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Commonwealth Edison Company
Date: June 26, 1984

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 JOHN HANSEL'S TESTIMONY ON CONTENTION 1 (REINSPECTION PROGRAM)

I. John Hansel is employed by Evaluation Research Corporation as Division Director of the Energy and Environmental Sciences Division, and as Deputy to the President.

II. The Byron Reinspection Program was initiated to assess and determine the qualifications of QC inspectors employed by several construction contractors at the Byron Station. The data generated was also used as one basis for determining the quality of the construction work.

III. Mr. Hansel conducted an independent survey and evaluation of the Byron Reinspection Program. As part of his evaluation, he

A. held background discussions with Edison personnel and read background documentation;

B. selected five contractors for review: Johnson Controls, Inc. Hunter Corporation, Hatfield Electric Company, Powers-Azco-Pope, and Pittsburgh Testing Laboratory;

C. visited the plant site, reviewed Edison's direction to the contractors concerning the Reinspection Program, and reviewed contractors' responses and memoranda and the systems for recording reinspection data; and

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D. interviewed representatives for the five contractors and conducted sample basis audits of the contractors' records during which specified matters were reviewed and checked.

IV. Mr. Hansel evaluated all significant elements of the Reinspection Program with particular reference to Hatfield, Hunter and Pittsburgh Testing Laboratory. His conclusions are the following:

A. The inspector sampling plan was adequate to yield reliable results.

B. Reinspection of the first 90 days of each inspector's work was sufficient to evaluate inspector qualification.

C. The Reinspection Program contained adequate acceptance criteria for both objective (95%) and subjective (90%) attributes. In fact, the criterion for subjective attributes is conservatively high.

D. Under the Program, if an inspector's work for his first three months did not meet the acceptance criteria, an additional three months of that inspector's work was reinspected. If the inspector failed the additional three month period, he was considered unqualified and all his work was reinspected. In addition, the original inspector sample was increased by 50%.

E. Adequate provisions were made to assure that no inspector would reinspect his own work. Moreover, there were no patterns indicating the existence of a buddy system or any attempt to alter results.

F. Adequate measures were taken to assure that the standards, drawings and specifications used for the reinspection were the same as those used for the initial inspection.

G. Some work was not reinspected because it was categorized as either inaccessible or non-recreatable. These categorizations were properly made.

H. Mr. Hansel found no evidence of less rigorous inspection by QC inspectors of non-recreatable work or work soon-to-become inaccessible.

I. Third party Level III inspectors performed additional inspections of subjective attributes of visual weld discrepancies in order to assess the differences between the results of the inspections by the original inspectors and those of the inspectors performing the reinspections. This assured the accuracy of the final results.

J. Discrepancies discovered during the reinspections by Hatfield, Hunter and PTL were reviewed, evaluated, catalogued and dispositioned in accordance with established procedures.

K. Mr. Hansel has confidence in the engineering evaluation methods used by Sargent & Lundy.

L. The results of the Reinspection Program were accurately reflected in the February 1984 Report.

M. Mr. Hansel concludes that the results of the reinspection program provide a valid basis for drawing conclusions about the qualification of inspectors both overall and for specific contractors. He further concludes that, through the Reinspection Program, Edison has provided reasonable assurance that the QC inspectors who performed inspections at Byron were qualified.

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Testimony of Mr. John Hansel

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

A.1. My name is John L. Hansel. I am employed by Evaluation Research Corporation located in Arlington, Virginia. I am Division Director of the Energy and Environmental Sciences Division, and Deputy to the President. My duties include management of the Division which is involved in low-level waste management studies and technology transfer, energy conservation programs/studies, and energy management services for Oak Ridge National Laboratory and Bonneville Power Authority. I also provide consultant services to several utilities in the area of quality assessment and quality assurance. Similar services have been provided to the NRC, DOE and NASA.

Q.2. Please describe your educational background and work experience.

