BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF SOUTH DAKOTA

In the Matter of the Transmission Permit for the Big Stone South to Ellendale Project

EL13-028

DIRECT TESTIMONY OF DANNY FREDERICK

BACKGROUND OF WITNESS

Q. Please state your name, current employer, and business address.

A. My name is Danny Joe Frederick. I work for POWER Engineers, Inc. ("POWER"). My business address is 555 Briarwood Circle, Suite 205, Ann Arbor, Michigan 48108.

Q. What is your current position with POWER?

A. Project Engineer II.

Q. What are your duties and responsibilities in that position?

A. As a Project Engineer, I am responsible for technical aspects of transmission line design projects. This includes structure spotting, structure design, foundation design, material and construction specifications, construction observation and inspection, and cost estimating.

Q. What is your educational background?

A. I received a Bachelor of Science degree in civil engineering from the University of Missouri in 2002.

Q. Do you have any professional licenses?

A. I am a professional engineer registered in Missouri.

Q. Before becoming a project engineer, what other positions did you hold at POWER?

A. I worked as a design engineer at POWER from 2002 to 2007.

Q. What did you do in that position?

A. As a Design Engineer, I assisted project engineers and project managers with transmission line design tasks. These tasks included foundation design, wood and steel structure design, project estimating, preparation of material and construction specifications, transmission line hardware selection, preparation of structure and material drawings, construction support, and onsite construction observation.

Q. Have you been involved with the Big-Stone South to Ellendale 345kV transmission line project ("the Project")?

A. Yes, I have been extensively involved with the Project.

Q. What has your role been within the Project?

A. I have been the Project Engineer leading the preliminary engineering design efforts and providing engineering review during routing and permit application preparation. During the preliminary design efforts, I was responsible for evaluating the proposed route for the Project from an engineering and constructability perspective. While working on the preliminary engineering design, I drove the entire preferred route of the line. I also have completed a structure study, which was provided to the Owners to assist them in selecting the structures for the Project. I am continuing to work on the preliminary design of the project. I also have been working on determining the preliminary structure (pole) spotting that indicates the tentative structure locations on the Project. As proposed changes of the routes have been reviewed by the Project, I have participated in the review of those proposed changes from an engineering standpoint.

Q. Other than this Project, do you have any other experience working on transmission line projects?

A. Yes. I have worked on transmission line projects for the previous 12 years. I have prepared construction specifications, provided engineering support to issues that arise during construction, and have been an onsite resident engineer that provided construction engineering support on other transmission line projects.

Q. What is Exhibit 14?

A. This is my curriculum vitae.

Q. Is this true and accurate?

A. Yes.

BACKGROUND OF POWER

Q. What is the background of POWER?

A. POWER is an employee-owned consulting engineering firm specializing in energy, facilities, communications and environmental services. It was founded in 1976, in Hailey, Idaho. Services to the electric utility industry have been a core service provided by POWER since its beginning.

Q. Where are POWER's offices located?

A. In addition to its headquarters in Hailey, Idaho, POWER Engineers has offices located in the following states and international locations:

Arizona – Phoenix

California – Anaheim, Sacramento, and San Diego

Colorado – Denver

Florida – Orlando

Georgia – Atlanta

Hawaii - Hilo

Idaho – Boise, Hailey (HQ)

Kansas – Kansas City

Maine - Freeport

Massachusetts - Boston

Michigan – Ann Arbor

Minnesota – Minneapolis

Missouri – St. Louis

Montana – Billings

New Jersey – Hamilton

New York - Syracuse

Ohio – Akron, Cincinnati

Oregon - Portland

South Carolina – Fort Mill

Tennessee - Knoxville

Texas – Austin, Fort Worth, and Houston

Washington – Clarkston, Plover, Seattle, Tacoma, and Vancouver

Wisconsin – Green Bay, Madison, Plover

International offices in Manchester and Gatwick, United Kingdom, and Johannesburg, South Africa

Q. How many employees does POWER currently have?

A. POWER has 1,863 active employees.

Q. How are the employees divided within POWER?

A. The business groups within POWER Engineers and the number of employees in each group are:

Power Delivery – 1,056

Operations -- 180

Facilities – 220

Communications – 34

Resource & Asset Management – 216

Federal – 32

Generation – 125

Q. What group do you work for?

A. I work in the Power Delivery group.

Q. How many professional engineers work in POWER's Power Delivery group?

A. POWER employs 355 registered professional engineers with approximately 230 registered professional engineers in the Power Delivery Group.

