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UNITED STATES OF AMERICAN
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

'84 AGO 13 A11:29

In the Matter of	)	
	)	
DUKE POWER COMPANY; et al.	)	Docket Nos. 50-413 OL
	)	50-414 OL
(Catawba Nuclear Station, Units 1 and 2)	)	
	)	

APPLICANTS' SUPPLEMENTAL RESPONSE TO "PALMETTO ALLIANCE AND CAROLINA ENVIRONMENTAL STUDY GROUP'S INTERROGATORIES AND REQUESTS TO PRODUCE DOCUMENTS ON DIESEL GENERATION CONTENTIONS TO APPLICANTS AND NRC STAFF" AND "CESG'S INTERROGATORIES TO DUKE POWER REGARDING EMERGENCY DIESEL CONTENTIONS ADMITTED BY ATOMIC SAFETY AND LICENSING BOARD"

Pursuant to the discovery schedule established in the Board's July 20, 1984 Order and in accordance with their duty to update answers to interrogatories, Applicants hereby file supplemental responses to the interrogatories identified in the caption. Applicants' original responses were filed April 2, 1984.

The initials of the individual providing the primary information used in the answer to the interrogatory is indicated in parentheses following each answer. The business address, occupation and employer of each such person is provided in the attachment to these responses that contains each such person's affidavit.

DS03

RESPONSES TO INTERROGATORIES

A. GENERAL INTERROGATORY

2. Please identify each and every person whom you are considering to call as a witness at the hearing in this matter on this contention, and with respect to each such person, please

   a. State the substance of the facts and opinions to which the witness is expected to testify;

   b. Give a summary of the grounds for each opinion; and

   c. Describe the witness' educational and professional background.

(a) Applicants in developing their direct case and testimony on the admitted contention have identified the following witnesses: G. Wayne Hallman, Nuclear Maintenance Manager for Duke Power Company, Russell P. Muschick, Maintenance Engineer for Duke Power Company; Jesse O. Barbour, Quality Assurance Manager Operations, Duke Power Company; Malcolm Curtis, Quality Assurance Manager, Vendors, Duke Power Company; Dr. Clifford H. Wells, Vice President, Research and Development, Failure Analysis Associates; Dr. Lee A. Swanger, Managing Engineer, Failure Analysis Associates; Dr. Jeffrey Gorman, Dominion Engineering, Inc.; Robert Ward, Dominion Engineering, Inc.; and either Dr. Simon K. Chen, President, Power and Energy International, Inc. (PEI) Consultants or Dr. John N. Beck, Vice President, PEI Consultants. Applicants anticipate

calling these witnesses to testify as to the testing, disassembly, inspection, component repair/replacement and reassembly aspects of the program to assure the reliability of the Catawba diesel generators. The resumes of these witnesses are appended as Attachment 1.

B. SPECIFIC INTERROGATORIES

Indentify in detail any and all documents reflecting the Catawba diesel generators' operating history and any problems, deficiencies or unusual or abnormal operations observed. Include each item and event reflected in response No. 8 and Applicants' 2/22/84 submittal. Please update your response to include any subsequent developments.

Recent inspection results for Catawba diesel generator engine 1B have become available. As a result, a list of problems detected has been assembled and is enclosed as Attachment 2. (GWH)

Respectfully submitted,

Albert V. Carr, Jr.

August 10, 1984

Failure Analysis Associates

CLIFFORD H. WELLS

Specialized Professional Competence

Structural lifetime prediction and reliability analysis, nondestructive evaluation, mechanics of deformation and fracture, elevated temperature design methods and analysis, mechanical test methods and fracture analysis, microstructural mechanisms of fatigue and material modeling, and integrated inspection and analysis systems for structural lifetime assurance.

Past research includes mechanical behavior of materials at high temperature and in aggressive environments, development of a turbine rotor fatigue lifetime prediction system, modeling of material deformation and fracture under complex stress states, development of mechanical testing methods.

