COPY DUKE ENERGY INDIANA'S EXHIBIT G

REBUTTAL TESTIMONY OF RONALD A. HALPERN PRESIDENT, GENERATOR CONSULTING SERVICES, INC. ON BEHALF OF DUKE ENERGY INDIANA, INC. CAUSE NO. 38707FAC76-S1 BEFORE THE INDIANA UTILITY REGULATORY COMMISSION

FILED
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INDIANA UTILITY REGULATORY COMMISSION

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME, POSITION, AND BUSINESS ADDRESS.

A. My name is Ronald A. Halpern. I am President of Generator Consulting Services, Inc. ("GCS"). My business address is 2098 Lynnwood Drive, Schenectady, New York 12309.

Q. PLEASE BRIEFLY DESCRIBE YOUR EDUCATIONAL BACKGROUND AND PROFESSIONAL EXPERIENCE.

A. I have a Bachelor of Engineering, Mechanical Engineering from the City College of New York. Throughout my business career, I have been involved primarily with electric generators. In 1974, I began working for GE as an Engineer installing, maintaining, and providing technical support on GE's steam turbine generators throughout the United States and overseas. I continued working for GE for the next twenty-four years in various engineering, technical, and management positions related to GE's global turbine generators. From 1992 to 1998, I was the Generator Product Line Manager for GE. In that position, I was responsible for the strategic direction of GE's generator business for over 10,000 GE units globally. I also formulated GE's business wide strategy on liquid cooled generator leaks and rewinds. In 1998 I left GE and founded GCS, which specializes in commercial and technical consulting on large power generator operation, maintenance, service, testing and inspection, failure/root cause analysis, liquid-cooled generator leaks and bar abrasion, project planning/management, and specification and proposal preparation. I assist utility and industrial power generators, generator Original Equipment Manufacturers ("OEMs"), insurance companies, industry organizations and failure investigation companies to advise on all aspects of generators. Frequently, I am asked to investigate highly complicated and unusual failures or operational issues to determine the root cause. I also counsel and advise power generators on proper maintenance and solutions to generic industry problems on generators. Since 1998, I have investigated approximately 60 generator failures. I have attached as Exhibit G-1 to my testimony more detailed information regarding my professional experience.

Q. HAVE YOU TESTIFIED BEFORE STATE REGULATORY COMMISSIONS?

A. Yes. I have testified before state regulators in Oregon and Wyoming.

Q. WHAT IS THE PURPOSE OF YOUR REBUTTAL TESTIMONY?

A. I am submitting rebuttal testimony in response to the direct testimony submitted by Mr. James Dauphinais. Specifically, I will discuss Mr. Dauphinais' conclusion that Duke Energy Indiana acted imprudently by not strictly adhering to certain GE Technical Information Letters ("TIL") regarding maintenance of the generator at Gibson Unit 4. Based on the information that I have reviewed, I have reached the conclusion that the stator bar failure on January 20, 2008 was atypical and that though the root cause of the failure is unknown, in my opinion it was not due to a water leak. I will also discuss Mr. Dauphinais' assertion that the Company was imprudent in extending the outage schedule for Gibson Unit 4. The basis for Mr. Dauphinais' conclusion is again a failure to strictly adhere to a GE recommendation. That recommendation to test stator bars, formulated approximately 10 years ago, does not take into account realistic utility industry business practices and I conclude that the maintenance intervals utilized by Duke Energy Indiana is consistent with good utility practice and industry standards.

Q. WHAT INFORMATION DID YOU REVIEW IN FORMULATING YOUR CONCLUSIONS?

A. I reviewed all of the testimony that has been filed in this proceeding, the data responses, the insurance adjuster's report, the incident report authored by the Company, the Inspection & Repair Report authored by GE ("GE Report"), numerous pictures and interviews with persons who first inspected the damaged Gibson Unit 4 generator, including the GE Generator Specialist who was in charge of the failure investigation and repair.

II. STATOR BAR FAILURE

Q. HAS THE ELECTRIC GENERATOR INDUSTRY HAD A HISTORY OF STATOR BAR LEAKS?

A. Water-cooled generators of the type that has been operated at Gibson Station have had a history of stator bar water leaks, although Gibson Station has not had such a history. The most potentially damaging leak is the clip to strand leak that occurs over time and saturates the insulation on the stator bar. Once the insulation becomes wet, it loses its electrical insulating properties and because the bars operate at a high voltage, they can arc to ground where the bar enters the grounded core.