Q. What experience does POWER have in the design and construction of transmission lines?

A. POWER has been involved in the design and construction of transmission lines since its beginning in 1976. Since 2008, we have been involved in the design and construction of over 7,000 miles of 345 kV and 500 kV transmission lines, split approximately 50/50 between the two voltages. For voltages below 345 kV, we also have thousands of miles of design and construction experience. Examples of recent projects or clients and approximate mileages include:

CREZ (Competitive Renewable Energy Zone) Projects = 600 miles of 345kV

NEEWS (New England East-West Solutions) = 100 miles of 345kV

MPRP (Maine Power Reliability Program) = 150 miles of 345 kV

CapX 2020 = 300 miles of 345kV

Nebraska Public Power District = 150 miles of 345kV

POWER'S ROLE IN THE PROJECT

Q. What is POWER's role in the Project?

A. The Project contracted with POWER to provide overall project coordination and preliminary engineering for the Project. The preliminary engineering is in support of obtaining the permits required for the project and includes routing, public involvement and preliminary design.

Q. What has POWER done to date in regard to the Project?

In addition to coordination with the owners Otter Tail Power Company (OTP) and Montana Dakota Utilities (MDU) and the Project's various consultants, POWER is providing engineering support for the preparation of the route permit applications in North Dakota and South Dakota. POWER has also determined the preliminary line location and preliminary structure locations for the transmission line.

Q. What will be POWER's role if the Project is constructed?

A. POWER's role in the construction of the Project has not been determined by the Applicants.

Q. In performing its work on the Project, did POWER perform any engineering studies?

A. Yes. I prepared a structure (pole) study. Additionally, Jon Leman at POWER was responsible for the production of electrical studies relating to the conductors (lines) on the Project, as well as the effects of electrical fields, magnetic fields, and corona.

Q. Have you reviewed these studies and their findings?

A. Yes, I have reviewed all of these studies.

Q. Are these studies the type of information relied upon by engineers providing engineering services on transmission line projects?

A. Yes, the studies are the type of common information gathered and relied upon by engineers in our field.

Q. What were the conclusions of these studies?

A. The structure study estimated the installed cost of H-frame structures, monopole tangent structures, guyed deadend structures and self supporting deadend structures. Regarding the corona and field study and the conductor study, Jon Leman will testify about those studies.

Q. Have you reviewed the Exhibit 1 and 1A, which is the Application, as amended, filed with Commission?

A. Yes.

Q. To what sections of the Application does your testimony relate?

A. Sections 22 and 23 of the Application.

<u>TRANSMISSION FACILITY LAYOUT AND CONSTRUCTION</u>

Q. Are you familiar on the anticipated plans as to the proposed construction of the transmission line?

A. Yes.

Q. What is the current status of the engineering design of the transmission line?

A. Preliminary structure (or pole) spotting has been completed, the conductor (or power line) has been selected, a structure family is in development, and the design criteria is in development.

Q. What has been done in regarding to designing the transmission line structures and facilities?

A. The structure family is in development. Structures are expected to be monopole, delta configuration tangents and light angles, and vertical configuration large angles and deadends. Typical foundations will be concrete drilled piers with anchor bolts to attach the structures.

Q. What will the structures look like?

A. If you go to Appendix H of the Application, this will show you what the typical structure is expected to look like.

Q. Why was the monopole structure selected?

A. Monopole structures were selected due to their small foundation footprint and low impact to landowners.

Q. How does the cost of the monopole compare to the cost of the other structures?

A. Monopole structures were compared to direct embed H-frame structures. When span lengths are factored in, monopole structures cost approximately 40% more than H-frame structures.

Q. Does the monopole provide any advantages to the landowner?

A. Monopole structures have an overall smaller foundation footprint than H-frame or lattice tower structures. Monopole structures also allow for longer spans than H-frames and lattice towers when used on the same right-of-way.

Q. What surveying has been done of the route from engineering prospective?

A. At this time, the land surveying has been limited to surveying on public rights-of-way. An aerial survey was completed along the preferred route of the transmission line.

Q. When will final engineering surveying be done?

A. Final engineering surveying is anticipated to start in March 2016 in preparation for construction.

Q. Explain the process for constructing the structures (poles).

A. The construction process is described in Section 22.0 of the Application. Generally, for the structures, the construction process requires several steps. First, the structure locations will be determined through surveys. Then, the foundations will be excavated and placed. Next, the structures themselves will be assembled near the foundations. Finally, the structures will be lifted into place and bolted to the foundation.

