Evaluations

EQUIPMENT QUALIFICATION
- Environmental and Seismic
- Identification (Q-List)
- Procurement (Spares)

THERMODYNAMICS

System Design and Performance Evaluations

Productivity Evaluations

ELECTRICAL

System Design

INSTRUMENT AND CONTROL

Control System Design, Modeling, Evaluation

Data System Design through Operation

Instrument Design

NUCLEAR

Core Physics/Fuel Cycle

Shielding

Release Circulations

MATERIALS

Corrosion/Erosion

Welding/Mechanical Properties

Friction and Wear

CHEMICAL

Water Chemistry

Radiochemistry

RADIOACTIVE WASTE MANAGEMENT

Shipping

Storage

Disposal

QUALITY ASSURANCE

NRC-Approved QA Program

Design, Construction and Manufacturing Audit

Training

Quality System Evaluations

Implementation Audits

LICENSING

SAR Preparation

Responses to NRC Requests

Emergency Response Planning

PROJECT MANAGEMENT

Organization Data Management and Control

Activity and Cost Control

ATTACHMENT 2

TPT SERVICES PROVIDED TO UTILITIES

UTILITY	PLANT NAME	TPT ROLE*	SERVICE PROVIDED
American Electric Power		Primary	Dissimilar metal weld analysis
Arizona Public Service	Palo Verde 1, 2, & 3	Primary Secondary	Independent design review Plans and schedules Human factors-control room Piping stress Equipment qualification Structural design Design report preparation
Boston Edison	Pilgrim	Primary	QA training Control room design review
Cincinnati Gas & Electric	Zimmer	Primary	Independent project management review
Cleveland Electric Illuminating	Perry 1 & 2	Primary	Safety related equipment identification and spares procurement system Licensing-FSAR review Limited life parts evaluation QA training
Commonwealth Edison	Various	Primary	Q-List software development
	Byron-Braidwood	Primary	Auxiliary feedwater reliability evaluation Reinspection program consulting
	La Salle	Secondary	Probabilistic risk assessment
	Quad Cities	Primary	Control rod removal and disposal

UTILITY	PLANT NAME	TPT ROLE*	SERVICE PROVIDED
Consolidated Edison	Indian Point 2	Secondary	Probabilistic risk assessment
		Primary	Control room design review
Consumers Power Co.	Palisades	Primary	Licensing support Technical specification review Shield cooling pipe sealing program
	Big Rock Point	Primary	Licensing support Technical specification review
	Campbell 3	Primary	Boiler assessment and repair consulting
Electric Power Research Institute	Various	Primary	Value impact analysis Fuel test data analysis Steam generator program technology transfer Bimetallic weld program
Florida Power & Light	St. Lucie	Primary	Electrical penetration consulting
General Public Utilities	Oyster Creek	Primary	Control rod removal and disposal Motor operated valve analyses Radionuclide activation analyses
Houston Lighting & Power	South Texas Project	Primary	Safety-related spare parts Q-List Equipment qualification Control room design review
Illinois Power		Primary	QA training

UTILITY	PLANT NAME	TPT ROLE*	SERVICE PROVIDED
Korea Electric Co.	Korea Nuclear 5, 6, 7 & 8	Secondary	Control room review (NUREG-0578) Piping stress analysis Preparation of design reports Seismic equipment qualification review Structural design I&C review and revision
Long Island Lighting Co.	Shoreham	Primary	Independent construction review Laboratory services
Louisiana Power & Light	Waterford 3	Primary	Independent design review
Metropolitan Edison Co.	TMI	Secondary	Damage claim analysis
Montana Power & Light		Primary	Reheater scrubber vibration analysis
New York Power Authority	Various	Primary	Motor operated valve analyses
Niagara Mohawk Power Corp.	Nine Mile Point 1	Primary	Control rod radiation measurement Radionuclide activation analyses
Northeast Utilities	Millstone 1 & 2	Primary	Reload fuel design evaluation Fire Protection Risk Assessment
Northern States Power	Monticello	Primary	Control rod removal and disposal
Pacific Gas & Electric Co.	Diablo Canyon 1 & 2	Primary	Equipment qualification package review Radiochemical analyses

UTILITY	PLANT NAME	TPT ROLE*	SERVICE PROVIDED
Pennsylvania Power & Light	Susquehanna 1 & 2	Primary	Equipment qualification Engineering support
Philadelphia Electric Co.	Peach Bottom 2 & 3	Primary	Remote decontamination machine design Control rod removal and disposal Control rod activation analysis
Public Service of Colorado	Fort St. Vrain	Primary	Quality assurance audit Facility review committee
Public Service Indiana	Marble Hill 1 & 2	Primary	Independent construction review Auxiliary feedwater reliability evaluation
Sacramento Municipal Utility District	Rancho Seco	Secondary	High energy piping Control room design Electric room design Radwaste filter modification Seismic qualification review
		Primary	Control room design review
Southern California Edison	San Onofre 1, 2, & 3	Primary	Analytical chemistry Radiochemistry Laboratory services Hot cell services Hot debris removal planning Safety-related spare parts categorization and procurement Radiation monitor system assessment and instrument calibration Independent Review of Seismic Design Independent problem analysis ASME Code consulting Emergency Preparedness Licensing QA training

UTILITY	PLANT NAME	TPT ROLE*	SERVICE PROVIDED
		Secondary	Seismic qualification review Startup probability Licensing Environmental equipment qualification Plans and schedules Emergency planning
Southern Services	A. Vogtle	Secondary	Piping stress analysis Seismic equipment qualification Shielding/nuclear sampling Response to NRC standards Pressure/temperature containment analysis I&C-effluent radiation monitoring
Tennessee Valley Authority	Various	Primary	Equipment qualification
	Browns Ferry	Secondary	Probabilistic risk assessment
Toledo Edison Co.	Davis Besse	Primary	Limitorque operator reliability Core analysis seminar Piping analysis seminar Electrical system evaluation
Taiwan Power Co.	Maanshan 1 & 2	Secondary	Project engineering coordination High energy piping TMI review Bid evaluation Radiation analysis Process system design Seismic equipment qualification review Pressure/temperature containment analysis
	Kuosheng 1 & 2	Secondary	Seismic qualification review

UTILITY	PLANT NAME	TPT ROLE*	SERVICE PROVIDED
Vermont Yankee Nuclear Power Corp.	Vermont Yankee	Primary	Control rod removal and disposal
Virginia Elec. & Power Co.	Surry	Secondary	Fuel damage claim evaluation
Wisconsin Electric Power Co.	Point Beach	Primary	Radiation monitoring system assembly
Wisconsin Public Service Corp.	Kewaunee	Primary	Control room design review

* LEGEND

Primary = TPT was the primary contractor
Secondary = TPT was a subcontractor

ATTACHMENT 3

LOUIS D. JOHNSON
Manager, TPT Projects

PROFESSIONAL SPECIALTY

Project and functional management, engineering design and development, multi-discipline management.

EDUCATION

B.S., Mechanical Engineering, Wichita State, 1959

EXPERIENCE

Managed the Shoreham nuclear power plant independent construction review and provided expert testimony on the results of the review before the Atomic Safety and Licensing Board.

Responsible for all projects under Torrey Pines Technology, the engineering services division of GA Technologies Inc. Assisted in all phases of the establishment, organization, growth, and profitability of the engineering services business. Projects involved all aspects of nuclear power plant engineering.

Managed all plant engineering effort on the Fort St. Vrain nuclear power plant including mechanical, electrical, control, and systems engineering, analysis, and document control functions. Efforts of 100-150 people were concerned with operation of the plant and support during remote core refueling operations. Directed engineering effort relating to the core outlet temperature fluctuation problem on the plant and plant analyses.

Represented company in federal licensing matters relating to a nuclear reactor. Discerned trends, reviewed and attempted to influence regulatory documents, and estimated licensing risks.

Managed a functional group of 100-150 engineers and draftsmen providing design, drafting, materials engineering and manufacturing engineering service to all site run projects at the Idaho Nuclear Engineering Laboratory. Work involved all elements of a nuclear plant (core, structure, vessel, piping, steam generator, pumps and circulators, valves, irradiation facilities, casks and waste management). Included technical and leadership training, recruiting and staffing, and coordination of efforts with both local and Washington NRC offices.