A.2. I received a Bachelor of Science degree in 1965 from

Rollins College (Winter Park, Florida) in Mathematics and Science, and a Masters of Science degree in Systems Management and Engineering from the Florida Institute of Technology in 1968. I am certified by the American Society for Quality Control as a Certified Quality Engineer. I am currently President of the American Society for Quality Control.

My professional career and work experience includes 30 years of experience in the quality control and quality assurance fields. For 27 of those years, I have been involved in large complex aerospace and energy programs. For example, I was employed for 14 years (1965-1979) with Rockwell International as Director of Quality Assurance of NASA's Space Shuttle Orbiter and the Apollo and Saturn Programs.

I served as a consultant to the Kemeny Commission in their investigation of the Three Mile Island accident. My task was to evaluate two components and one system to determine how much conservatism (margin) was included in the design. I was also asked to compare TMI with the aerospace industry to determine if certain advanced technologies in the assurance sciences were being used at TMI, i.e., reliability methods/tools, sneak circuit analysis, transient analysis, fault trees, etc. In 1983, I was also selected by the U.S. Nuclear Regulatory Commission to serve on an independent review panel, which was established to provide an overview

of a study conducted by the NRC and consultants to evaluate NRC's approach to quality and to recommend improvements.

I have also published several papers and am the author of the Quality Engineering Course for the American Society for Quality Control. A more detailed presentation of my professional qualifications is set forth in Attachment A.

Q.3. Are you familiar with the Reinspection Program conducted at Commonwealth Edison's Byron Station?

A.3. Yes, the Byron Reinspection Program is documented in a report, dated February 1984, and it was prepared by Commonwealth Edison Company. At the request of Commonwealth Edison Company, I performed an independent survey and evaluation of the Byron Reinspection Program, including its organization, approach and adequacy.

Q.4. Can you explain your understanding of the purpose of the Byron Reinspection Program?

A.4. The primary purpose of the Reinspection Program was to develop a plan to assess and determine the qualifications of Quality Control Inspectors who were employed by several contractors involved in construction of the Byron Station. This objective was met by reinspecting previous QC inspections

and by analyzing any discrepancies (differences between the original inspection and the reinspection) to determine what their significance might be. The data collected from this process was then used to draw inferences about the qualifications of the total population of inspectors on a contractor-by-contractor basis. The data was also used as one basis for determining the quality of the construction work.

Q.5. Why was the Reinspection Program initiated?

A.5. As a result of a Construction Assessment Team inspection which was conducted during the Spring of 1982, NRC raised a question concerning the adequacy of the Byron construction contractors' procedures for certifying their Quality Control Inspectors. In accordance with ANSI Standard N45.2.6. (1978), Commonwealth Edison initiated a Recertification Program beginning in June, 1982 to review and revise, where necessary, the contractors' procedures to comply with NRC's interpretation of this Standard. This action solved the immediate concern; but it did not provide assurance that the inspectors who performed the QC inspections prior to June, 1982 were qualified. Consequently, Edison developed and implemented the Reinspection Program to answer this question. The results of the Program and certain supplemental reinspections address the question of work quality at Byron.

Q.6. Please explain the manner in which you conducted your survey and evaluation of the Byron Reinspection Program.

A.6. As a first step, I held discussions in early February, 1984 with Edison personnel to gain an understanding of the problem and events leading up to the start of the Byron Reinspection Program. I read the background documentation dating back to June 30, 1982 to gain a good understanding of the Program.

I then selected five contractors for review. To assure a broad coverage of safety-related work, I chose contractors who had performed work on mechanical systems, large and small bore piping, electrical systems, HVAC controls, and process and instrumentation. The contractors were Johnson Controls, Inc., Hunter Corporation, Hatfield Electric Company, and Powers-Azco-Pope. The selection of these four contractors represented approximately 70% of all safety-related work. I also selected Pittsburgh Testing Laboratory, the independent testing lab/agency, to understand their role and interaction with other contractors.