Q. How will the conductors be installed?

A. Conductors will either be installed by pulling a rope along the ground between structures or by aerial construction using helicopters to pull the rope between the structures. Typical construction involves first pulling a rope between the structures and using the rope to pull in a steel cable which is then used to pull in the conductor. It is unknown at this point if helicopters will be used.

Q. What is the span length between structures?

A. Span lengths will vary depending on the terrain and features specific to each location but they are expected to be approximately 700 to 1,200 feet.

Q. Will the transmission line be buried underground?

A. No portion of the transmission line will be placed underground, with the exception of copper or copper-clad ground rods and ground wire.

Q. Why not?

A. At this voltage, placing the line underground would not be an economical choice as the cost can be 15-20 times more expensive than the cost of conventional overhead transmission. Maintenance and repair issues can take much longer to repair than overhead transmission lines due to accessibility and material availability.

Q. Do you anticipate any construction challenges?

A. Although river crossings and existing line crossings always present unique challenges due to access and outages, the Project is equipped to handle these challenges.

Q. What measures will be undertaken during construction to mitigate damage to the land?

A. To minimize the impact of construction, the Project will employ best management practices (BMPs) as stated in Section 22.2.1 of the Application.

Q. What measures will be undertaken by the Project to restore the land after construction?

A. As indicated in Section 22.3 of the Application, the Project intends to restore any disturbed areas consistent with agreements negotiated with the landowner. Unless otherwise agreed to by the landowner, all construction material and debris will be removed from the site once construction is complete. Post-construction reclamation activities include dismantling temporary facilities, employing appropriate erosion control measures, and reseeding areas disturbed by construction.

Q. How will the structures be maintained after construction completed?

A. Section 22.4 of the Application addresses the maintenance procedures. As indicated in that section, the transmission line will be regularly inspected for maintenance and repairs, and if necessary, they will be made. Access for maintenance will typically be limited to the right of way.

ENGINEERING CONSIDERATIONS

Q. Describe your view from engineering standpoint as to the proposed line's reliability?

A. The routing and design of the transmission line follows many of the same procedures and criteria used for other lines of the same size and function that have been in service for decades. The transmission line structures will be designed to withstand weather loads that are typical for the area in which the line is located. The structures will be designed to meet the National Electric Safety Code (NESC) strength requirements and will also be designed to withstand 200 year return period weather events for extreme wind and concurrent wind and ice. A 200 year return period weather event is a weather event that statistically has a 0.5% chance of occurring during any one year.

Q. Describe your view from an engineering standpoint as the safety of the proposed line?

A. The transmission line will be designed to meet or exceed all applicable safety standards, including the NESC. The structure designs will be similar to structures that have been in service for many years and have a proven track record of safety.

Q. Do you foresee any issues relating to tree clearing during construction?

A. No, we do not anticipate any issues related to tree clearing during construction. The project attempted to avoid tree row wind breaks but where it was unavoidable, crossings were made near perpendicular to minimize the quantity of trees to be cut.

Q. Is someone else testifying about any issues relating to electrical fields, magnetic fields, and stray voltage from the transmission line?

A. Yes, the testimony of Jon Leman is addressing those topics.

Q. What about the effects of the transmission line on farming equipment and GPS units, whose testimony addresses those issues?

A. Jon Leman.

LANDOWER ISSUES

Q. Have landowners raised any other engineering related concerns about the Project?

A. Yes, landowners have raised some concerns. Regarding engineering concerns, the issues generally relate to GPS interference, health concerns regarding electric and magnetic fields, and structure spotting in general. Again, John Leman is testifying about GPS interference, and the health concerns regarding electric and magnetic fields.

Q. What has the project done to address landowner concerns about structure locations?

A. Structure spotting issues are being considered in discussions between the landowners and right-of-way agents and through our structure spotting process. The Project continues to work with landowners in an effort to address the landowners' concerns.

ENGINEERING OPINIONS

Q. At this time do you perceive any significant challenges in constructing and operating and maintain the proposed line from an engineering prospective?

A. There are challenges with every project but I do not feel that this Project presents any challenges that we cannot handle.

Q. From an engineering perspective, do you have an opinion regarding whether the construction, operation, and maintenance of the transmission line will cause serious damage to any landowner's property, or the health and safety of the landowners?