Q. WHAT TYPE OF TESTING IS DONE TO DETECT A STATOR BAR LEAK?

A. The most sensitive testing to detect a wet bar that can only be performed during major outages is the helium tracer gas test and capacitance mapping which is done at the very end of the core where the bar exits to determine if the insulation is wet. Other tests (pressure and vacuum decay) are also used to determine the presence of stator bar leaks, but are not as sensitive and are used to detect gross or major leaks. If the insulation of the stator bar is wet, it means that there has been a leak at the clip to strand brazed joint and the water has traveled along the length of the bar arm and saturated the bar's insulation to reach the area at the end of the core. Similarly, leaks at other areas, such as brazed plumbing connections, will also cause the insulation to get wet.

Q. WAS THIS THE TYPE OF LEAK THAT OCCURRED IN THE GENERATOR AT GIBSON UNIT 4?

A. No. The failure at Gibson Unit 4 was at the connections, not at the end of the core. Attached is Exhibit G-2, which are diagrams and pictures that show the location of typical stator bar leaks and the location of the failure that occurred on Gibson Unit 4. I have also attached pictures, attached as Exhibit G-3, taken as the Gibson Unit 4 generator was being disassembled which reinforces my conclusion that the failure was at the connections and not at the end of the core. This type of failure is very unusual and, in my opinion, means that the cause of the failure was not a typical clip to strand leak which saturated the bar arm from the connection area all the way to the core line.

Q. ARE THERE OTHER REASONS THAT YOU BELIEVE THAT THE STATOR BAR FAILURE WAS ATYPICAL?

A. Yes. Gibson Unit 4 tripped electrically due to a phase to phase fault. The typical failure mode for a clip to strand leak which causes a wet bar would be a stator ground fault at the end of the core. The stator ground fault was present in the case of the only other known in-service failure of a water-cooled generator. Normally, when there is a wet stator bar due to a clip to strand leak, the unit trips due to a stator ground. In some cases a potential leak is detected by the daily monitoring conducted by electric utilities on their generators. Generally, the first indication of a stator bar leak is increased hydrogen consumption. I have determined that Duke Energy Indiana monitored hydrogen consumption on a daily basis for the Gibson units and there was no indication that a stator bar was experiencing a leak.

Q. MR. DAUPHINAIS, CITING THE COMPANY'S INCIDENT REPORT AND THE INSURANCE ADJUSTER'S REPORT, ARGUES THAT THE TYPICAL STATOR BAR LEAK WAS THE LIKELY CAUSE OF THE GIBSON UNIT 4 FAILURE. HOW DO YOU RESPOND?

A. Due to the extent of the damage at the failed area, no one can say for certain the cause of the Gibson Unit 4 failure. Mr. Dauphinais appropriately qualifies his opinion because all parties involved in investigating the Gibson Unit 4 outage said a root cause analysis could not be done due to the extensive damage done to the inside of the generator. Nevertheless, I cannot agree that the Gibson Unit 4 failure was due to a typical stator bar leak. There is simply not enough factual evidence to support that conclusion. I also believe that the Company's Incident Report and the Insurance Adjuster's Report must be placed in the proper context. The Company's Incident Report was completed within five days of the failure when all efforts were focused on returning Gibson Unit 4 to service and before GE had an opportunity to do any testing. I cannot tell if there was an extensive investigation before it was written. Likewise, the Insurance Adjuster's Report does not provide any indication as to the thoroughness of the investigation before it was written. In my opinion, the GE Report issued in the summer of 2008, after the repairs were made and Gibson Unit 4 was back in service, is a better source for forming an opinion as to potential causes of the Gibson Unit 4 outage. Mr. Dauphinais does not discuss this report.