Managed a group of forty engineers engaged in the design and development of electromechanically driven control valves and piping systems for both high and cryogenic temperature applications in a radiation and space vacuum environment. Technical disciplines included probabilistic design analyses, electrical and mechanical design, and component development planning, test and analysis.

PROFESSIONAL ASSOCIATIONS

Registered Professional Nuclear Engineer, California 1976.
Member of ASME.

ATTACHMENT 4

PROGRAM PLAN

THIRD-PARTY REVIEW OF SYSTEMS CONTROL CORP.
ITEMS AT BYRON STATION

PREPARED FOR ISHAM, LINCOLN AND BEALE

MAY 22, 1984

TORREY
PINES
TECHNOLOGY

A Division of GA Technologies Inc.

TABLE OF CONTENTS

1. SUMMARY

This program plan has been developed to provide the basis for an objective assessment of the adequacy of all safety-related hardware supplied by Systems Control Corp. (SCC) for the Byron station. This program will be performed by TPT, a division of GA Technologies, Inc., for Isham, Lincoln & Beale. The program is organized into six tasks, as follows:

Task A	Data Collection
Task B	Records Review
Task C	Engineering Evaluation
Task D	Inspection
Task E	Discrepancy Documentation
Task F	Evaluation and Report

Byron Units 1 & 2 are currently in final stages of the licensing process. SCC has supplied cable pans and hangers, main control boards, and local panels, all of which have become suspect because of a breakdown in the SCC QA program. As a result, the SCC work to demonstrate acceptability of their products is in question. CECo has implemented a program of inspections, tests and analyses, to demonstrate that the SCC hardware is acceptable. TPT will review that work and will perform additional inspections and analyses, as deemed necessary, to enable TPT to draw defensible conclusions regarding the adequacy of SCC hardware.

The review will begin on 5/22/84, and will be completed by 7/13/84. The summary schedule for this work is shown in Figure 1.

2. TASK DESCRIPTIONS

The purpose of this review is to evaluate the acceptability of all SCC-produced safety-related items in the Byron station.

The review will be based primarily on available records of inspections, tests, and analyses performed by parties other than SCC, supplemented by inspections and analyses performed by TPT.

The program is structured to permit TPT to make an objective assessment of the adequacy of all Byron items supplied by SCC.

Four categories of items will be considered: main control boards, local instrument panels, cable pans, and cable pan hangers.

TASK A - DATA COLLECTION

Objective

To identify and assemble all available records,* other than those generated by SCC, which provide information on acceptability of SCC items.

Subtasks

A1 Identify, by part name and lot or serial number, all items supplied by SCC at the Byron plant. Prepare a list of these items, by part name.

A2 Identify, and obtain copies, of all specifications and drawings which specify requirements for items supplied by SCC. Prepare a checklist listing each inspection, test, or analysis required for each item.

A3 Identify and list, for each item (or lot of items), each inspection, test, or analysis record associated with that item, and all backup records for disposition of deficiencies (NCRs).

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*Records include specifications, drawings, procurement documents, material receiving reports, nonconformance reports, engineering analyses, test reports, NRC documents, inspection records, letters, and memos.

TASK B - RECORDS REVIEW

Objective

To review available records on SCC items and evaluate the degree to which those records provide objective evidence of acceptability of SCC hardware at Byron.

Subtasks

A1 Review a representative sample of inspection and test records identified in Task A to determine if they provide objective evidence of the acceptability of the item. Use the checklist developed in Task A for verifying test and inspection requirements.

A2 Record results of the review on master list of items prepared in Task A.

A3 Identify items for reinspection to verify accuracy of inspections by each inspecting agency. Include each category of items for reinspection. Perform inspection per Task D.

A4 Prepare a summary report, listing for each item or lot of items supplied by SCC:

a) Inspections and tests performed for which a credible record exists,

b) Results of TPT review of record content,

c) Result of inspections or test (accept or reject), and disposition of rejectable conditions,

d) Identification of all items for which no credible inspection record exists

e) Identification of all items which have 2 or more independent inspection records which do not have the same results.

TASK C - INEERING EVALUATION

Purpose

To review the technical basis used to substantiate acceptability of SCC items, and to perform independent analyses, if required.

The following items will be reviewed for validity:

C1 Main Control Boards - Review seismic test results, seismic analysis, and similarity justification for those boards not tested. Evaluate lowest margin welds as determined by the seismic analysis.

C2 Local Instrument Panels - Review analysis that confirms sufficient margin in panel welds.

C3 Hangers - Review adequacy of statistical inspection and analysis confirming sufficient margin in hanger welds. Review a representative set of "worst case" hanger welds (load, configuration, weld quality) to confirm adequate margin for use.

C4 Cable Pan Parts - Review adequacy of statistical inspection and analysis confirming sufficient margin in pan welds. Review a representative set of "worst case" pan welds to confirm adequate margin for use.

C5 Prepare a summary report including:

a) Description of TPT work performed above.
b) Results and conclusions based on TPT work and justification for conclusions.
c) List of Discrepancy Reports.

TASK D - INSPECTION

Purpose

To inspect SCC items installed in Byron station.

NOTE: All inspections shall be performed by individuals certified as Level II or III inspectors per ANSI N45.2.6.

D1 Based on results of Tasks B and C, develop list of number of items to be inspected.

D2 Select specific items in the plant. Provide written justification for selection and for Unit 1/Unit 2 selection.

D3 Prepare inspection checklist based on drawing and specification requirements.

D4 Inspect items and record all results on the checklist, sign and date checklist.

D5 Compare inspection results with that of other inspection reports, if available.

D6 Prepare a summary report, including:

- a) List of items inspected by TPT, with TPT inspection results and other inspection results, if applicable.
- b) Justification for selection of items for inspection.
- c) List of Discrepancy Reports.

TASK E - DISCREPANCY DOCUMENTATION

Purpose

To provide detailed documentation of each discrepancy* found in the review.

E1 Reviewers shall document any discrepancy on the attached form (Fig. 1). Include sufficient information to permit an assessment of the discrepancy.

E2 Supervisor shall review the Discrepancy Report (DR) for accuracy and clarity of criteria and observed condition. Supervisor shall coordinate his review with a review by the cognizant CECo and/or S&L engineer, to ensure the accuracy of the DR.

E3 Each DR shall be given unique ID # and a log shall be maintained of all DRs prepared.

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* Discrepancies include (a) item(s) without a credible inspection record, (b) inspections, tesst or analyses by TPT which are in disagreement with CECo inspection, test or analyses results, or (c) other conditions which may cast doubt on the acceptability of SCC items.

TASK F - EVALUATION AND REPORT

Purpose

To evaluate all reviews, analyses, and inspections by TPT and to draw objective conclusions regarding acceptability of SCC items.

F1 Evaluate all information generated by TPT and prepare report on conclusions regarding acceptability of SCC items; present conclusions for each type of item. The criteria for acceptability is that the indicated as-built hardware must be adequate to withstand design conditions and that there is no observed inadequacy of inspection records.

F2 Provide recommendations to CECo regarding any additional work required to provide full justification for acceptance of SCC items.

F3 Prepare a report with above information and a description of all work performed by TPT, along with records of all TPT inspections, reviews, and analyses.

F4 Prepare testimony on the results of the third party review as required.