A. Yes, I have an opinion.

Q. What is that opinion?

A. The Project will not cause serious damage to landowner's property or the health and safety of landowners.

Q. From an engineering perspective, do you have an opinion regarding whether the the construction and operation of the line to be a serious threat to the environment or the inhabitants or future inhabitants of where the line is anticipated to be constructed?

A. Yes, I have an option.

Q. What is your opinion?

A. The construction and operation will not pose a serious threat to the environment or the inhabitants where the line is anticipated to be construction.

Q. Are you aware as a result of your studies and investigation of the Project that the construction and operation of the line will unduly interfere with any development of the region?

A. No, it will not.

Q. Does this complete your direct testimony?

A. Yes, it does.

DANNY FREDERICK, P.E.
PROJECT ENGINEER

YEARS OF EXPERIENCE
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EDUCATION
> B.S., Civil Engineering, University of Missouri, Columbia, 2002

AREAS OF EXPERTISE
- Drilled-pier foundation design
- Alternative foundation design
- On-site inspection
- Transmission structure design
- Transmission structure spotting
- Material specifications
- Construction specifications
- On-site engineering

LICENSING
> P.E., Civil: Missouri

HARDWARE/SOFTWARE
- PLS-CADD
- PLS-Pole
- Alcoa Sag10
- TLW-FAD
- AutoCAD

EXPERIENCE SUMMARY

Mr. Frederick is an experienced transmission line engineer, specializing in foundation and structural engineering for overhead transmission line projects. As a project engineer, he is responsible for all technical aspects of transmission line projects. As a foundation engineer, he has met many design challenges, including installation of foundations in lakes, in mine spoils, and water crossings. His experience includes new line designs and rebuilds of existing transmission lines, with voltages up to 500 kV.

Progress Energy Florida, Lake Bryan to Windermere 230 kV Line, Florida

Design Engineer responsible for assisting in the foundation and structural engineering. POWER was responsible for the design and layout of approximately 10 miles of 230 kV double circuit transmission line using tubular steel structures with polymer braced-post insulators and 1622 Pecos/ACSS/TW conductor. The work scope included survey coordination, structure layout, foundation design, utility coordination, wetland access roads, permit drawings and structure design. The project required minimizing outages on the existing 230 kV line and transferring an OPGW cable from the existing line to the new line.

Progress Energy Florida, Vandolah-Whidden 230 kV Line, Florida

Design Engineer responsible for assisting in the foundation and structural engineering. POWER was responsible for the design and layout of approximately 15 miles of 230 kV double circuit transmission line utilizing tubular steel structures with polymer braced-post insulators and 1622 Pecos/ACSS/TW conductor. The work scope included routing analysis, attendance at public meetings, survey coordination, structure layout, foundation design, utility coordination, wetland access roads, permit drawings and structure design.

Kenny Construction Company, 500 kV Trans Allegheny Interstate Line, Multiple States

Civil/Structural Engineer responsible for final foundation design for a new 500 kV transmission line. The project features 500 kV lattice steel structures. POWER was the design and permitting contractor for a 160-mile line that spans Allegheny Energy's service territory from SW Pennsylvania through West Virginia to northern Virginia. POWER provided environmental resource studies and jurisdictional permitting and licensing services, and detailed transmission line engineering and design, including material specification and establishing new line and structure design criteria.

EXHIBIT
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Otter Tail Power Company, Montana Dakota Utilities, Big Stone South to Ellendale 345 kV Transmission Line, Multiple States

Project Engineer responsible for preliminary line design and permitting support. Duties included the development of an aerial survey specification, conductor optimization study, structure optimization study, design criteria development, route and corridor development support, structure spotting, and representing engineering at the public and PUC meetings. This multi-value, jointly-owned, 165-mile 345 kV transmission line project is integral to the MISO transmission network to improve reliability, increase system capacity, and support public policy. POWER is providing overall project coordination for the environmental, permitting, routing, right-of-way acquisition, surveying, and legal support work (done by others), and is completing the preliminary engineering for this transmission line. In addition, POWER's scope involves design support including development of the design criteria, conductor selection, evaluation and selection of structures, preliminary structure spotting, and cost estimating.

American Transmission Company, Arrowhead to Weston 345 kV Transmission Line, Wisconsin

Project Engineer for two line sections consisting of 49 miles of single circuit and double circuit 345/161 kV line. Also served as the overall lead design engineer for steel structure and foundation design (all are drilled pier foundations). Responsible for all engineering field reviews of the structure spotting on the entire line. The project involved design and construction of a new 220-mile-long, 345 kV steel pole transmission line running from southern Minnesota to central Wisconsin. POWER's project scope included field surveys, electrical studies, structure designs, line design, material specifications, construction specifications, right of way acquisition and construction monitoring services. The noteworthy project received achievement awards from the Wisconsin chapter of ASCE and from the Edison Electric Institute.