Q. DOES THE GE REPORT PROVIDE INFORMATION REGARDING POTENTIAL CAUSES OF THE JANUARY 2008 OUTAGE?

A. Yes. I have attached to my testimony the Confidential GE Report as Confidential Exhibit G-4 (attachments to the Report are not included). First, the Report on page 20 states that a "formal root cause analysis was not performed". Accordingly, only plausible theories remain since the entire stainless elbow from the hose to phase lead was "beamed" to the "far reaches" of the stator frame taking all evidence with it. However, GE went on to temporarily plug only the two open nipples on the pipes after removing the damaged hose, and the remaining winding passed all HIT skid tests (pressure and vacuum decay, capacitance mapping, wet insulation detection, and helium tracer gas tests). If the windings passed all of these tests, then the failure was not a clip to strand leak. The only components that could have leaked and caused the failure were the teflon hose and stainless elbow. Further, the copper T appears to be intact from the photos that I have reviewed. A failure of the hose or stainless elbow is very unusual. Also, GE conducted capacitance mapping tests on January 27, 2008 after the failure, the results of which indicate that the bars that failed were not wet at the core line. I was not satisfied with the level of detail contained in the various reports so I insisted on talking with the person who I thought would be the most knowledgeable regarding the failure – Mike Hilkey, who was the GE Generator Specialist in charge of the repair. I asked him if he had seen any indications of wet insulation at or near the point of failure and he indicated that none was observed. If the Teflon hose or stainless elbow had developed a leak, the insulation and the putty would have been soft and evidence of long-term exposure to water would have been found. I have attached Exhibit G-5 that shows the area of the generator where soft insulation or wet putty would have been found had there been a leak. He found no areas of soft insulation or putty. This strongly indicates that there was no water leak at all. The failure could have been a mechanical failure caused by a crack in the copper, resonance or failed insulation. The subsequent arcing could have burned through the teflon hose and stainless elbow, causing massive water loss.

Q. WHAT IS YOUR CONCLUSION FROM THE MATERIAL THAT YOU REVIEWED AND THE DISCUSSIONS THAT YOU HAVE HELD?

A. My conclusion is that the failure was not due to a water leak.

Q. HOW DOES THIS CONCLUSION TIE IN TO MR. DAUPHINAIS' POSITION?

A. Mr. Dauphinais criticizes the Company and concludes it was imprudent by not performing all of the stator bar tests that were recommended by GE. Even if the Company had performed all of the stator tests that GE recommended during the 2006 minor outage, they would not have found any leaks.

III. <u>MAINTENANCE INTERVALS</u>

Q. TURNING NOW TO MR. DAUPHINAIS' CRITICISM OF DUKE ENERGY INDIANA EXTENDING THE INTERVALS BETWEEN MINOR AND MAJOR OUTAGES, PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE WITH MAINTENANCE INTERVALS.

A. I have been involved with both utilities and OEM's in determining maintenance intervals. In my present position, I am frequently asked to consult for utilities on questions related to maintenance activities. Specifically, I consult on both the scope of inspections and monitoring and how frequently to schedule these activities. In addition, I am involved with various industry organizations such as the Electric Power Research Institute ("EPRI") and the Nuclear Turbine-Generator Users group. I am frequently asked to prepare and present papers at conferences for these organizations and those of Power Gen (Domestic and International), based on my non-theoretical current and practical experience on the subject of generator maintenance and recent OEM problems.

In my prior experience with GE, I was responsible for articulating the OEM's recommended maintenance practices and inspection schedules to utilities.

I also monitored other OEM's practices to maintain GE's competitive position. Finally, I personally wrote many GE instruction book recommendations for operation, maintenance and inspection intervals and technical service notices to customers.

Q. DO YOU AGREE WITH MR. DAUPHINAIS' CRITICISMS OF DUKE ENERGY INDIANA FOR EXTENDING THE GIBSON UNIT 4 GENERATOR MAINTENANCE SCHEDULE?

A. No. Mr. Dauphinais cites a generator maintenance interval standard of 30 months (minor) and 60 months (major) for leak testing. However, this maintenance recommendation was based upon a maintenance interval recommendation for generator inspection and testing which was based upon an overall generator plant maintenance first articulated by GE, approximately 40 years ago. This standard has not changed since first articulated. Rather, generator inspections and maintenance are governed by the balance of the plant and primarily the need to maintain the turbine. The GE inspection intervals are very conservative and more importantly, the 30 month minor interval that is recommended is not based on any empirical data and represents a conservative estimate and general guideline. The frequency of generator maintenance is unit specific and based on many variables, with the most important being previous inspections, maintenance history, and current monitored conditions.