Background and Professional Honors

B.S. (Mechanical Engineering), Yale University
M.S. (Civil Engineering), Yale University
Ph.D. (Applied Mechanics), Yale University
Oak Ridge School of Reactor Technology
Vice-President, Research and Development,
Failure Analysis Associates
Assistant to President and Director of Engineering Mechanics,
Southwest Research Institute
Assistant Manager, Materials Engineering and Research,
Pratt & Whitney Aircraft
Structural Engineer,
Oak Ridge National Laboratory
Research Assistant,
Yale University

Fellow, ASME
President-elect, Federation of Materials Societies
Chairman, Air Force Studies Board Panel on NDE, National Research Council
Chairman, National Materials Advisory Board Committee on Fatigue at Elevated Temperature
Member, National Materials Advisory Board Committee on Fretting Initiated Fatigue
Chairman, Executive Committee, Materials Division of ASME
EPRI Materials and Corrosion Committee
Metal Properties Council Subcommittee on Materials for Coal Conversion
Editor, Fatigue of Engineering Materials and Structures
Editor, Journal of Nondestructive Evaluation

Selected Publications

"Mechanical Test Methods for Coal Gasification Environments," Proceedings of Conference on Properties of Materials in Coal Gasification Environment, American Society for Metals (1981) (with L. A. Zeiss and R. D. Brown).

"Mechanical Properties of Alloys in Coal Gasification Atmosphere," Proceedings of Conference on the Properties of Materials in Coal Gasification Environment, American Society for Metals (1981) (with L. A. Zeiss and R. D. Page).

"Reliability of Steam Turbine Rotors," Proceedings of Conference on Residual Life, Copenhagen, Denmark (1980).

"Analysis of Life Prediction Methods for Time-Dependent Fatigue Crack Initiation in Nickel-Base Superalloys," National Materials Advisory Board Publication NMAB-347, National Academy of Sciences (1980).

"High-Temperature Fatigue," Fatigue and Microstructure, 1978 ASM-TMS Seminar, American Society for Metals, pp. 307-333 (1979).

"Development of an Automated Life Prediction System for Steam Turbine Rotors," ASME Paper 78-WA/DE-15, The American Society of Mechanical Engineers, New York (1978) (with T. S. Cook and H. G. Pennick).

"Fundamental Mechanisms," Control of Fretting-Initiated Fatigue, National Materials Advisory Board Report NMAB-333, National Academy of Sciences (1977).

"Fatigue at Elevated Temperature," edited by C. H. Wells, A. E. Carden and A. J. McEvily, ASTM Special Technical Publication No. 520 (1973).

"Quantitative Lifetime Assurance of Turbine Rotors," Fatigue Life Technology edited by T. A. Cruse and J. P. Gallagher, ASME, pp. 37-51 (1977).

"Uniaxial Creep Behavior of Metals Under Cyclic Temperature and Stress or Strain Variations, Journal of Applied Mechanics, Vol. 98, pp. 445-449 (1976) (with P. R. Paslay).

"Mechanisms of Dynamic Degradation of Surface Oxides," Proceedings of Symposium on Mechanical Properties of Surface Oxides, Metallurgical Society of AIME (1975) (with P. S. Follansbee and R. R. Ellis).

"Prospects of Lifetime Prediction in Creep and Fatigue," NSF Workshop on Inelastic Constitutive Equations for Metals-Experimentation-Computation-Representation, edited by E. Krempl, C. H. Wells and Z. Zudans (1975).

"Design Procedures for Elevated Temperature Low-Cycle Fatigue," Proceedings of the 38th Meeting of the Structures and Materials Panel, Advisory Group for Aerospace Research and Development, NATO, AGARD-CP-155.

"On the Applicability of Fracture Mechanics to Elevated Temperature Design," International Conference on Creep and Fatigue in Elevated Temperature Applications, Institution of Mechanical Engineers, London, England (with A. J. McEvily).

"Electrochemical Grinding of Cylindrical Test Specimens," Journal of Engineering for Industry, ASME Transactions, Vol. 93, pp. 1090-1092 (1971) (with T. W. Knight, R. B. Barrow and L. A. Williams, III).