TORREY PINES TECHNOLOGY
A Division of GA Technologies Inc.
P.O. Box 85608
San Diego, California 92138

DR#____________

BYRON REVIEW - DISCREPANCY REPORT

ITEM NAME: ____________________

SERIAL/LOT NOS. ____

REQUIREMENT(S):

DESCRIPTION OF DISCREPANCY:

PREPARED BY ________________________ DATE____________

REVIEWED BY ________________________ DATE____________

Proposed Schedule for Review of Systems Control Corp. Items at Byron Station

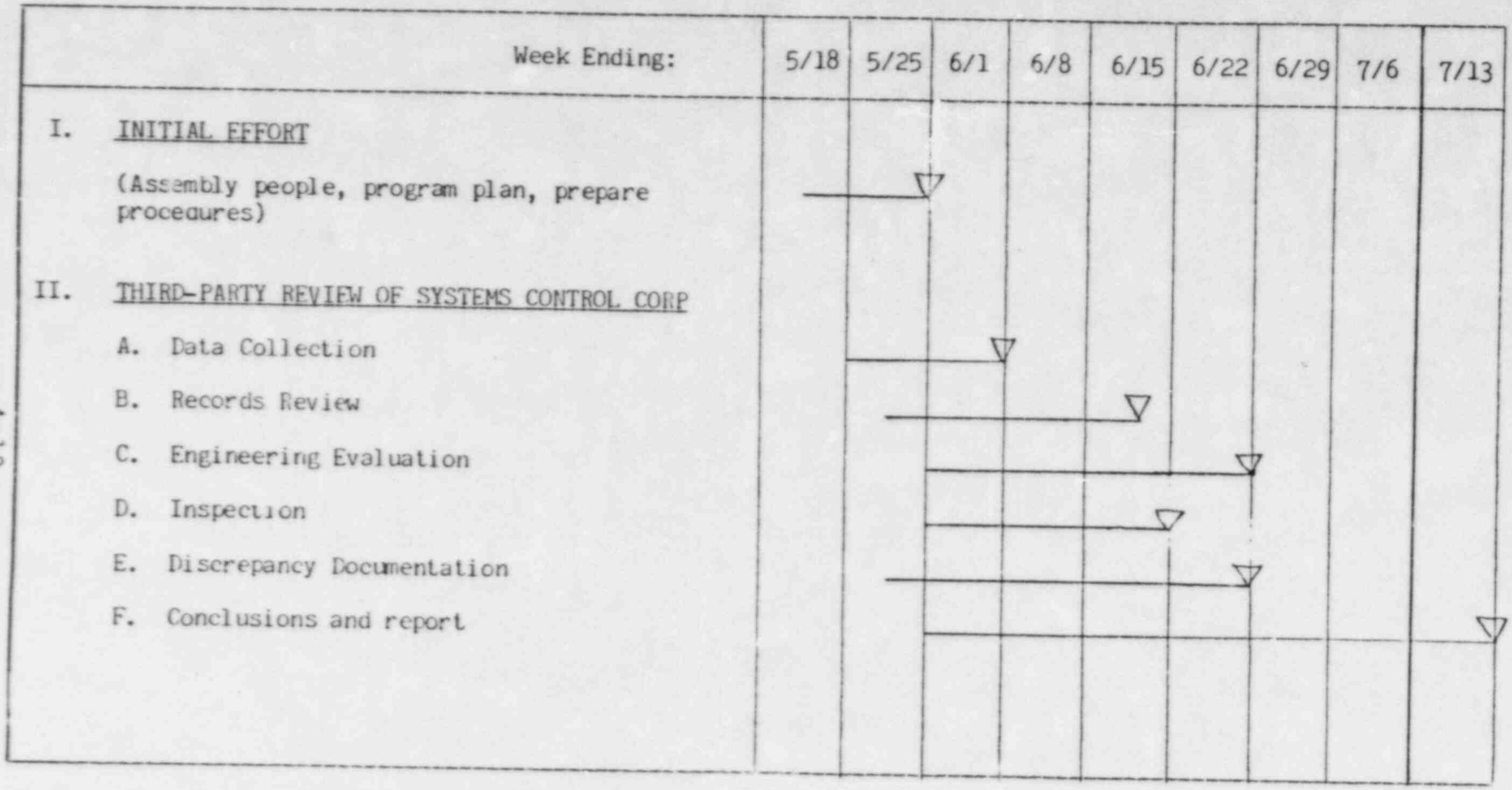

Figure 1

CROSS EXAMINATION

BY MR. CASSEL:

Q On page 17 of your testimony you indicate that Torrey Pines inspected one of the main control boards and found that out of 68 welds, 20 had discrepancies. Was that a visual inspection?

A Yes, it was.

Q No means other than visual were used?

A No, they're not. Visual inspection is the criteria to which these welds are accepted.

Q And the welds on this board at the time your inspector looked at them, was the paint still on them, or was the paint removed for this inspection?

A The paint was removed.

Q And that was on one main control board out of 12?

A That's correct.

Q On page 29 of your testimony, Answer 29, you referred to roughly 5500 safety-related cable tray hangers supplied by SCC. Do you know whether the actual number is the 5717 number in Mr. Kostal's testimony?

A I would accept that.

Q And your Torrey Pines review of this SCC equipment was strictly a hardware review that did not look at any questions concerning management, either at SCC or Edison QA with respect to SCC. Is that correct?

A That is correct.

MR. CASSEL: I have no further questions.

BY MR. WILCOVE:

Q Good afternoon, Mr. Johnson.

A Good afternoon.

Q This won't take too long. Turn to page 17 of your testimony. You give two definitions of weld discrepancies that have yet to be defined on the record. They are underfill and boxing. Let's start with underfill. Is that undercut or is it something else?

A No, it's something else. Underfill is a term that relates to a butt weld having less than required thickness of the weld, as opposed to a fillet weld.

Q And boxing?

A Boxing is I think another term has been used here before. It relates to bringing the weld around the corner when the weld runs out at the end of a member.

Q If you could turn to page 34 of your testimony, please, the paragraph that begins with the word, "Fourth" here. The sentence that says, "The components have redundant load paths available and do not depend on single welds for structural integrity."

You next state in the next sentence that some of the connections have two welds, am I correct?

A Two or more, yes.

Q But some have two, right?

A Two is the minimum I think we've seen.

Q Now, in that situation if a weld were missing, then the connection would depend on one weld for its integrity, would it not?

A That's correct.

Q So would it be more accurate to say that the components have redundant load paths available and do not depend by design on single welds for structural integrity?

A That's one way to say it, yes.

The other thought with respect to the single welds is that in most cases generally there are more than two welds in a given connection, and there's more than one connection for a given load path.

Q Now turning to page 39 of your testimony, look at the second paragraph where you state that your conclusion as to the adequacy of the trays finds further support in the results of various cable tray inspections. I'm having a hard time reconciling that statement with your statement on page 37, Question and Answer 33, where you state that discrepancy report 003 was prepared to document the lack of inspection records on most cable trays?

A Yes.

Q Could you reconcile those two statements?

A Certainly. The statement on page 37 is correct.

There's not a complete and precise inspection record on cable trays. They were generally accepted by lot rather than individual cable trays. The statement on page 39 is based on the fact that of the inspection records that do exist, the discrepancies that have been identified are consistent with the discrepancies that have been identified on other SCC-produced hardware.

Q So it's just basically a question of what you have there for what it's worth lends a certain amount of support.

A Yes, or to say it in a negative manner, there is no evidence that there's anything different on cable trays than there is in the rest of the SCC hardware with respect to weld quality.

Q I believe you also mentioned in your testimony when the records and the data were gathered for Torrey Pines review, no documentation generated by SCC was included.

A No inspection documentation, that's correct. We did look at some SCC documents; their drawings, their QA Manual and their welder certification and qualification documents.

Q Could you tell us why the inspection documents were not used?

A It was our understanding coming into this review that there was a significant question on the accuracy of

SCC documentation in the inspection area, and so we structured the review to not use that documentation.

MR. WILCOVE: That's all I have, Mr. Chairman.

MR. GALLO: Judge Smith, I neglected to ask the witness one or more questions with respect to three items in his testimony where he indicates that his group at Torrey Pines has yet to complete a review of certain Sargent & Lundy evaluations. The evaluations, as I understand it, are now complete and I'd like to clarify the record if I could at this point.

FURTHER DIRECT EXAMINATION

BY MR. GALLO:

Q Mr. Johnson, the first one is on page 22, and it's Answer 22. As I understand it, you and your group were reviewing a recent evaluation by Sargent & Lundy concerning DC fuse panels. Is that correct?

A That is correct.

Q Has that review been completed?

A Yes, it has.

Q Can you indicate for me and explain, first of all, what was the subject of review, and secondly, how was the review conducted by you and your organization.

A The review that is the subject of this question related to a DC fuse panel where some stitch welds at the cross brace were determined to be missing in an inspection that was performed. Sargent & Lundy did a finite element analysis of that structure, excluding the welds that were missing and determined that structure to be adequate for design use.

Our review generally of engineering analyses involves determining the requirements in terms of the configuration of the component's location in the plant, the specifications relating to the component in terms of design allowables, in terms of material allowable stresses, in terms of required loads, both in static loads and in seismic load criteria, and we review the inputs to an analysis, we review the structure of an analysis, whether it's appropriate for the subjects that are being addressed; we review the reasonableness of the output of the analysis.