Q. HAS THE UTILITY INDUSTRY EVOLVED FROM THIS 30 TO 60 MONTH STANDARD?

A. Yes. As technology is more sophisticated and better technology has become available, the generation industry has started and continues to expand condition-based maintenance rather than time-based maintenance. Mr. Pulskamp and Mr. Faulkner discuss extensively condition-based maintenance in their direct and rebuttal testimonies and I agree with their statements. More importantly, I agree that electric industry standards and good utility maintenance practices have extended the minor and major maintenance intervals. Over the last 10-15 years, there has been an increasing trend to extend outage intervals for generators. This topic is a frequent item of discussion at industry meetings, such as those sponsored by EPRI, which I have attended and at which I have made presentations. One major reason for this generator maintenance interval extension is that generators are one of the most reliable pieces of equipment in a power plant. There are more utilities that are extending generating maintenance intervals to 10-12 years with OEM's assistance and approval. As to generating units, fossil fuel generating units are extending their minor maintenance intervals to 4-5 years and major maintenance intervals to 8-10 years and in some cases longer. There is a core benefit to utilizing condition-based maintenance.

Q. WHAT CONCLUSIONS DO YOU DRAW FROM THIS EVOLVING MAINTENANCE STANDARD?

A. The primary conclusion that I draw is that Mr. Dauphinais' strict adherence to a maintenance interval standard developed 40 years ago is misplaced and not consistent with industry practice. Accordingly, Duke Energy Indiana's extension of these maintenance intervals is not imprudent in any way. From a general standpoint, blind adherence to OEM's generator maintenance recommendations, without consideration of actual operating history, current monitored conditions and informed engineering judgment, is not consistent with good utility practice or electric industry standards. Therefore, Mr. Dauphinais' conclusion of overall imprudence is without merit.

Q. DOES THIS CONCLUDE YOUR PREPARED TESTIMONY IN THIS CAUSE?

A. Yes, it does.

Ronald A. Halpern

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Experience

1998-present Generator Consulting Services, Inc. Schenectady, N.Y.
President

- GCS specializes in both commercial and technical consulting on large power generator operation, maintenance, service, testing & inspection, failure/root cause analysis, liquid cooled generator leaks and bar abrasion, project planning/management, and specification & proposal preparation.

1974-1998 General Electric-Various assignments:

1992--1998 GE Energy Services Schenectady, N.Y.
Generator Product Line Manager

- Set strategic direction for generator business for over 10,000 GE units globally served by 60 engineers, & 300 service engineers and technicians.
- Responsible for leadership of GE's global generator parts & services business.
- Identified, generated product specifications, appropriated funding and managed annual new product development budgets and associated sales.
- Formulated GE's business wide strategy on liquid cooled generator leaks, bar abrasion and rewinds
- Mentored the GE process teams for Stators, fields, retaining rings, and uprates
- Represented GE in all customer, industry and external functions such as technical paper generation, trade shows, state of the art seminars, major technical conferences, customer meetings, trade press, press releases, insurance industry relations.
- Attended and published several papers at EPRI, CIGRE, GE SOA's, annual utility conferences, Power Gen Int'l., Latin America & Europe.
- Served as primary focus for competitive intelligence and strategy
- Evaluated and provided strategic direction for major proposals and commercial decisions
- Evaluated, reviewed and approved all major strategic and transactional headquarters pricing decisions; advised field of appropriate transactional pricing levels
- Directed commercialization efforts of new and existing products and services
- Identified and evaluated candidate organizations for acquisitions
- Project managed the BECO Pilgrim forced outage, failure investigation and

record setting rewind

- Led GE's Generator efforts on Conditioned Based Maintenance strategy
- Grew liquid cooled stator rewind business while reducing installation cycles 40% to perfect the short cycle rewind capability resulting in several world record outage cycles for fossil and nuclear rewinds.
- Led the implementation, promotion and commercialization of the highly successful Epoxy injection leak repair process.
- Led the repair and rewind new business ventures on Westinghouse, Alstom, Toshiba, Hitachi, Ansaldo and other Non-GE OEM's.
-

1990-1992 GE Global Service and Parts Schenectady, N.Y.