"Creep of Single Crystal Nickel-Base Superalloy Tubes under Biaxial Tension," Journal of Applied Mechanics, ASME Transactions, Vol. 38, pp. 623-626 (1971) (with P. R. Paslay, G. R. Leverant and L. H. Burck).

"Mechanisms of Fatigue in the Creep Range," Metal Fatigue Damage Mechanism, Detection, Avoidance and Repair, ASTM Special Technical Publication No. 495, pp. 61-127 (1971) (with M. Gell and C. P. Sullivan).

"Fatigue of a Glass-Bead Blasted Nickel-Base Superalloy," Metallurgical Transactions, Vol. 1 (6), p. 1595 (1970) (with L. H. Burck and C. P. Sullivan).

"The Fatigue Strength of Nickel-Base Superalloys," The Achievement of High Fatigue Resistance in Metals and Alloys, ASTM Special Technical Publication No. 467, p. 113 (1970) (with M. Gell and G. R. Leverant).

"An Analysis of Primary Creep of Face-Centered Cubic Crystals," Journal of Applied Mechanics, ASME Transactions, Vol. 37 (3), p. 759 (1970) (with P. R. Paslay and G. R. Leverant).

"Elevated Temperature Testing Methods," Manual on Low-Cycle Fatigue Testing, ASTM Special Technical Publication No. 465, p. 87 (1969).

"Interactions Between Creep and Low-Cycle Fatigue in Udimet 700 at 1400°F," Fatigue at High Temperature, ASTM Special Technical Publication No. 459, p. 59 (1969) (with C. P. Sullivan).

"Low-Cycle Fatigue of Ti-6AL-4V," ASM Transactions Quarterly, Vol. 62, p. 263 (1969) (with C. P. Sullivan).

"An Analysis of the Effect of Slip Character on Cyclic Deformation and Fatigue," Acta Metallurgica, Vol. 17, p. 443 (1969).

"A Small-Strain Plasticity Theory for Planar Slip Materials," Journal of Applied Mechanics, ASME Transactions, Vol. 36 (1), p. 15 (1969) (with P. R. Paslay).

"The Control of Build-up and Diametral Growth in Shear Forming," Journal of Engineering for Industry, ASME Transactions, Vol. 90 (1), p. 63 (1968).

"Low Cycle Fatigue of Udimet 700 at 1700°F," ASM Transactions Quarterly, Vol. 61 (1), p. 149 (1968) (with C. P. Sullivan).

"An Analysis of the Bauschinger Effect in Some Engineering Alloys," Journal of Basic Engineering, ASME Transactions, Vol. 89 (4), p. 893 (1967).

"The Elastic Constants of a Directionally-Solidified, Nickel-Base Superalloy, Mar M-200," ASM Transactions Quarterly, Vol. 60 (2), p. 270 (1967).

"The Effect of Temperature on the Low-Cycle Fatigue Behavior of Udimet 700," ASM Transactions Quarterly, Vol. 60, p. 217 (1967) (with C. P. Sullivan).

"An Improved High-Temperature Extensometer," Materials Research and Standards, Vol. 6 (1), p. 20 (1966) (with D. N. Tishler).

"Low-Cycle Fatigue Damage of Udimet 700 at 1400°F," ASM Transactions Quarterly, Vol. 58 (3), p. 391 (1965) (with C. P. Sullivan).

"The Low-Cycle Fatigue Characteristics of a Nickel-Base Superalloy at Room Temperature," ASM Transactions Quarterly, Vol. 57 (4), p. 841 (1964) (with C. P. Sullivan).

"The Latent Strain Hardening of Aluminum Alloy in Monotonic and Cyclic Loading," Applied Materials Research, Vol. 2 (4), p. 193 (1963).