I visited the plant site where I reviewed Edison's direction to the contractors concerning the Reinspection Program, contractors' responses and memoranda and the systems for recording reinspection data that had been established. I also reviewed the systems that were utilized for a weekly exchange of information between the contractors, Edison construction management, Edison Site QA and Sargent & Lundy.

Q.7. What was the focus of your review with respect to Hatfield, Hunter and Pittsburgh Testing Laboratory?

A.7. As was the case with respect to all five contractors, I interviewed representatives from each of the contractors mentioned and I conducted an audit of their records on a sample basis as follows:

a. I reviewed internal procedures documenting that the contractors' efforts on the Reinspection Program were compared with Edison's instructions to assure consistency.

b. I obtained copies of the rosters used to select the inspectors as candidates for reinspection. I checked the rosters for accuracy to determine what types of inspections the inspectors were certified to perform. I then made a crosscheck of these records against a random selection of personnel folders to verify that the inspectors were inspecting only those attributes for which they were certified.

c. I reviewed the roster of inspectors to determine if the selection was made in accordance with the sampling plan i.e.,

the first inspector and every fifth inspector thereafter. I also reviewed these lists to assure that additional inspectors were added if the sample size required expansion.

d. I reviewed the design requirements to be utilized for the reinspection to determine if, as provided in the Reinspection Program, the requirements were equal to or more stringent than those used for the initial inspection.

e. I reviewed the processes that were used to determine what inspections had been conducted by a specific inspector in his first 90 days of employment after certification. I conducted a sample audit of this process.

f. I reviewed the qualifications of a sample of those persons conducting the reinspections. I checked to verify that no one was reinspecting their own work. I also looked at the assignment of the reinspection inspectors to assure that an individual inspector's work was being reinspected by more than one inspector,

and that random assignments were being made.

g. I reviewed the contractors' records of the Reinspection Program to verify that accurate and verifiable records were being maintained.

Q.8. Have you completed your evaluation of the Byron Reinspection Program?

A.8. Yes. My evaluation of the Reinspection Program serves as the basis for my testimony.

Q.9. What is the purpose of your testimony?

A.9. My testimony addresses a number of issues concerning the Byron Station raised by the Appeal Board and the Licensing Board in their orders of May 7 and June 8, 1984, respectively. Specifically, I discuss my evaluation of the basic framework of the Reinspection Program, the methods used to implement the program and its results as applicable to the Hatfield Electric Corporation, Hunter Corporation and Pittsburg Testing Laboratory. I also address whether or not the integrity of the Reinspection Program may have been compromised because

the reinspections were conducted by the contractors' personnel, rather than by an independent organization.

Q.10. What aspects of the Program's basic framework did you evaluate?

A.10. I evaluated all of the significant elements of the Reinspection Program. I reviewed:

a. the method used to select the QC inspector candidates for reinspection;

b. the rationale used to select the portion of the candidates' work to be reinspected; and

c. the acceptance criteria used to determine inspector qualification.

Q.11. I will be asking you a series of questions about these three elements of the Reinspection Program beginning with the first item. What method was used to select the QC inspectors for reinspection?

A.11. The Reinspection Program covered the QC inspectors of eight contractors who were involved in construction work

at the Byron site. The inspectors for six of the contractors, including Hatfield, Hunter and PTL, were selected on the basis of a sampling technique. For these contractors the first and every fifth inspector thereafter were selected from a roster of inspectors. The roster for each contractor contained a complete list of the names of all inspectors employed on the job.

Q.12. Should not all of the QC inspectors have had their work reinspected rather than using a sampling technique?

A.12. No, a 100% reinspection effort was not necessary because a properly structured sampling plan will achieve reliable results. A sampling plan can be developed that permits sound judgments to be drawn with respect to the total population based on the sample results.