Manager Gas Turbine Generator Parts/Outage Support

- Responsible for $280M gas turbine generator parts delivery group during period of record growth
- Interfaced with high level manufacturing and sourcing contacts to insure accurate and timely design and manufacturing.
- Identified, hired and organized a new group of 20+ people to manage conversions, modifications and uprates.
- Served as primary high level customer interface for escalation issues
-

1988-1990 GE Product Service Schenectady, N.Y.

Manager Contract Administration/Outage Support

- Established a new group of 6 engineers with contractual responsibility for selected, high priority, non-routine major global turbine generator projects having special requirements.
- Designed and implemented new systems to reduce costs and improve profitability.
- Maintained high visibility position with senior level management for commercial and technical reporting.

1985-1988 Generator Engineering Schenectady, N.Y.

Technical Leader Generator Rebuild and Supply Engineering

- Provided senior level HQ engineering technical support to field personnel.
- Responsible for supervision & training generator engineering personnel, field engineers, service shop, overseas business associates.
- Personally managed the advanced generator maintenance program which trained over 80 generator specialists, startup engineers, and shop personnel in a 6 year period.
- Transitioned experience from two departing senior engineers to preserve technical expertise.
- Presented training and information seminars to IEEE, utilities and at GE technical conferences
- Instituted a new warranty complaint tracking and processing system to

expedite estimating, processing and tracking.

- Completed a project covering 25 years of stator rewinds to predict future market potential, and competitive positioning
- Worked to effectively reduce costs for stator rewinds
- Project managed the first major generator synchronous condenser conversion
- Managed one of the first radial-axial-radial to diagonal flow field conversions to eliminate grounds, coil distortion and thermal sensitivity; provided direction for the first time temporary repair of a RAR field to generate new business.
- Authored and Published several Technical information letters
- Provided total technical management for a unique cracked shaft repair.
- Coordinated the technology transfer of the medium generator fleet from Lynn, Ma. To Schdy.
- Anchored a major failure investigation of an overseas nuclear unit
- Designed and Automated a new computer driven rewind quote and ordering system
- Led several overseas high profile failure, repair and maintenance efforts

1982-1985 Generator Engineering Schenectady, N.Y.

Technical Leader Generator Availability Engineering

- Provided senior level engineering technical support to field personnel.
- Mentored, trained and supervised less experienced office and field engineers on factory and field projects, designed several technical training courses.
- Supervised factory/manufacturing technical support for redesigns, replacement fields, retaining ring diagnostic inspections and replacements,
- Supported field ground investigations, negative sequence heating evaluations, field and stator contamination problems, rewinds and auxiliary equipment operation.
- Led the generator portion of several major GE technical conferences
- Led the technical evaluation and resolutions of unusual field thermal sensitivity vibration issues to restore several units to service
- Directed the repair of fields with unusual damage
- Provided support for manufacturing pursuit of a new field rewind business.

1978-1982 Generator Engineering Schenectady, N.Y.

Engineer Generator Availability Engineering

- Provided technical support for maintenance and installation of GE's worldwide fleet of large steam turbine generators
- Made frequent trips to job site to resolve unusual/outstanding technical problems and advise GE field personnel and customers.
- Wrote repair procedures & resolved root cause and effect of units forced out of service, responsible for field engineering and generator specialist manuals
- Made recommendations for proper operation and protection of operating units
- Made formal technical presentations to other components, customers on

state of the art maintenance activities.