If it happens to be a hand calculation we make checks for the accuracy of the math, and we review the conclusions that are drawn based on those outputs as to whether we agree that they're reasonable or not. And we did that on this analysis and found it was a properly conducted analysis.

Q That was the conclusion reached by Torrey Pines?

A Yes.

Q Does the Torrey Pines analysis of this particular Sargent & Lundy review change your opinion in any way as stated on page 20?

A No, it does not.

Q Next open matter, if I can call it that, is on page 28 of your testimony. Your Answer 27 refers to a recent Sargent & Lundy evaluation concerning local instrument panels.

Let me ask if you and your group have complete your review of this evaluation.

A Yes, we have.

Q Will you also explain here how that review was conducted?

end 21

T22MM/mml

A The structure of the review was the same as I just described for the previous one. The elements that we reviewed were the inspection results from the inspections that were done.

The comparisons that were made between the inspected panels and the seismically tested panel, and the finite element analysis that was run on the local instrument panel structure that confirmed that there were large margins in the panel.

And again, we found the analysis to be complete and accurate.

Q That, again, is a Torrey Pines conclusion, not --

A Yes.

Q Does this conclusion and the review you conducted of Sargent and Lundy analysis change in any way your conclusion as stated in Answer 25?

A No, it does not.

Q Last item is on page 41. Here it is indicated in your answer 36 that Torrey Pines is reviewing a recent analysis performed by Sargent and Lundy on cable ladder trays.

Can you tell me if that review has been completed?

A Yes, it has.

Q And again, how was that review conducted?

A Again the methodology was the same.

mm2

What we looked at was the analysis of the as-built welds on the ladder trays that was done by Sargent and Lundy. And they determined through that analysis that those ladder trays as built were sufficient to accept the design loads. And we confirmed that determination.

Q Again, does that change your conclusion in any way as stated in Answer 34?

A No, it does not.

MR. GALLO: Thank you. That concludes my questions as to those open matters.

JUDGE CALLIHAN: Mr. Gallo, with apologies, I may have missed something. While you are on that subject, near the top of page 29, there is a statement of Torrey Pines reviewing. Did you mention that?

MR. GALLO: Yes, I did.

JUDGE COLE: I thought you said answer 24. I thought you were referring to answer 26.

MR. GALLO: I hope that my first -- the three areas that I asked questions about involved questions on pages 17, 28 -- I'm sorry, 22, 28 and 41.

JUDGE COLE: Okay. So that would have been answer 36.

MR. GALLO: You are talking now about 41, page 41?

JUDGE COLE: Yes.

MR. GALLO: Yes. It is answer 36 on page 41.

mm3

JUDGE COLE: You said page 36.

MR. GALLO: If I said that, I stand corrected. Thank you.

JUDGE SMITH: I'm confused. What was the correction that just was made as a result of your dialogue with Dr. Cole?

MR. GALLO: Dr. Cole believed, and I am sure he is correct, that when I referred to answer 36 on page 41, that I inadevertently said answer 41, instead of answer 36.

JUDGE SMITH: I thought the dialogue related to the conclusion which appears in another answer other than 36.

MR. GALLO: The conclusion that I was referring to is on page 37. It is answer 34.

JUDGE COLE: That was correct then.

Forget that dialogue.

MR. GALLO: As I understand it, Judge Cole, the original dialogue that I had with the witness is correct?

JUDGE COLE: Yes.

(Laughter)

JUDGE SMITH: Based upon the revisions, do you have cross examination?

MR. CASSEL: No.

EXAMINATION BY THE BOARD

BY JUDGE COLE:

xxx

Q Just one question, Mr. Johnson. In characterizing

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your testimony here today, is it fair to characterize the work of Torrey Pines as a third-party independent review of the as-built components installed by Systems Control Corporation?

A Yes, I think so.

Q And any conclusions that you have drawn with respect to the adequacy for design use of those components referred to those components as actually installed in the plant?

A That is correct.

JUDGE COLE: Thank you.

BY JUDGE CALLIHAN:

Q One small clarification, Mr. Johnson, please.

On page 10, under Task A in your Data Collection, you remark, as was mentioned earlier, that you didn't look at records generated by System Control, and those are --

A The inspection records.

Q Inspection records. Correct.

Then your Task B, your Records Review, whose records were those?

A Those are all the records collected under Task A. And they come from many sources.

Q So, System Control is not included in it?

A No, they are not.

Q It is a trivial matter, but I wish to clear it.

mm5

Similarly, on a matter of records, page 19 you are talking about the fuse panel. You have the statement, "no weld inspection records were identified."

Then you immediately go into Wyle Laboratories. Just for clarification here, whose records there were not identified?

A On the rest of the SCC hardware, we generally found inspection records by PTL or Pittsburgh Testing Service, and that was not the case on the DC fuse panels.

Q by "identified" you mean you couldn't find them?

A Yes, sir.

JUDGE CALLIHAN: I notice Mr. Kostal is packing his suitcase. Before he gets out, I have some questions.

MR. KOSTAL: I wasn't packing, I was looking something.

(Laughter)

JUDGE CALLIHAN: You are perfectly free to go, of course.

(Laughter)

Does Sargent and Lundy do the analysis that Mr. Maurer talked about, the individual element analysis?

MR. KOSTAL: Finite element analysis? Yes, sir, we did the same analysis for the DC fuse panel as well as the local instrument panel. It is done in the exact same fashion as Mr. Maurer has done.

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JUDGE CALLIHAN: Thank you very much.

I'm sorry I interrupted your search.

(Laughter)

BY JUDGE CALLIHAN:

Q Towards the end, Mr. Johnson, on 39, you are talking about some stiffeners which may not be very important, but nonetheless we have heard the last ten days or so, that cracks in welds were truly no new item.

And you startled me a little bit when you said you found a couple of cracks and Sargent and Lundy analyzed t[illegible] and found they weren't significant.

A That's correct.

Q Can you clarify my confusion on that, please?

A I'm not sure I understand the question. We found two weld cracks on stiffeners on the cable trays and cable tray fittings that we inspected. They were on separate stiffeners; one was at the intersection of two stiffeners and it was a transverse crack where the two welds had run together and then cracked.

In that case, that crack would have no structural significance as far as the stiffener was concerned, because the stiffener welds were still there.

In the other case, there was a crack at the end weld on one stiffener, and we knew from previously reviewing the Sargent and Lundy analysis relating to, I believe, NCR 707,

mm7

that it was not necessary to have both welds at the end of the stiffener to retain the structural integrity.

And so that is the reason for the statement that they are not significant.

Q So it isn't really welds, per se, it is where they are that you have taken into account?

A Yes, sir.

Q Someplace in here you looked at some equipment that Wyle had tested. Is it sheer coincidence that the unit that Wyle tested has the most cracks or discrepancies?

A I think so.

When we make a selection of items to inspect, we try to cover a full spectrum of variables. And one of the things we wanted to do was make sure that we looked at the unit that had been seismically tested. And, it just happened that the welds we looked at on the unit had some discrepa on it.

Q You don't associate that with the shaker table?

A No, it relates to the welding, not the seismic tests.

JUDGE CALLIHAN: Thank you. That is all I have.

JUDGE SMITH: Mr. Gallo?

MR. GALLO: No redirect.

JUDGE SMITH: Any other questions?

MR. CASSEL: A couple of short followups, Judge.

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FURTHER CROSS EXAMINATION

BY MR. CASSEL:

xxxx

Q Mr. Johnson, of the various types of equipment supplied by SCC to Byron, you have indicated in response to a question by the NRC Staff attorney, there was a lack of inspection records on most cable trays.

And, in response to a question by Judge Callihan, that there were no records concerning DC fuse panels.

On page 34 of your testimony, you also indicate that the inspection results do not provide a complete inspection history of Byron cable tray hangers.

Is there any incompleteness in the records with respect to the cable tray hanger inspection similar to the other two that you mentioned?

A No. There are inspection records on cable tray hangers.

What we would have liked to have seen in the inspection record is a documentation of specifically which hangers were acceptable, as well as which hangers were found to be discrepant. That was not in the inspection record, and so it was not possible for us to trace a previously accepted specific hanger to a later point in time.

There were inspection records on the hangers. The statement here relates to preciseness of those records and being able to trace specific hangers through the inspection mm9 ±

path.

Q So there was not a specific inspection record for each particular hanger?

A I'm not sure how you mean that.