Failure Analysis Associates

LEE A. SWANGER

Specialized Professional Competence

Failure analysis of materials; metallurgical engineering, physical and mechanical metallurgy, and thermodynamics; foundry process development including ferrous and non-ferrous castings; powder metallurgy and powder rolling; electrochemistry, including electroplating and corrosion; materials testing, fatigue, and fracture; metal matrix and polymer matrix composites; tribology, friction, wear, and lubrication; internal combustion engine and compressor component design and testing; sleeve bearing design, manufacture, and failure analysis.

Background and Professional Honors

Ph.D. (Materials Science and Engineering), Stanford University, with Distinction
M.B.A. (Marketing/Finance), Cleveland State University
M.S. (Materials Science and Engineering), Stanford University
B.S. (Metallurgy), Case Institute of Technology, with Highest Honors

Managing Engineer,
Failure Analysis Associates
Director, Research and Development,
Imperial Clevite Inc.
Associate Director, Product Development,
Gould Inc., Engine Parts Division
Manager, Tribology and Bearing Research,
Gould Laboratories, Materials Research
Associate Senior Research Metallurgist,
General Motors Research Laboratories
Lecturer, Metallurgical Engineering,
Cleveland State University
Visiting Research Associate, Metallurgical Engineering,
Ohio State University

Registered Professional Engineer, State of Ohio, #44024
Member, Tau Beta Pi, Engineering Honorary Fraternity
Member, Sigma Xi, Scientific Research Honorary Fraternity
Member, Beta Gamma Sigma, Graduate Business Honorary Fraternity
National Merit Foundation Scholarship
Xerox Corporation Fellowship
IBM Corporation Fellowship
Hertz Foundation Fellowship
Member, American Society for Metals
Member, Society of Automotive Engineers
Interviewer, Hertz Foundation Fellowship Project

Selected Publications

U.S. Patent No. 4,333,215: "Bearing Material and Method of Making," issued June 8, 1982.
"Compacted Graphic Cast Iron Components for Improved Thermal Fatigue Resistance," Imperial Clevite Inc., Internal Report (January 1982).
"Marketing Strategies to Achieve Cash Flow Objectives," M.B.A. thesis, Cleveland State University (June 1982).
"Squeeze-Cast Pistons for Heavy-Duty Applications," Gould Inc., Internal Report (February 1981).
"Evaluation of Graphite-Epoxy and Graphite-Babbitt Composite Sleeve Bearings," Gould Laboratories, Phase Report (October 1977).
"Environmentally Induced Blistering of Aluminum P/M Components," Gould Laboratories, Project Completion Report (December 1976).

"Inhomogeneous Thermodynamics and Spinodal Decomposition," Ph.D. dissertation, Stanford University (August 1972).

"On the Necessary Conditions for Homogeneous Nucleation of Gas Bubbles in Liquids," Journal of Crystal Growth, pp. 323-326 (1972) (with W. C. Rhines).

"The Elastic Energy of a Straight Dislocation in an Infinite Anisotropic Elastic Medium," Physica Status Solidi (B), pp. 419-428 (1971) (with D. M. Barnett).

"Computer Simulation of One-Dimensional Spinodal Decomposition," Acta Metallurgica, pp. 9-14 (1970) (with P. K. Gupta and A. R. Cooper, Jr.).

Invited Lectures

"Bearing Materials Update," presented to SAE Off-Highway Conference, Milwaukee, September 1981.

"Developments in Bearings and Pistons," presented at *O Motor no Futuro* (The Engine of the Future), Sao Paulo, Brazil (September 1980).

"Selection of Crankshaft Materials for Optimum Bearing Performance," presented to Society of Manufacturing Engineers Conference, Los Angeles, CM80-392 (June 1980).

"Heavy Duty Bearings: Materials and Process," presented at Carnegie-Mellon University (March 1980).

"The Linear Team and Spinodal Decomposition," presented at the University of Florida (February 1978).

DOMINION ENGINEERING, INC.