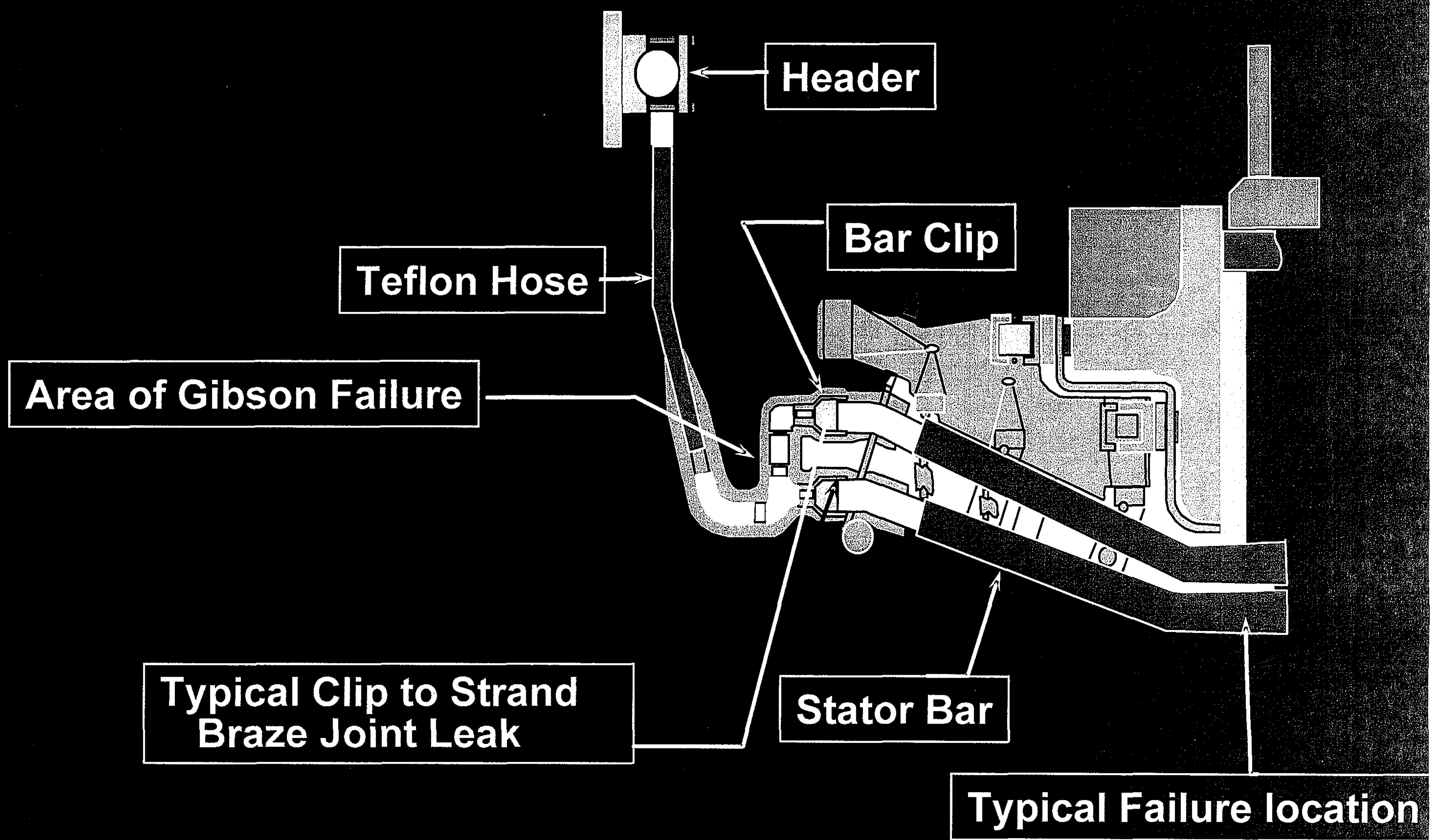
- Worked with engineering design units, production and manufacturing organizations , marketing, lab
- Spearheaded the early retaining ring stress corrosion investigations and repairs to set overall policy
- Investigated early copper dust incidents and developed repair procedures.