There were shipments of hangers made, and it was recorded which specific hangers were in that shipment. And, large portions of those shipments were quite acceptable, or those inspection lots, if you will. So, in that context there was a record for specific hangers that were acceptable.

Q It may be in your testimony and I may have miss- it, but we have now talked about the records on cable trays, cable tray hangers and DC fuse panels.

What was the situation with regard to the records on local instrument panels?

A Local instrument panels had a complete inspection record.

end 22

Start 23

Q And by complete inspection record, you mean all the welds had been inspected and there was a record as to whether the welds were found to be discrepant or not?

A There was a record of inspection on each panel and indications if there were any discrepancies identified.

Q Is the same true for main control panel?

A Yes.

MR. CASSEL: No further questions, Judge.

JUDGE SMITH: Is there anything further?

mm10

MR. WILCOVE: I have nothing.

JUDGE SMITH: Mr. Johnson, thank you.

(Witness excused)

JUDGE SMITH: We will take a ten-minute break at this time.

xx

(Recess)

SYmgc24-1

JUDGE SMITH: Mr. Miller?

MR. MILLER: Judge Smith, as I informed the Board off the record, I have a personal emergency, and I am going to have to leave the hearing. But before I do, I would like to make a statement for the record.

When Mr. Marcus completes his cross-examination, the Applicant will have put on its complete case with respect to the reinspection program, Systems Control Corporation, and the other issues that were identified in the Board's prehearing conference order and the Appeal Board remand.

I realize that the Licensing Board has been inundated both with prefiled written testimony and, of course, with the cross-examination that has taken place over the last few weeks. Nonetheless, on behalf on Commonwealth Edison Company, I ask that the Board consider whether, in accordance with Paragraph 5(g)(1) of Part II, that is Appendix A to Part II, that if there is additional information which the Board wishes on any issues to which there has been testimony already educed or as to issues which the Board, on its own, feels requires further evidentiary presentation, without meaning to sound impertinent at all, I would like to suggest that perhaps sometime late next week, we might have -- or early in the week following, we might have a conference call to discuss that subject.

mgc24-2

I want to make certain that Commonwealth Edison provides the Board with the information that it needs, so that it can reach a decision on this important matter. If there are gaps in what we have presented or further matters as to which the Board wishes information, we want to present that information to the Board.

I know from the depositions that Commonwealth Edison Company has taken of the Intervenors' experts that unless those gentlemen do not appear for some reason, that in all likelihood we will call at least one expert witness on rebuttal, but that's still at a somewhat preliminary stage. We will make every effort to have prepared written testimony for that person in shape to deliver to the Board and parties prior to the resumption of the hearings on August 20th.

JUDGE SMITH: I don't know if you're going to be able to have a conference call before we resume the hearings. I don't know if we will be able to have an effective conference call before we meet again here on a subject matter of such substance. Nevertheless, notwithstanding the part of Appendix A to which you cite, the Board is -- as to which I have my doubts about the relevancy -- the Board is sympathetic to the purpose of your request, and we certainly will try to accomodate you.

MR. MILLER: Thank you.

gc24-3

MR. CASSEL: Judge, is it appropriate at this time to inquire concerning the identity and subject matter of the rebuttal witness' testimony?

MR. MILLER: Well, I will tell you that we have not -- I have not met the person who I believe will be our expert witness in rebuttal, and until I do so, I really think it's premature. As soon as we make a determination, I will inform you of his name and the general subject matter of his testimony.

MR. CASSEL: That's fine.

JUDGE SMITH: All right. Mr. Miller, I presume since there's a chance that we will finish tonight, I presume we won't be seeing you again during this session, obviously. So at this point, I want to take a moment.

Is there going to be a two-week hiatus? I expect that perhaps there will be some effort made toward preparing proposed findings on this session that has just transpired. I would appreciate it if the counsel for the Applicant could prepare an organization -- or a table of contents or whatever you wish as to which your proposed findings will take and circulate it with Mr. Cassel and counsel for the Staff toward the end that the proposed findings follow the same organization.

It's much easier, much more efficient, and it is better for the parties if the proposed findings match

mgc24-4

the Applicant's proposed findings. They have the burden, but I can find your points much better if there is similar organization, if you follow the same table of contents. There will be less chance that a point that you want to make will be overlooked.

MR. CASSEL: I agree. That sounds good.

JUDGE SMITH: And then the way we have proceeded in the past is simultaneous findings. The parties, in the interim, might explore the possibility of having serial findings, so that findings with which you agree don't have to be decided unless we see the need to. You see, if you have to start fresh and start your proposed findings for the whole case, as opposed to serial prepared findings, we don't know where you are in agreement and where you are not.

MR. CASSEL: What I think might work out, Judge, is simultaneous findings, but counsel could get together and hopefully stipulate to a lot of this stuff. We do it all the time in findings and pretrial orders that you have to do for federal cases. I think that would be more efficient, rather than have one party commit to all kinds of things.

JUDGE SMITH: Well, what I was going to suggest is that during the interim you explore a method by which that result could be accomplished.

MR. MILLER: We will do that.

mgc24-5

JUDGE SMITH: Because it seems to me that as the evidence unfolded, there were many areas where stipulations could be entered into.

MR. CASSEL: Judge, one other question, and I don't mean to keep Mike for this, if you don't need to,

Do you have any sense of the timing? If we can assume that the August 20 hearings will conclude that week -- do you have a sense of how far beyond that or by what date following that week you would want to have all proposed findings?

JUDGE SMITH: Well, we will want to hear from you on that, what you feel your proposed findings burden is, you know, how much remains in dispute that has to be submitted in proposed findings.

Other than that, we will probably look at the regulations and cut some out of that.

MR. MILLER: Judge, I would hope that -- and we are shooting to get our proposed findings to the Board within two weeks after the record is closed.

JUDGE SMITH: Well, that would be very, very helpful.

MR. CASSEL: Off the top of my head, Judge, that sound like a reasonable timeframe, something along that order. To me, I don't know, the Staff has more experience in these things than I do.

mgc24-6

JUDGE SMITH: Well, we can give more time to --

MR. LEWIS: My experience tells me that you are being rash, Mr. Cassel.

MR. CASSEL: Well, it won't be the first time.

JUDGE SMITH: Well, that's why you want to explore the possibility of serial proposed findings. That could relieve your burden a great deal, and also you could take the approach that you don't have to propose findings on anything that does not remain in dispute.

But it might just save everyone a lot of work if you just thought over the two-weeks hiatus as to a common organization in your approach and a method to accomplish that purpose.

Mr. Miller, go ahead.

MR. MILLER: Thank you.

(Mr. Miller leaves the hearing room.)

JUDGE SMITH: Mr. Marcus has been sworn.

Whereupon,

GEORGE F. MARCUS

resumed the stand and, having been previously duly sworn, was examined and testified further as follows:

DIRECT EXAMINATION

BY MR. GALLO:

Q Mr. Marcus, would you state your full name and address for the record, your business address for the

mgc24-7

record, please?

A George F. Marcus, and I work in the Quality Assurance Department, Commonwealth Edison General Office in the Marquette Building in Chicago.

Q Did you prepare testimony for this proceeding?

A Yes, I did.

Q I have in front of me, Mr. Marcus, a document entitled "Testimony of George F. Marcus," consisting of eleven pages and Attachment A, and ask if that is the testimony that you prepared for this proceeding?

A Yes, eleven pages and Exhibit A.

Q In this proceeding, we call them attachments.

A Okay.

Q Mr. Marcus, are there any corrections or additions to your testimony?

A No, there are not.

Q Is it accurate and complete, to the best of your knowledge and belief?

A Yes, it is.

MR. GALLO: At this time, Your Honor, I would like to introduce into evidence the testimony of George F. Marcus and have it bound into the transcript as if read.

JUDGE SMITH: Are there objections?

MR. CASSEL: No objection, Judge.

mgc24-8

JUDGE SMITH: The testimony is received.

(The prepared testimony of Mr. George F. Marcus, with attachment, follows.)

mgc24-9

MR. GALLO: The witness is available for cross-examination.

JUDGE SMITH: Mr. Cassel?

CROSS-EXAMINATION

BY MR. CASSEL:

Q Mr. Marcus, without going into all the specifics discussed -- well, let me backtrack.

You are familiar not only with your testimony, but also with the Staff's testimony on this matter and with the recent Staff Report 84-32?

A Yes, I am.