In this case, we are considering inspection repeatability or agreement between the original inspector and the reinspector. The sample of inspectors was selected on a random basis. The sampling plan was designed to include at least 20 percent of the original inspectors. This number was increased by the NRC. The selection of these additional inspectors included those whose work the NRC considered suspect. This combined sample was large and it provided a sufficient amount of data to draw reliable inferences about

the total population of inspectors. Moreover, an inspector was not selected as a candidate for reinspection unless he or she had participated in a minimum number of inspections. In such an instance, the next inspector on the roster was selected for the program. Based on these factors, I consider the sampling plan adequate to yield reliable results.

Q.13. Turning now to the second element of the Reinspection Program -- how much of each inspector's work was subject to reinspection?

A.13. The first 90 days of each inspector's work was reinspected. In other words, the inspections performed by the inspectors during the first 90 days of their employment were subject to reinspection.

Q.14. Is the first 90 days of work sufficient to evaluate inspector qualification?

A.14. Yes, it is. The first 90 days covers the time when an inspector would be most likely to make mistakes. He has just completed his training. He is new to the job and he still is in the process of learning the specifics of his new assignment. In other words, the inspector is still at the lower end of the learning curve. Therefore, a conservative bias was factored into this element of the Reinspection Program. The bias is conservative by concentrating the

reinspections during the period of time when the inspectors were most inexperienced. The result, contrary to Edison's interest, would reflect more discrepant inspections than would be the case if inspectors' work were selected for reinspection randomly from their entire work experience.

Q.15. Why select 90 days in lieu of a longer period of time, for example six months?

A.15. The same line of reasoning applies. The QC inspector is new on the job, and will be more prone to make mistakes early. The longer he is on the job, the better trained he should be. He will advance on the learning curve through experience and instructions from supervisors and other inspectors. If you were to select a six-month base, you would tend to make it easier for him to meet the acceptance criteria based on this learning process. Results from the later time period (three additional months) would tend to mask any problems and improve his chances of meeting the criteria. Conversely, a shorter period of time likely would not produce meaningful results because of the requirement that each inspector perform a minimum number of inspections.

Q.16. Turning now to the third element of the Reinspection Program -- what were the acceptance criteria used to determine inspection qualification?

A.16. The reinspection of QC inspections was divided into two categories, inspections involving objective attributes and those involving subjective attributes. For inspections involving objective attributes, the acceptance level was set at 95 percent, that is, 95 percent of the inspected work had to be determined acceptable in order to qualify the original inspector. The types of inspections included in this category, such as dimensions that should not change and verification of materials and shape, are repeatable and require very little exercise of judgment by the inspector.

For inspections involving subjective attributes, the acceptance level was set at 90 percent. These attributes were designated as subjective because they require the exercise of a great deal of judgment and interpretation by the inspector. Visual weld inspections are an example of this type of inspection.

Q.17. Do you believe these criteria were set at a proper level?

A.17. Yes. Both acceptance criteria were set high enough to identify any problem areas. In fact, the criterion for subjective attributes is high based on my experience. I was somewhat surprised that the level for subjective attributes had been set at 90 percent. There are usually too many variables involved and human beings are not nearly as predictable

as one might think in performing inspections. Studies have been conducted by human factors' experts in an attempt to fully understand and quantify the results that one should expect from subjective-type inspections.

In the 1960's, Drs. Harris and Cheney conducted studies to evaluate the repeatability of inspection results by different inspectors. The results of their work was published in 1969 in a book entitled Human Factors in Quality Assurance. They had a number of inspectors inspect the same hardware (with built-in discrepancies) in an attempt to correlate the results. Their studies concluded that an agreement rate of only 65-75 percent should be expected on a complicated piece of hardware containing many attributes. Although the hardware which was the subject of the Reinspection Program is less complex, I would have thought, based on these studies, that Edison nevertheless would only achieve agreement in 70-80 percent of the reinspections.

Q.18. What action was taken if the original inspector's work did not meet the acceptance criteria?