JEFFREY A. GORMAN

EDUCATION

- B.S. Civil Engineering, Cornell University, 1958
- Bettis Reactor Engineering School, Naval Reactors, USAEC, 1961
- M.S. Engineering Science, California Institute of Technology, 1966
- PhD Engineering Science, California Institute of Technology, 1968
- Registered Professional Engineer

EMPLOYMENT

- 1958 to 1959 American Overseas Petroleum, Ltd.
- 1959 to 1965 Naval Reactors Headquarters, USAEC
- 1968 to 1980 MPR Associates, Inc.
- 1980 to present Dominion Engineering, Inc.

EXPERIENCE

- Troubleshooting equipment problems especially related to fracture, fatigue, corrosion and erosion of mechanical components
- Evaluation of nuclear fuel mechanical design and performance
- Development of steam generator support system design and operation guidelines to minimize corrosion damage
- Engineering evaluation of steam generator eddy current inspection results and other NDE problems
- Development of inservice inspection programs and evaluation of inspection results for nuclear and fossil power plants
- Structural design and analysis to ASME Code requirements
- Design and analysis of piping system components such as piping, valves, pumps, etc.
- Evaluation of metallurgical problems, performance of fracture mechanics analyses, and development of specification requirements for power plants and for offshore structures
- Design of specialized reactor servicing equipment such as TV inspection systems, underwater lighting, and shielding
- Development of repair procedures for major reactor plant problems such as pipe cracking
- Quality Assurance audits of nuclear power plant design, construction, and fabrication activities
- Member of EPRI Corrosion Advisory Committee/Materials and Corrosion Committee, and assisted in review of ARPA's stress corrosion cracking handbook

DOMINION ENGINEERING, INC.

S. ROBERT WARD

EDUCATION

- B.S. Electrical Engineering, University of Michigan, 1959
- Bettis Reactor Engineering School, Naval Reactors, USAEC, 1960
- Graduate Work, University of Maryland, 1963
- Registered Professional Engineer

EMPLOYMENT

- 1959 to 1963 Naval Reactors Headquarters, USAEC
- 1963 to 1965 Central Engineering, Chrysler Motor Corporation
- 1965 to 1980 MPR Associates, Inc.
- 1980 to present Dominion Engineering, Inc.

EXPERIENCE

- Analysis of specialized problems associated with both dc and ac machinery
- Design, specification and troubleshooting of instrumentation, control and process systems for central station power plants, marine equipment, and offshore structures
- Design, specification and review of power distribution systems for nuclear power plants, ships and offshore structures
- Design, specification and review of components and hardware such as pumps, propulsion system components, bearings, seals, underwater mechanisms, mooring systems and tow cables
- Structural review of pressure vessels and piping systems
- Design reviews of offshore structures from the standpoint of structural, material and fabrication adequacy
- Preparation of operating manuals, maintenance instructions, and troubleshooting procedures
- Quality assurance audits of nuclear power plant design, construction and start-up activities

RESUME

JESSE O. BARBOUR

PERSONAL: Business Address: Duke Power Company
Quality Assurance Department
P.O. Box 33189
Charlotte, NC 28242

Telephone: (704) 373-4795

Age: 45 Height: 6'5" Weight: 205 lbs.

FORMAL EDUCATION: NC State University: BSME (with honors) 1961
NC State University: Special Continuing Education Course in Nuclear Physics - 1972

ADDITIONAL TRAINING: Management Training Course at Duke Power Management School - 1977

Advanced Management Training Course at Duke Power Management School - 1981

Numerous (30+) In-House Seminars and Classes on all Aspects of Quality Inspections and Assurance at Duke Power Company

PROFESSIONAL INVOLVEMENT: Registered Professional Engineer - NC 3821

Member ASME (21 Years)

WORK EXPERIENCE:

FROM	TO	TITLE	COMPANY
5/74	Present	Quality Assurance Manager, Operations	Duke Power

Manage group of 134 people responsible for implementation of the Duke Power Operational Quality Assurance Program and the Inservice Inspection program at Oconee, McGuire and Catawba Nuclear Stations. This consists of:

1) Surveillance of day-to-day station activities to assure compliance with established procedures
2) Review of work packages for maintenance and modification work to establish Quality Control Inspection hold points
3) Quality Control Inspections of maintenance and modification work activities to assure compliance with established procedures
4) Review of finished work packages for completeness and accuracy

FROM	TO	TITLE	COMPANY

5) Development of Inservice Inspection plans to meet Section XI of the ASME Boiler and Pressure Vessel Code
6) Bid specification preparation for Inservice Inspection contracts
7) Bid proposal review and contract award for Inservice Inspection work
8) Contract Management and field implementation of Inservice Inspection work by both Duke and contractor personnel
9) Issue of reports of Inservice Inspection work to regulatory authorities
10) Development of procedures and revisions necessary to carry out these activities
11) Procurement and maintenance of equipment necessary to carry out these activities
12) Interface with regulatory authorities as necessary involving these activities.

Current budget for this operation is $9.1 million annually.

9/72 5/74 Staff Quality Assurance Engineer — Duke Power

Same responsibilities as above except on a smaller scale as only Occonee Nuclar Station was involved at that time.

9/71 9/72 Staff Maintenance Engineer — Duke Power

Responsible for coordinating maintenance work on company steam generating equipment (both fossil and nuclear) by contract and Duke personnel.

8/68 9/71 Maintenance Supervisor, Shops and Field — Celeanse Fibers Co. Rock Hill, SC

Supervised crew of 8 foremen and 90 craftsmen in operation of a large industrial maintenace shop involving machinists, welders, sheet metal workers, riggers, pipe fitters, painters, carpenters and laborers. This shop supported a textile plant which manufactured acetate and triacetate yarn and other textile products.

6/65 8/68 Project Engineer — Celeanse Fibers Co. Rock Hill, SC

Supervised designers and technicians in the design, procurement and installation of chemical processing and textile equipment.

6/61 6/65 Design Engineer — RJ Reynolds Tobacco Co. Winston-Salem, NC

Designed Pressure Vessles to Section VIII of the ASME Boiler and Pressure Vessel Code as well as atmospheric tanks and mechanical machine components and monitored manufacture of these items in company shops.

J M CURTIS

Personal: 1116 Réverdy Lane
Matthews, NC 28105
Home Telephone: 704-847-4708

Education: Georgia Institute of Technology toward E.E. not complete.
I.C.S. Stationary Engineering completed
Technical level - completed Electrical, Electronics, Non-destructive Testing, Radiography, Ultrasonic and Magnetic Particle
NDE Schools date back to 1959. Management schools dated back to 1965

Professional Involvement: American Society of Mechanical Engineers
American Society of Non-destructive Testing
American Society of Quality Control

Accomplishments: Apprenticeship as electrician
National Board of Boiler & Pressure Vessel Inspectors Commission #5393
North Carolina Boiler & Pressure Vessel Inspections - 1960
Registered Professional Quality Engineer State of California #5442

Work Experience:

From	To	Title	Assignment	Organization
1969	Present	QA Manager, Vendors QA Supervisor Senior Designer	QA Depart. Engineering Dept.	Duke Power

Four of the years in Mechanical Engineering Section, ten years in Quality Assurance Department. Activity mostly directed to the monitoring and control of vendor's Quality Assurance Programs.

1954	1969	District Manager Test Engineer Inspection Engineer	Loss Prevention & Loss Control	Factory Mutual Engrg.

Inspection and testing mechanical and electrical equipment. Supervision during last ten years of engineering activity involving loss prevention. Ten years also involved field test engineering in all phases of non-destructive testing.

1949	1954	Inspection	Mechanical & Electrical Dept.	U S Steel

Inspection and repair of mechanical and electrical equipment with leading steel manufacturing company.