Q Without going into all the details of the problems that there have been in terms of inspections being done and records being kept and all of that that is laid out in detail in all three of those documents, can you explain to us, in your view, what was the cause of all this series of problems with respect to recordkeeping and inspections related to SCC?

Was there some lapse here on the part of Edison's QA organization?

A Your question is referring to Inspection Report 84-32, the one we just received this week?

Q Well, that, plus the matter is discussed in your testimony and the Staff's testimony on this subject.

A My testimony is primarily directed at the

mgc24-10

response that we gave to the Nuclear Regulatory Commission in conection with their Inspection Report 80-04. We made certain statements regarding commitments in connection with source inspection, procurement and System Controls, and we made certain statements regarding activities that had transpired in the eleven months previous to the date that we wrote the response. That was the extent of my testimony.

Q Well, in addition to that, as you know, the Staff report discusses the representation that no purchases had been made since 1978 from SCC and none would be made, but, in fact, some were made. It discusses the fact that SCC was removed from the approved bidders list in January of '84, but nonetheless further purchases were made.

It discusses some of the points that you cover as well in terms of inspections that Edison thought were being done by somebody, but it turns out they weren't.

I believe you were here during Mr. Johnson's testimony when he indicated that inspection records for a number of items were not present. This whole concentration of problems relating to SCC, doesn't it indicate that there was some lapse on the part of Edison's QA organizatin or Edison's management with respect to SCC?

A It's a very large overall question that you are asking, and I can break it down into some pieces, and

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maybe put some perspective on that, if you would like me to do that.

In connection with the concerns about source inspections, in our response to the Nuclear Regulatory Commission, we made the statement in January of 1981 that all shipments from Systems Control, all shipments, would be source inspected. Those were the exact words, and that is exactly what Edison did. We had source inspections performed on all shipments, and I think the exhibit or the attachment to my testimony demonstrates that point.

Also at that point in time, 1981, we made statements regarding source inspections that had been conducted since February of 1980. The statements that we made were inaccurate to some degree. The statements said that we had -- that Commonwealth Edison had inspected all equipment shipped since February of 1980. Clearly, we had never intended to make that statement, because our program does not consist of either on-site or off-site inspecting of all items.

What we had clearly intended to say was the same content that was in the second part of that statement, which was that we had inspected all shipments since February of 1980. So there was a difference in intent and interpretation of what we were trying to communicate and what actually came out in our response.

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Be that as it may, I did review the accuracy of even the intent of our statements since February of 1980, and even looking at the intent, we did not fully represent correctly what had happened.

We did in regard to instrument racks or Spec 2809, and since February of 1980, there were shipments of instrument racks totalling 53 racks, and all 53 racks were source inspected.

I feel that one of the reasons why we were correct for instrument racks is that the citation we were responding to, the general thrust of it dealt with instrument racks. Our failure to do a proper -- to do proper inspections for racks which were received at the Byron Station in 1979, I talked to the people who were involved in preparing and reviewing the response, I talked to the cognizant people at the site, and it was clear to me that the impression that they had in their minds is that they were talking about instrument racks and not talking about the total population of types of items shipped by Systems Control since 1980. And I suspect that was one of the reasons why the source inspection was complete for instrument racks -- almost complete for hangers. There was only one hanger shipped since February of 1980 until the time we prepared our response -- but it was inaccurate in regard to cable pans, because there were ten shipments

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of cable pans, and we had performed source inspections on six of those shipments.

In regards to the main control boards, there were four shipments of seven boards, and I could not arrive at the reason why that statement in our response to the NRC was inaccurage.

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Q Without going down to all of them, you don't see a common thread tying all these problems with regard to SCC together; you think there's a different explanation for each individual problem?

A I think there's a whole variety of things, of situations that occurred with Systems Control that are unique to Systems Control as a manufacturer. Clearly, since we began we've issued our purchase orders to Systems Control as early as 1977. There were times when our Edison program did not completely do what it was required to do.

There were more occasions when the Systems Control program was not adequate. Actually, there were, in my mind, three significant times when the Systems Control program sufficiently broke down that we had to take very significant corrective actions.

In tow of those cases I believe the Commonwealth Edison Company program was adequate to identify those problems, to report those problems and to take very responsible corrective actions.

In retrospect, in those two situations I feel that the corrective actions probably could have been even more stringent than what they were. But certainly, the Commonwealth Edison Company QA Program worked in identifying the problems and taking corrective action.

The case in 1979 when the instrument racks were received onsite and they had numerous defects, deficiencies, discrepancies as we were reported today, in that case I feel that our Edison program did not totally perform as it should have. It was deficient in the sense that at that point in time, our receiving inspection activities, which were being performed by our Construction Department, were not adequate at that time to identify the problems with the AWS welding.

Also, our program at that time broke down in the regard that we do have a vendor inspection point program where we are notified of shipments by the vendor, which gives us an opportunity to go to the plant and examine the equipment before it is shipped our site.

When those potential inspection points are called in the review is to be made by our construction people, and if the inspection point is to be waived, concurrence by the Quality Assurance Department is required. And that sequence of events did not take place.

So in regard to our failure to really properly implement the inspection point program at that point in time and to perform inspection sufficient to identify the problems, I would say that our Commonwealth Edison program in that regard did break down.

Q What about the continued purchases through reorder forms after SCC was represented first in Mr. Reed's 1981 letter to the NRC not to have been the subject of any purchases since 1978, and even after January 1984 when Systems Control was removed from the approved bidders' list? What is the explanation for how those occurred?

A There again, it was a matter of semantics and intent of what our corporate management really intended to do in January of 1981.

At the same time that we responded to the Nuclear Regulatory Commission -- wehave on record the letter from our corporate managers of engineering and quality assurance clearly stating the Edison position that we are to make no further procurements from Systems Control but that change orders to existing contracts would indeed be allowable.

That letter was written in January 1981, within two days of the same letter which we prepared in response to the Regulatory Commission. Our intent always was to issue change orders to existing purchase orders. We were not taking action to remove them from all procurement as such. It was a limited form of action, so to speak.

However, in our response to the Regulatory Commission the people drafting the response had in their minds the awards which we made to Systems Control for specification type purchases, which are major procurements identified by specification numbers.

The last such purchase had, indeed, been awarded to Systems Control in 1978. I can say that there was a communication problem. It was clear in our minds corporately what we had intended to do. The response did not reflect that accurately.

Q What is the normal meaning of the removal of a vendor from the approved bidders' list? Would that normally be inconsistent with further purchases from that vendor through amendments to purchase orders?

A At the time that we took the steps to say that we should have no further procurement from Systems Control -- the letter was written in 1981 -- the clarity of what that meant did not exist. It was not written down in any particular form. It was a letter that made that statement internally at the corporate level, but it certainly was not clear for all the different aspects of which we are allowed to make purposes.

In January of this year, when the issue of Systems Control was brought up as a result of this proceeding, it became clear to us that we should take an action to remove Systems Control from our approved bidders list. Even at that time the clarity of exactly what that meant was not specifically spelled out in corporate documents.

I can give you an example. If they are removed from the approved bidders list, does that mean that, indeed, you can accept shipments of materials which were purchased prior to their removal date? That was not clear.

What happened with Systems Control caused us to corporately establish a very clear policy as to exactly what that meant. And that has been done.

Q Has there since been articulated a policy about the impact of removal from the approved bidders list on amendments of existing purchase orders, or additions to existing purchase orders?

A Yes, that policy is now clear.

Q What about the problem with the documentation for inspections of cable tray hangers? Is that something that you have any knowledge of?

A I heard that discussion in the last testimony that was up here. I am not sure that all of the items were sorted out.

For example, Systems Control has performed inspection of cable tray hangers at their plant in Iron Mountain, Michigan.

Q I don't mean to interrupt, but could I just clarify? I'm not talking now about the SCC inspections. I believe the earlier witness stated that he was deliberately not looking at those. I'm talking about the inspections by PTL and either Edison or its contractors, other than SCC.

MR. GALLO: I'm going to object to that as beyond the scope of the witness' direct testimony.

MR. CASSEL: It's not specifically addressed in his testimony but it does seem to me to be part of the whole pattern here, and if the witness is familiar with it, I think it fits in. If he's not familiar with it, then I would agree with Mr. Gallo that it's certainly beyond the scope.

JUDGE SMITH: It's your option, Mr. Gallo if you don't want the examination.