1974-1978 Installation & Service Engineering Various locations

Installation Engineer/Field Engineer/Generator Specialist

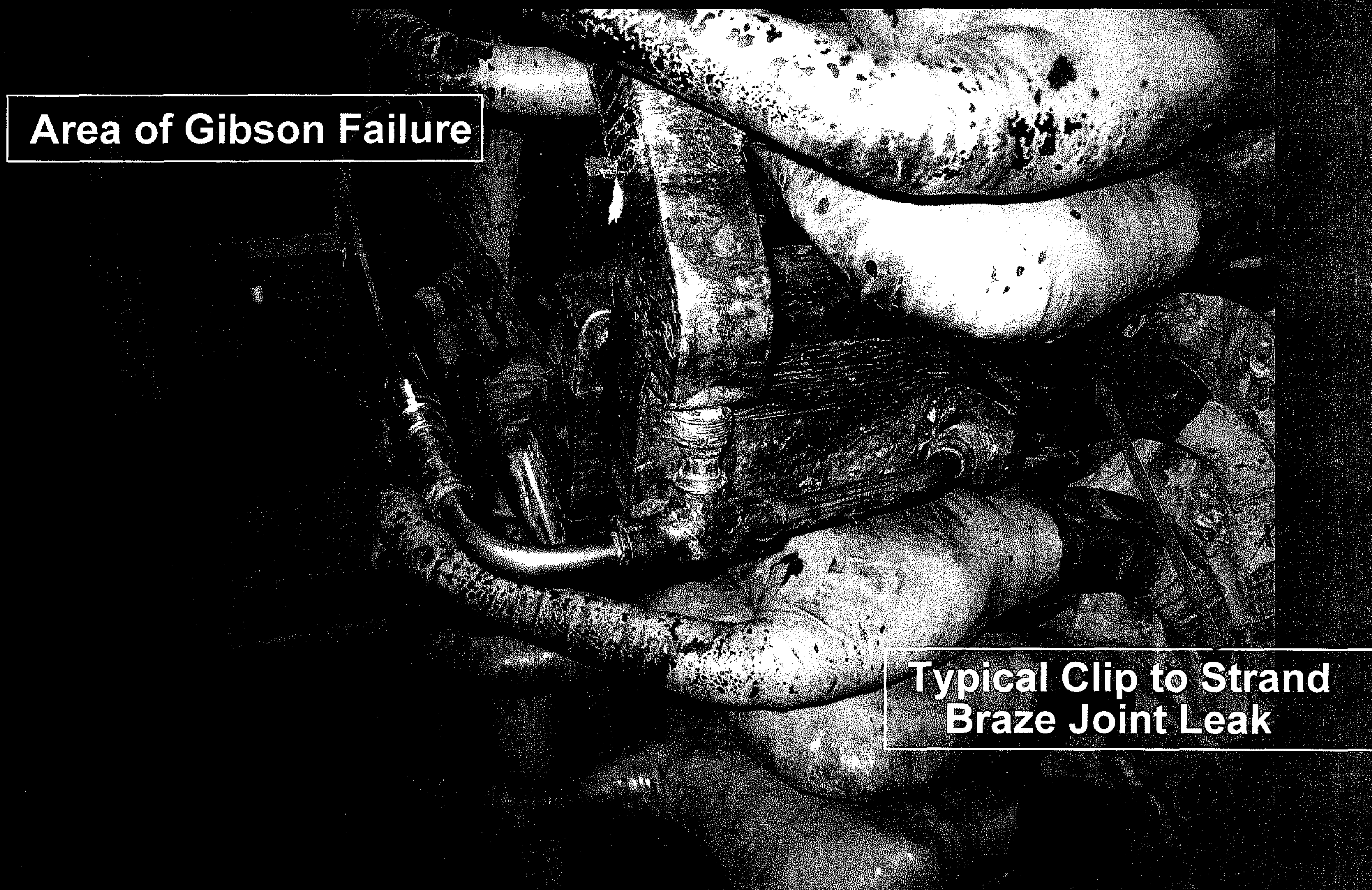
- Responsible for field technical support for installation of 12 new 600+MW units
- Worked on the maintenance of large, medium steam, and gas turbines in the Philadelphia district
- Installed a 660 MW G3 large steam turbine in Minneapolis
- Headquarters assignment for installation of new computer system to track installations
- Graduated the Advanced Generator Maintenance Program.
- Major rebuild of several overseas generators while on loan to the international department, including turbine work.
- Tested, inspected and maintained utility and industrial Generators throughout the central U.S.

Typical Leak Locations vs. Gibson Failure Location



Typical Leak Locations vs. Gibson Failure Location

Note: Picture is for orientation purposes only-this is not actual failed bars.