PEI CONSULTANTS	Biographical Data On Dr. Simon K. Chen, PE	March 16, 1983

Position President

Home 325 Racine Street, Delavan, WI 53115
Home Phone: 414-728-6994

Education

B.S., M.E.	1947	National Chiao-Tung University
M.S., M.E.	1959	University of Michigan
Ph.D., M.E.	1952	University of Wisconsin
M.B.A.	1964	University of Chicago, Executive Program

Work Experience

President, Power and Energy International, Inc. — 1979 - present
Technical consulting and product development

President, Beloit Power Systems, Inc. — 1973 - 1979
Manufacturers of engine and turbine driven alternators, up to 15,000KW, rotary positive screw gas compressor, power plant controls, and gen-sets.

V.P., Engineering and Application, Fairbanks-Morse Power Systems — 1969 - 1973
Colt Industries
Developer of O.P. Blower series line with increased rating, O.P. sparked gas engine, manufacturer of SEMT-PC-2 for marines, stationary and nuclear standby applications, developer of 38A-20 engine, producer of large irrigation pump, rotary compressor, alternators and motors.

Divisional Chief Engineer, Diesel Engine R&D, International — 1965 - 1969
Harvester Company
Developer and manufacturers of vehicular diesels and spark-gas engines for construction equipment, farm equipment, medium-duty truck, and industrial applications.

Chief Project Research Engineer, Engineering Research, IH — 1956 - 1965
Corporate research on alternate power plant, engine combustion, advanced power train concept, advanced vehicle analysis, and corporate product planning.

Project Engineer, IH, Melrose Park — 1952 - 1956
In charge of combustion research on diesel and stratified charge engine.

Technical Society Membership List and Honors

SAE, ASME, SNAME, EGSMA, CIE, Who's Who in the World, Who's Who in Finance and Industry, Engineers of Distinction by Engineers Joint Council in 1973, SAE Arch T. Colwell Merit Award in 1966, University of Wisconsin Alumni Distinguished Service Award, 1973, Chinese Institute of Engineer's Achievement Award in 1976, Director and Technical Chairman of Diesel Engine Manufacturing Association, 1971-73, Member Compressed Air and Gas Institute, 1973-79, SAE Fellow-1983, Registered Professional Engineer - State of Wisconsin.

PEI CONSULTANTS	Publications Dr. Simon K. Chen	January 16, 1984

- "Compression and End Gas Temperatures from Iodine Absorption Spectra," Co-author, SAE, 1954.
- "Development of a Single Cylinder Compression Ignition Research Engine," Co-author, SAE 650733, 1965.
- "Development and Evaluation of the Simulation of the Compression-Ignition Engine," Co-author, SAE 650451, 1965.
- "Engine Development Criteria and Techniques," Modern Engineering and Technology Seminar, Taiwan, Republic of China, July 1974.
- "Engine Cycle Analysis and Combustion Problems," Modern Engineering and Technology Seminar, Taiwan, Republic of China, July 1974.
- "Diesel Application," Modern Engineering and Technology Seminar, Taiwan, Republic of China, July 1974.
- "Highlights of the Energy Session," Energy Quarterly, Republic of China, January 1975.
- "A Collection of Abridged Management Papers," Modern Engineering and Technology Seminar, Taiwan, Republic of China, July 1976.
- "Marketing in a Competitive Market," Modern Engineering and Technology Seminar, Taiwan, Republic of China, July 1976.
- "Management Philosophy and High Technology Development," Energy Quarterly, Taiwan, Republic of China, January 1978.
- "Vibration Analysis for a Sound Generator-Set Design," Electrical Generating Systems Marketing Association, Chicago, IL, September 26-27, 1978.
- "Waste Heat Recovery Cycle Analysis and Systems for Diesel and Gas Turbine Engines," 13th CIMAC Conference, Vienna, Austria, May 7-10, 1979.
- "Small Industrial Diesel Planning," September 16, 1980.
- "An International Perspective of Taiwan's Automotive Industry," Society of Automotive Engineers, SAE-ROC Technical Meeting, Tawian, Republic of China, November 23-25, 1981.
- "The Development of ROC Machine Tool Industry and the Impact of Automation," Industrial Technology Research Institute, Taiwan, Republic of China, September 1981.
- "Japan's Robot and Robotics Development," March 11, 1982.
- "Techno-Economic Recommendations to Fight Recession Accelerated by Energy Shock," May 5, 1982.
- "US Robots and Robotics," August 1983.
- "A Review of Engine Advanced Cycle and Rankine Bottoming Cycle and Their Loss Evaluations," Co-authored, SAE 830124, 1983.
- "Flexible Manufacturing Systems Applications," Modern Engineering and Technology Seminar, Singapore, November 1983.
- "The Impact of Automation on Newly Industrialized Countries," Modern Engineering and Technology Seminar, Singapore, November 1983.