MR. GALLO: I will withdraw the objection at this point.

THE WITNESS: In regards to Systems Control, we had performed audits -- or let me clarify that. In regards to inspections of hangers for cable hangers we had performed audits at the construction site within the last 18 months that demonstrated that it was necessary to improve our audit-keeping records, or to have our contractor improve their records for inspection of cable tray hangers.

A program was undertaken to sort that data out that existed, identify which hangers indeed had proper inspection reports and which did not. This was a large volume of information. It was formulated in a way that could be processed on word processing machines so we would have good access to that type of information.

I believe at this point in time that we could produce inspection records for the electrical cable pan hanger installations at the Byron site. Whether those records reflect all the information that was needed by the independent third party to evaluate for their purposes is another question. I think it satisfies our purposes that those items were, indeed, properly inspected.

Q And has that program that you referred to now been completed?

A I believe it is complete, yes.

Q Mr. Johnson also indicated -- and again, only if you're familiar with this area because it is beyond what you testified to in your direct testimony -- that there were no weld inspection records for DC fuse panels. Is that a part of this same program that you just described, or is that something different? If you know.

A Here again, I think you would have to qualify that question because the DC fuse panels were manufactured by Systems Control. Inspection records for the welds in those panels -- if you're talking about the fabrication welds -- would be at the Systems Control plant.

Q I'm sorry, you're right. My question wasn't clear. I'm referring to inspections by PTL, or anyone on Edison's behalf other than SCC. I believe the witness's testimony was that he deliberately did not look at SCC's records, and therefore, when he says no weld inspection records were identified he meant other than SCC.

A The DC panels delivered under Spec 27-88 main control board specification, -- in my testimony I indicate that PTL -- that we did not do source inspections on that type of equipment. That is the thrust of my testimony. So those records would not exist in detail. The source inspection records would not exist.

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Q And the source inspection, of course, was done by PTL prior to -- in those cases where it was done, the source inspection was something PTL did at the SCC plant prior to shipment at Byron?

A That's correct.

Q Is it also your testimony then that there was no inspection of the welds on DC fuse panels once the material arrived at Byron?

A I cannot answer. I don't have information to answer that question.

Q Finally, on this line of questioning, the prior witness Mr. Johnson, also testified to the lack of inspection records on most cable trays, again referring to records other than SCC's own records.

Do you have any knowledge of why that occurred?

A I'm not sure what records he is referring to.

Q Well, were there -- see, we are talking about cable trays here. Once cable trays arrived at Byron, do you know whether there were any inspections of the welds done for those cable trays?

A For the cable trays there are receiving inspections which are performed at the site and all shipments of cable trays have receiving inspection records. The answer is, yes the records exist.

Here again, the detail of the information that is

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required by Mr. Johnson in his study may not be sufficient in our records for what it was that he was looking for.

Q Isn't the main purpose of receiving inspection, an inspection for shipping damage?

A That is one of the purposes, yes.

Q In Mr. Reed's January 26, 1981 letter which we have been discussing -- and if you want to look at this, let me know -- but attachment A to it, which is Edison's Response to Notice of Violation discussed in that letter, states on page 2:

"The site receipt inspection performed by the project construction department was primarily an inspection for shipping damage."

Do you want to see the letter before --

A No, I am familiar with it.

Q Okay.

Is that an accurate statement?

A Yes, it is.

Q So it would have been normal then for a receiving inspection on these cable trays to be looking at weld quality in the way that a QC inspector would be looking at weld quality?

MR. GALLO: I am going to object at this point.

I permitted, perhaps in error, an excursion from the direct testimony of the witness. Mr. Cassel is now

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carrying it well beyond a few questions, and I object to any further questions along this line.

MR. CASSEL: I don't think it is that important, Judge.

JUDGE SMITH: That is probably true for the basis for it. I don't think you counted on receiving information that you needed.

MR. CASSEL: It is not that important, Judge.

BY MR. CASSEL:

Q Mr. Marcus, in your testimony on the bottom of page 4 in answer 6, you talk about receiving inspections. And you indicate that the company's intent in the 1981 letter to just do a sample source inspection on each shipment is consistent with your practices on receiving inspections.

Isn't the purpose of the source inspection very different from the purpose of the receiving inspection, namely that the source inspection is really to look at the quality of the manufactured product, whereas the receiving inspection as Mr. Reed's letter states, is primarily to check for shipping damage?

A I think it is important that I clarify this point on the shipping damage.

In our response, in January of 1981 -- up to that point in time, project construction enginner did receiving inspection,and the thrust, the major thrust of that inspection was for shipping damage.

Since that time, however, we have revised our receiving inspection program and our receiving inspection goes far beyond that. Not only is the material offloaded for shipping damage, it is inspected by the project inspection engineer who has a full-time basis inspector examining the material for quality.

And then the quality assurance engineer is required to overinspect once again.

So, there is three levels receiving inspections that have been in effect since January 1981.

Mr. Reed's comment was referring to what had primarily existed up to that point in time.

Now, in regards to the question on the bottom of page 4, our source inspections and receiving inspections accomplish approximately the same thing. Generally, when we do source inspections there is a reason for it, and we tend to go into more detail while the person is at the plant dedicated to that work activity.

But, our standard practice would not require that an inspector, if he were looking at a box of 5000 bolts, to look at 5000 bolts. Nor, would anyone expect him to do that.

There are sampling approaches that we use when the shipments become very large. For the smaller shipments,

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generally all items are inspected. The larger shipments it is done on a sampling basis.

Q On attachment -- following up on that, on attachment A to your testimony, you list all the source inspections for the SCC shipments since -- I guess the earliest one there is March of 1980. There are a number of these shipments, are there not, including all of those under the heading of control boards, 4 of those under cable pans, and one under hangers, for which no source inspections were done, even though the number of items involved was quite small?

Two control boards, one control board, one hanger, et cetera.

A Mr. Cassel, the purpose of my testimony was to demonstrate that exact point. We missed those. That's why I tabulate them that way.

end T26

MR. CASSEL: I have no further questions, Judge.

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CROSS-EXAMINATION

BY MR. WILCOVE:

Q Mr. Marcus, turning to -- let's focus on the time period, May of 1980 through January 26, 1981, the day the letter was sent.

Your responsibilities were not Byron-specific, were they?

A No, they were not.

Q How many plants did you have under your responsibility?

A 1981, I had LaSalle, Braidwood, Byron. I had the Station Nuclear Engineering Department, the quality assurance engineering activities in that department, the Operational Analysis Department, Systems Materials Analysis Department, Purchasing, Station Mechanical Engineering Department, the quality assurance activities for all of these areas.

Q And at the time, were your energies expended more towards one particular plant or plants?

A At that point in time, we were in the process of licensing and loading fuel at LaSalle, and it was probably -- from my point of view, that was where the preponderance of my efforts were directed.

Q So Byron at that time was down on the totem pole?

MR. GALLO: Objection. I'm not sure that the

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question isn't perjorative. It needs clarification from the point of view of this witness' work time and effort.

MR. WILCOVE: I will agree that that was not the most artfully phrase I've ever asked in a licensing proceeding.

BY MR. WILCOVE:

Q But in terms of your time and effort spent, was Byron relatively far down on the list?

A I would say the priorities of my time were directed specifically at the fuel loading and licensing at LaSalle Power Station.

Q Page 9 of your revised testimony, you state in the second paragraph that the Project Construction Department prepared the first of the response, with possibly some input from Site Quality Assurance.

When you say "prepared the response," I can think of a couple of things that could mean, one being that they were involved in the decision-making process to determine what steps would be taken to respond to the item of noncompliance, or it could be more of a scribe activity in which the decisions had been made and this organization was just going to prepare the letter or write the letter.

Which one of those was it?

A The subject of who prepared the response, how all

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the words got there, I spent a good deal of time trying to analyze that. As near as I can tell, the first draft ascribing, so to speak, was performed by the Project Construction Department. However, the information that's in that draft, it's clear there should have been or would have been some information from the Quality Assurance Department, that the Project Construction Department could not put all that information in there by themselves, because the Quality Assurance Department had responsibility.

I believe the draft was prepared there, again with some input, whatever that input was from the Quality Assurance personnel.

On thing that is clear is that the reviews were by multi-departments, by a number of departments.

Q Were you involved -- first question -- were you involved in the decision-making process as to what should go into the letter?