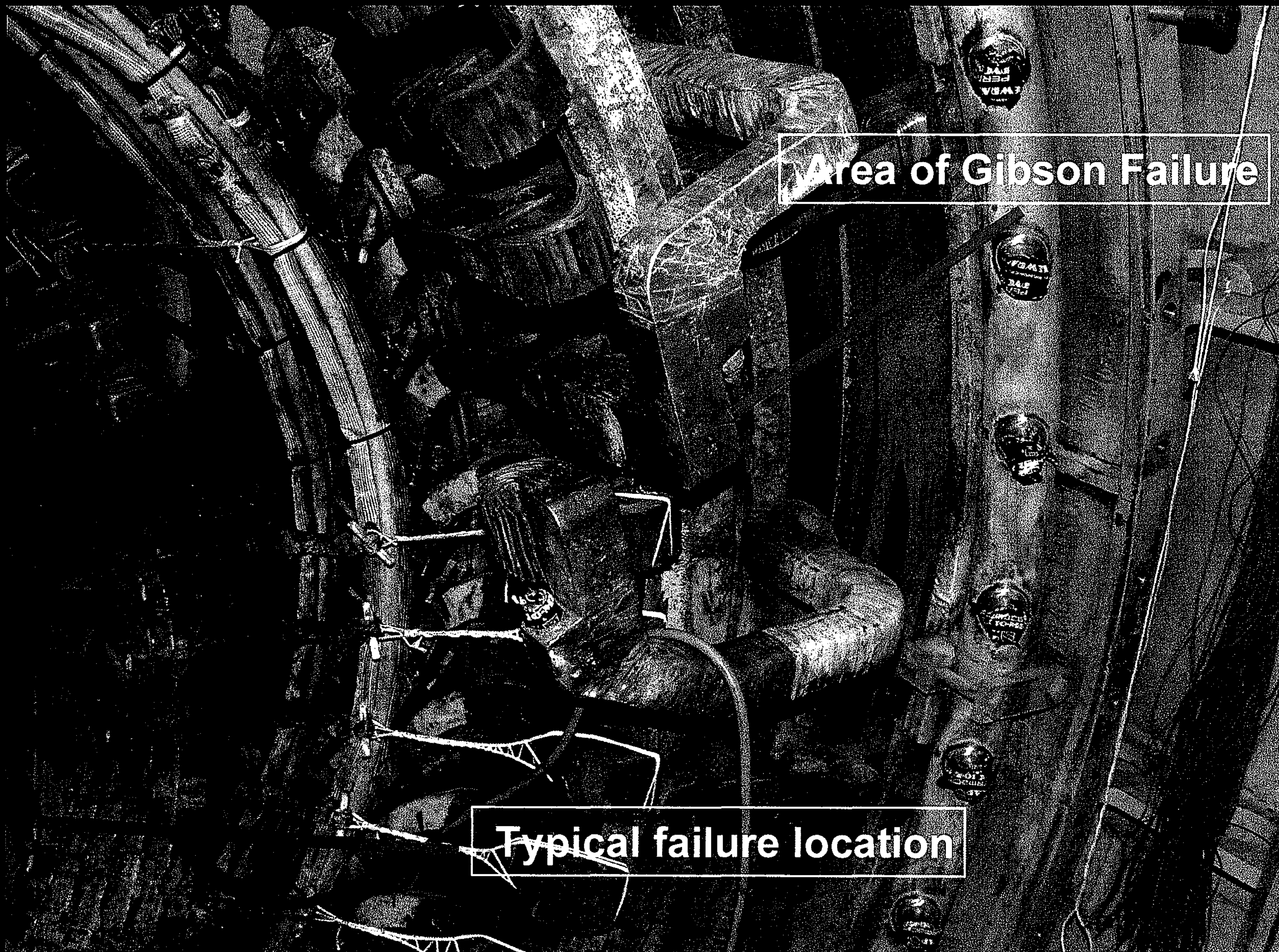


Area of Gibson failure at connections

Note: Picture is for orientation purposes only-this is not actual failed bars

Area of Gibson failure at connections

Note: Picture is for orientation purposes only-this is not actual failed bars



Area of Gibson failure at connections-as found condition

Area of Gibson failure at connections-after removing insulation

DUKE ENERGY INDIANA'S
CONFIDENTIAL EXHIBIT G-4

Evidence of water not found on Putty or Insulation