A.18. If the acceptance criteria were not met for the first three-month period, his work was suspect. In such cases the reinspection period was expanded for an additional three months. If the original inspector failed this

additional three-month period, that inspector was then considered to be unqualified and all of his work was reinspected. When this occurred, the original sample (number of inspectors who would have their work inspected) was increased by 50%. Edison selected additional inspectors who were certified in the same discipline as the inspectors who had failed. This practice allowed them to focus on areas where qualification was questionable.

If an inspector did not have inspections beyond that first three-month period, then the next inspector on the list was substituted. However, the reinspections conducted were maintained as a part of the overall data base.

Q.19. Are the results reliable in view of the fact that the reinspections of each company's inspectors were performed by personnel employed by the same firms?

A.19. Yes, Edison had provided specific direction to the contractors on this issue. Provisions were made to assure that no one inspector would be allowed to reinspect his own work. I questioned each of the contractors and I was assured in each case that they had taken steps to prevent this from happening. I also conducted a sample audit on a random basis to look for any inconsistencies and to determine if

any inspector had inspected his own work. I also looked for random assignment of the reinspectors. I did not observe any patterns that would indicate the presence of a buddy system or any attempt to game or alter the results. Due to the completeness of records and recording formats, I was able to review a large sample of the records. I did not observe any discrepancies in the records.

Q.20. Do you believe that adequate measures were taken to assure that the standards, drawings and specifications used for the reinspection were the same as that used for the initial inspection?

A. 20. Yes. Edison and the contractors took steps to assure that the engineering requirements used for reinspection were the same or equal to those used for the initial inspection. For objective attributes it was relatively easy to recreate the reinspection requirements. This was not the case for subjective attributes. Specifications had changed. The training and inspection checklists used for the initial inspections had been developed to an earlier set of engineering requirements. Additionally, in several instances the contractors were unable to produce copies of the initial set of requirements or checklists. I found one case where they could not clearly identify the appropriate criterion. In that instance, a current interpretation was applied by Hatfield for cable pan

configuration. Where it was not possible to reproduce the initial engineering evaluations or if questions were raised concerning the applicability of those requirements, the contractors utilized current requirements. In general, I found the current and original engineering requirements to be similar and as rigorous as their predecessors.

Q.21. Were all categories of work reinspected?

A.21. No. Some work was not reinspected because it was either inaccessible or non-recreatable.

Q.22. Was the work properly categorized as either inaccessible or non-recreatable?

A.22. Yes. In my review I looked for evidence of this, and found good documentation when work was placed in these categories. I observed that good reasons had been recorded as to why a certain inspector's work could not be reinspected. While I was on site, I observed an Edison audit team auditing these conditions as well. The audit included an inspection of the hardware to determine if in fact the work was inaccessible.

Q.23. Is there concern that a QC inspector might inspect either non-recreatable work or work soon-to-become inaccessible

less rigorously because he knows that the inspection cannot not be reinspected?

A.23. No. I have never experienced that phenomenon. I can see no benefit or motivation for an inspector to want to do anything less than good work. The inspectors that I have known and managed all took great pride in their work and usually were unconcerned about having anyone check their completed inspections for accuracy.

Q.24. Why were third party Level III inspectors used to perform additional inspections of visual weld discrepancies?

A.24. It was necessary for subjective attributes to assess the disagreements or differences between the results of the inspections by the original inspectors and those of the inspectors performing the reinspections to assure the accuracy of the final results. Based on the uncertainty of subjective-type inspections, it is well that Edison and the NRC agreed to the use of a Level III third-party inspector. The results of such inspections are based in substantial part on judgment and they are best evaluated by more experienced and qualified personnel. This practice fits my experience in that I have been accustomed to using quality engineers when an expert opinion was required to resolve differences in inspectors' opinions as to what constitutes a discrepant

condition. This is not to say that the original inspectors did a poor job of inspection; rather, the inspection requirements are not always well-defined and are often open to interpretation.