PEI CONSULTANTS	Biographical Data on Dr. N. John Beck	March 16, 1983

Position Vice President

Education

B.S., M.E.	1947	University of Colorado
M.S., M.E.	1948	California Institute of Technology
Ph.D., M.E.	1952	University of Wisconsin

Work Experience

President and Principal Owner, BKM, Inc. 1975 - present
Technical consulting, small engines, injection development

Group Vice President, Rohr Industries, Inc. 1971 - 1975
Ground Mass Transportation, BART system, transit bus

President, White Motor Corporation, Advanced Products Div. 1964 - 1971
Diesel engine development, power train

Chief Engineer, McCulloch Corporation 1961 - 1964
Lightweight, airdrone engine

VIce President, Research, Cummins Engine 1959 - 1961
Industrial and motor truck diesels R&D

Chief Propulsion Engineer, Douglas Aircraft 1953 - 1959
Aircraft engine and propulsion system development and installation

Technical Society Membership List and Honors

SAE, ASME, Who's Who in the West, Who's Who in American Science, Distinguished Service Award from University of Wisconsin, President of SAE in 1982.

Papers Published

- o Engine Temperature Measurements from Iodine Absorption Spectra, SAE, 1953
- o Fuel Cells as Vehicle Power Plants, SAE, 1962
- o Stable Precepts in a Changing World, Northrop Institute of Technology Commencement Address, 1968
- o Future of Turbines in Trucks, SAE, 1969
- o Next Ten Years, SAE Journal (FCIM) Issue, September, 1966
- o Forecast of Truck Power Plant Development, Transportation Research Forum, 1967

Product Experience

Cummins truck and industrial diesels, NH, V6, V8, V12, McCulloch outboards, chainsaw line, arc welder, White I-6 and V8 diesels, DOT transbus, BART cars, WMATA mass transit bus, BKM 2 and 5 HP lightweight engines, small air cooled diesel hi-pressure electronic injection system, hydromechanical transmission.

Attachment 2

PRELIMINARY LIST OF PROBLEMS DETECTED DURING
DISASSEMBLY AND INSPECTION OF CATAWBA 1B
DIESEL GENERATOR ENGINE

The following is a preliminary list of problems detected during the disassembly and inspection of the engine of the Catawba 1B diesel generator. As the results are still undergoing evaluation, they are preliminary. (GHW)

1. Three cylinder heads developed leaks similar to the one found on the 1A engine.
2. One head had a crack in the exhaust valve seat.
3. Excessive turbocharger bearing wear was detected similar to that found in 1A.
4. Cracks were found in three fuel injection pump discharge valve assemblies.
5. Leaks were detected in two fuel line fittings.
6. Hairline cracks similar to those found in 1A were found in the rocker arm pedestal in the rocker box subcover assembly.
7. Broken bolts similar to those found in 1A were found on the turbocharger exhaust gas inlet.
8. Cracks were found in a rocker arm adjusting screw swivel pad. (Improper disassembly suspected; therefore, problem may not be operational.)
9. Chrome plating on valve stems was chipped or flaked, similar to condition in 1A.

Attachment 2

10. Three connecting rod bearing shells ejected due to failure to meet X-ray subsurface acceptance standards. (Not an operational problem.)
11. Airstart distributor capscrew failed.
12. Intercooler jacket water line flange failed.
13. Turbocharger to intercooler flanged weld cracked, similar to failure in 1A.