A I was not.

Q Did you review the letter before it went out?

A Yes, I did.

Q When did you do so?

A It was transmitted to us in our corporate office, and I reviewed a draft down there.

Q And this would have been subsequent to its having been reviewed by site QA, probably?

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A Yes.

Q Turn to page 4 of your testimony. I'm going to talk a little bit more about your discussion of receiving inspection practices which had been in place for many years.

My first question is on page 5. You say it's consistent with industry practice, whereby sampling plans are used in performing receiving inspections.

By "industry," do you mean the nuclear industry or industry across the board?

A I'm referring to industry in general.

Q So that would be everything from nuclear power plants to Cabbage Patch Dolls?

A In general, yes.

Q And let's turn to nuclear power plants instead of Cabbage Patch Dolls.

With respect to the receiving inspection practices that are in place at the site, the ones you are talking about here, they would be documented, wouldn't they?

A I'm not clear what the question is. Are you talking about the procedure for how to do a receiving inspection?

Q As to how to do it and the scope of what should be inspected and how much.

A Yes. We have in our quality assurance program

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quality procedures that address the receiving inspection activity. In that procedure, it gives a general outline of what would take place in receiving inspections.

Q And, in turn, the inspectors would then receive instructions as to what to inspect and how much?

A Yes, that's correct.

Q And these instructions -- as a matter of fact, the inspector would have a form that he or she would have to fill out to say that the inspection be done, what discrepancies had been found , not found?

A Yes.

Q And these plans and instructions would be in place before the first shipment from the contractor is received, isn't it?

A Yes.

Q So that we're basically talking about the routine inspection practices that would go on just on a daily basis.

A That's correct.

Q So we're not talking about an inspection practice that might be instituted with respect to a specific problem that was discovered.

A Yes.

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Q You mentioned that you interviewed a number of the cognizant personnel who were involved in the drafting and the formulating of the January 26th letter. Who was in -- we'll start with the Site QA Department. Who did you interview?

A I interviewed the two quality assurance superintendents who had held the position at the point in time that the draft was being prepared. I also interviewed the cognizant quality assurance electrical engineers who were responsible for the electrical materials and equipment at that point in time.

I also interviewed -- that answers the question, I believe.

Q And these are the people who appear to have the overall impression with Commonwealth that PTL was at the SCC plant regularly in order to inspect all shipments?

A That's correct. Yes.

Q Turning to page 10 of your testimony, there's a statement that Site Quality Assurance issued a letter to PTL directing them to perform a final source inspection on safety-related instrument racks. Under whose signature would that letter have gone out?

A It went out under the signature of the site QA superintendent.

Q And this was one of the people that you interviewed, am I right?

A Yes, that's correct.

Q Just so the record is clear, this is a site superintendent who held that position at the time the letter went out, as opposed to the person who may be holding it now?

A Yes, that's correct.

Q Is the same person holding that position now as was then?

A No, it is not the same person.

Q When this person sent the letter, I presume a copy was retained onsite?

A That's correct.

Q Wouldn't there be some formal filing of this letter with the QA Department?

MR. GALLO: Objection. The question is vague, and also immaterial. I don't know where we're going with all this detail. The question had in it "formal filing." I don't know with whom or what that means. That's the vagueness objection.

The immaterial objection is I don't know what that kind of detail adds to the proceeding.

MR. WILCOVE: I'll tell you where I'm going. I'll just ask the question directly.

BY MR. WILCOVE:

Q I'll just ask the question of Mr. Marcus. Why couldn't the people that you interviewed simply have just checked the files to determine what PTL had been directed to source inspect?

A That's exactly what we did. We looked at all the documents associated with the directions and instructions given to PTL. We could only find this one letter that was written regarding instrument racks.

Q And, Mr. Marcus, you also suggest that replacement of Mr. -- is it McIntire?

A Yes.

Q McIntire with Mr. Stannish was a possible reason why the letter had the inaccuracies in it that it had. Did you discuss that with Mr. Stannish?

A Yes, I did.

Q And did he give that as a reason, that I just was new to the job, I was confused, I was overwhelmed with a lot of information? Is that what he said in form and in substance?

MR. GALLO: Objection. Let's let the witness indicate what was said instead of putting words in his mouth with the question.

BY MR. WILCOVE:

Q I said in form or in substance. Mr. Marcus can certainly qualify what I said.

JUDGE SMITH: He doesn't have to select from those options. Just answer it.

THE WITNESS: I talked at length with Mr. Stannish who currently works on my staff and has been there sometime at the corporate office. He recalls the draft; he does not recall the extent of his involvement, as he was new, coming into a new position. He was spending time with the previous superintendent and they were doing things simultaneously -- they were doing things together.

He doesn't recall the extent to which he participated in any information given in that letter, although he was aware of the letter. That's all he could tell me.

MR. WILCOVE: Mr. Chairman, could I have a moment, please?

(Counsel conferring.)

BY MR. WILCOVE:

Q One more point, Mr. Marcus and then I will be finished. You mentioned between February 1980 and January 26, 1981 one hanger was not source-inspected. Am I right?

A That's correct.

Q That was the only hanger that was shipped, wasn't it, in that time period?

A Yes, that's correct.

MR. WILCOVE: No more questions.

JUDGE SMITH: The Board has no questions.

MR. CASSEL: No recross, Judge.

MR. GALLO: May I have a moment, Your Honor?

(Counsel for Applicant conferring.)

MR. GALLO: No redirect.

JUDGE SMITH: Okay. You are excused, thank you very much, Mr.Marcus.

(Witness Marcus was excused.)

JUDGE SMITH: Messrs. Hayes and Connaughton.

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JUDGE SMITH: On the record.

We have arrived at an agreement that the Staff's testimony on information about the extent of corrective actions taken with respect to Systems Control Corporations equipment will be deferred until the resumed hearing, and possibly incorporated into the rest of the Staff's testimony.

Everyone has agreed to that.

MR.BECKER: Your Honor, I just want to get clear on the record exactly what the Staff's position is with regard to this testimony.

I infer from what your Honor has said, that at this point this testimony has been withdrawn. And I assume the Staff will inform us if they plan to refile it or some part of it as part of another piece of testimony?

MR. LEWIS: No. That would not be correct, Mr. Becker.

I expect that this testimony is a portion of the testimony that will comprise the totality of the Staff's testimony on Systems Control. Really, the only point we are making is that there is a rather artificial break between this testimony and the testimony of the NRC Staff which will not only discuss the historical matters, but will also contain our assessment of the evaluations that were received into evidence today. The Westinghouse evaluations, the Sargent and Lundy evaluations and any comments that we may

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have on the Torrey Pines evaluations.

And, simply because we felt that this matter -- that the particular subject matter of this direct testimony is very narrow, particularly since the inspection report which we have handed out goes into matters beyond this direct testimony, we suggested to the Parties that we might just simply put off the consideration of the matter until the next session.

I really am not insisting that the Parties refrain at that next session from asking some questions with respect to historical matters. I think that would be well within the bounds of what we would be permitted to talk about at that time.

I am not asking Mr. Cassel to waive any questions he may have on historical matters.

JUDGE SMITH: I am not sure I appreciate your concern, Mr. Becker.

MR. BECKER: I just wanted to get some clarification as to what to do with this particular document or piece of testimony; if we are going to see it again or we aren't.

I take it that we are.

JUDGE SMITH: We have got to see it again, or something like it.

MR. BECKER: Yes.

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JUDGE SMITH: Anything further before we adjourn?

(No response)

Well, this concludes this session and we are adjourned to meet again on August 20, 1984 at 2:00 p.m., I believe it is.

(Whereupon, at 4:25 p.m., the hearing in the above-entitled matter was adjourned, to resume on Monday, August 20, 1984 at 2:00 p.m.)

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CERTIFICATE OF PROCEEDINGS

This is to certify that the attached proceedings before the NRC COMMISSION

In the matter of: Commonwealth Ediscon Company (Bryon Nuclear Power Stations, Units 1 and 2)

Date of Proceeding: Thursday, August 2, 1984.

Place of Proceeding: Rockford, Illinois

were held as herein appears, and that this is the original transcript for the file of the Commission.

Mimie Meltzer
Official Reporter - Typed

Mimie Meltzer
Official Reporter - Signature

Suzanne Young
Official Reporter - Typed

Suzanne Young
Official Reporter - Signature