I reviewed the approach taken by the third-party inspectors who reviewed visual weld reinspections and the adequacy of the related documentation. I interviewed a third-party inspector and reviewed his records, several weld maps, and the records of two other third-party inspectors. This review was to gain an understanding of their role, criteria for inspection, and the methods used for dispositioning the nonconformance reports. I spent several hours with a Level III inspector inspecting some of the "worst case" welds to gain an insight as to the quality of the hardware. My review indicated that the third-party Level III inspectors did an excellent job of evaluating these discrepancies under difficult working conditions.

Q.25. How were the discrepancies discovered during the reinspections by Hatfield, Hunter and PTL reconciled?

A.25. As discussed in the testimony of the Sargent & Lundy witnesses, the discrepancies were reviewed, evaluated, catalogued and dispositioned in accordance with established procedures. Some discrepancies were dismissed as minor

irregularities or were determined not to be discrepancies. Others were dispositioned after being subjected to detailed engineering evaluations; and finally some discrepancies were dispositioned by an evaluation based on engineering judgment.

Q.26. Do you have an opinion concerning the validity of the engineering evaluation methods used by Sargent & Lundy?

A.26. I visited the Sargent & Lundy offices in Chicago to understand how they were conducting an engineering evaluation of various types of discrepancies for both objective and subjective inspections. I had previously reviewed a number of weld maps to assure myself that the third-party review process was effective, and that the maps would serve as a good tool for the engineers to use in their evaluation of the weld discrepancies. I discussed the engineering approach and justification for dispositioning certain types of discrepancies and the records that were being maintained of the as-built configuration and engineering calculations to verify design margins and factors of safety. I was quite impressed with the documentation that was being maintained. The records that I reviewed provided a sound basis for determining the level of detail and attention that was being given to the dispositioning process. Based on these reviews, I am confident that good engineering practices and judgments were being used.

Q.27. What role did Edison's QA Department play in the Reinspection Program?

A.27. The Edison QA Department was directly involved with the Reinspection Program. They attended the weekly coordination meetings between Edison, Sargent & Lundy and the contractors. They also utilized Pittsburgh Testing to reinspect some of the work that had been reinspected for a comparison of the results. Edison QA personnel were also involved in 3 on-site audits and numerous surveillance inspections during the Reinspection Program.

Q.28. Were the results of the Reinspection Program accurately reflected in the February 984 Report?

A.28. Yes. I reviewed the various data recording formats and calculations being performed by Edison for inclusion into the final report on the Reinspection Program issued in February, 1984. The purpose of this review was to assure an accurate transfer of data from the contractors to Edison, and to form an opinion of the adequacy of the data to support the conclusions that were to be drawn.

Q.29. Did you form an opinion concerning the validity of the

conclusions that were presented in the Reinspection Program Report?

A.29. Yes. The Reinspection Program was designed to assess the adequacy of early inspection certification programs and to determine if the contractors' procedures were adequate to assure the assignment of qualified inspectors. As mentioned earlier, it is not necessary to reinspect all of the prior work to make these assessments. I feel that the sampling process was properly designed to provide a sound assessment of the early certification procedures and to identify any problems or concerns. Edison monitored the program closely to assure that it was properly implemented, and Sargent & Lundy provided good support by conducting the engineering evaluation of discrepancies. The approach was sound, cost effective and well managed by Edison and the contractors.

The results were impressive. All Hatfield and Hunter inspectors whose work was reinspected passed the acceptance criteria for both objective and subjective attributes. All of PTL's inspectors passed the acceptance criterion for objective attributes. One inspector failed the acceptance criterion for subjective attributes. This resulted in an expansion of the sample to include all PTL inspectors whose work was accessible and who were qualified to perform visual weld inspections.

The number of inspectors whose work was reinspected, the amount and type of work reinspected, and the requirement for sample expansion provided a valid basis to draw conclusions about the qualification of the overall population of inspectors and more specifically for each contractor. Thus, I believe that Edison through the Reinspection Program has provided reasonable assurance that the QC inspectors who performed inspections at Byron Station beginning with the construction of safety-related work in 1976 through September 1982, were qualified.

ATTACHMENT A

JOHN L. HANSEL

PROFESSIONAL EXPERIENCE SUMMARY

Mr. Hansel's professional career encompasses 30 years of experience in the management of large complex programs for major energy and aerospace projects. His management and technical experience covers a wide range of projects, such as the Apollo and Space Shuttle programs, where he was responsible for reliability, quality assurance and safety; the Mark VI reentry vehicle program at Cape Canaveral, where he managed project conformance activity; the Department of Energy's Gas Centrifuge Enrichment Plant Project, for which he served as Project Director to the System Support Contractor, and the Three Mile Island investigation, where he participated in a Special Study Team.

Mr. Hansel recently served on an independent review panel commissioned to study and make recommendations for improvements to the Nuclear Regulatory Commission quality assurance controls that are levied on utilities for the construction of nuclear power plants. He has published numerous papers and articles on reliability, safety and quality control, and is currently serving as President-Elect of the American Society for Quality Control. Additionally, he received the National Aeronautics and Space Administration's Astronaut recognition award for sustained superior performance in support of the Apollo and Space Shuttle programs.

PROFESSIONAL EXPERIENCE CHRONOLOGY

EVALUATION RESEARCH CORPORATION, Oak Ridge, Tennessee

Mr. Hansel is currently the Principal Consultant for Evaluation Research Corporation. In this capacity he provides clients with a full range of consulting services including management assessments, development of quality and reliability programs, management audits and specialized services in development of design assurance programs.

SYSTEM DEVELOPMENT CORPORATION, Oak Ridge, Tennessee (5 Years)

Position: Project Director, System Support Contract, GCEP Project

Responsibilities: Systems management/engineering and project management/control services, including cost and schedule reporting and analysis for all GCEP contractor; configuration management, computer services, quality assurance, logistics and data management.

PROFESSIONAL EXPERIENCE CHRONOLOGY (Continued)

Position: Associate Project Director for Project Control
Responsibilities: Management of all project control activities, including quality and reliability engineering, logistics, value engineering, inspection, test and checkout, site activation and plant start-up, schedules, budgets and financial reporting.

Position: Manager, Special Projects and Studies
Responsibilities: Studies involving test plans for the gas centrifuge machine, development of manufacturing schedules, and specialized technical studies involving the centrifuge and plant equipment. He also served as a Consultant to the President's Commission on the accident at Three Mile Island.

ROCKWELL INTERNATIONAL, Palmdale, and Cape Kennedy/Canaveral, Florida (14 Years)
Position: Director of Quality Assurance on the Space Shuttle Orbiter and Apollo/Saturn Programs
Responsibilities: Quality assurance, reliability, and system safety on all launch and spacecraft equipment and facilities. He also participated as a team member for the Rockwell corporate audit organization in the conduct of audits on major groups and divisions.

GENERAL ELECTRIC, Cape Canaveral, Florida, and Cincinnati, Ohio (10 Years)
Position: Supervisor, Engineering Test
Responsibilities: Managed jet engine/rocket engine test facilities.

PRATT & WHITNEY (2 Years)
Position: Supervisor, Engineering Test
Responsibilities: Managed jet engine/rocket engine test facilities.

EDUCATION

M.S., Systems Management/Engineering, Florida Institute of Technology, Melbourne, Florida

B.S., Mathematics and Science, Rollins College, Winterpark, Florida

PUBLICATIONS

Mr. Hansel's publications include the following:

Quality Planning - The Basic First Step
System Engineering Applications in the Nuclear Industry
Quality Engineering Course for the American Society for Quality Control
Quality Assessments - How to properly utilize reliability data

PROFESSIONAL REGISTRATIONS/AFFILIATIONS

Professional Quality Engineer - California
President-Elect, American Society for Quality Control
Certified Quality Engineer - ASQC