CAPX 2020, Transmission Expansion Initiative, Multiple States

Project Engineer for Owner's Engineer services for two transmission projects under the CAPX 2020 initiative. The projects are a 200-mile, 345 kV transmission line from South Dakota to the Twin Cities, MN, area, (including four substation modifications and three new substations); and a 70-mile, 230 kV transmission line between Bemidji and Grand Rapids, MN (including two substation modifications and one new substation). Responsibilities included development of the material specifications, development of the construction specifications, performing vendor audits, performing technical reviews of the civil and electrical design, construction inspection and as-built review. CapX 2020 is a major initiative of 11 regional utilities to boost capacity and reliability of the electric transmission grid in Minnesota and surrounding states. POWER is acting as Owner's Engineer for four of the projects. Collectively, these projects will result in construction of roughly 600 miles of 345 kV transmission line, 70 miles of 230 kV transmission line, 9 new substations and modifications to several existing substations.

Sunflower Electric Power Corporation, Buckner Tap, Kansas

Project Engineer responsible for accelerated schedule of the installation of a tap into a 345 kV lattice tower E+PC transmission line project.

Sunflower Electric Power Corporation, River Road to Barber 115 kV Transmission Line, Kansas

Project Engineer responsible for the overall technical design of this 115 kV E+PC transmission line project. Responsibilities include structure design, foundation design, and material procurement. POWER is providing engineering services for an upgrade of Sunflower Electric Power Company's 115 kV River Road to Barber transmission line. The project encompasses nearly 25 miles of transmission line design and construction support that includes the replacement of existing wood H-frame structures with single circuit steel poles.

National Grid, Mullbury #3 to West Farnum 345 kV Transmission Line, Massachusetts

Project Engineer responsible for engineering and design services for the new Millbury #3 to West Farnum 345 kV Transmission Line (Line 366), a part of the New England East-West Solution (NEEWS) project for National Grid. Responsible for structural design, structure spotting, foundation design and budgeting updates. POWER is providing owner's engineering services for NEEWS, a major project to construct new transmission facilities and upgrades in Massachusetts and Rhode Island. These projects include new 345 kV single circuit transmission lines, reconductoring of existing 345 kV lines, rebuilds of existing 115 kV lines, new 115 kV taps to multiple substations, expansions and modifications to an existing 345/115 kV substation, and a new 345/115 kV substation. POWER's involvement includes engineering and design services; material, equipment, and construction services; procurement support; construction management; and start-up and close-out services.

Xcel Energy, Yankee to Brookings 115 kV Line, Minnesota, South Dakota

Project Engineer for a new, 12-mile, 115 kV transmission line in South Dakota and Minnesota. As one of the Buffalo Ridge Interconnection Generation Outlet (BRIGO) projects, approximately 6.5 miles in MN and 6.5 miles in SD of new line will be installed as an additional outlet for wind power generation. The line is single circuit, bundled conductor line on weathering steel poles and drilled pier foundations. There are sections of line that are required to be double circuit sections due to right of way constraints and corridor sharing.

Public Service Company of New Mexico, Alamo Tap to Alamo #1 115 kV, New Mexico

Project Engineer for 6 ½ miles of new wood pole and steel pole transmission line including distribution underbuild. This line was part of a reliability upgrade in the area which brings a new 115 kV source into the Alamogordo, NM area.

Texas New Mexico Power, Alamogordo to Tularosa 115 kV Line, New Mexico

Design Engineer for a new, 14 mile, 115 kV transmission line that features both wood and steel pole structures. The line is single circuit with distribution underbuild. The line is part of a reliability upgrade for the area.

Kenny Construction, Werner West 345/138 kV Lines, Wisconsin

Design Engineer involved in the construction phase of this project. Responsible for the engineering required to reconcile a number of construction issues and to also responsible for creating as-built documents. The project involved four 345 and 138 kV cut-ins to a new substation. The line has steel pole H-frame and three-pole dead-end structures.

American Transmission Company, DCRP #2, 138 kV Lines, Wisconsin

Design Engineer involved in the construction phase of this project, which was part of the Dane County Reliability Project #2 (DCRP). Responsible for the engineering required to reconcile construction issues and to create as-builts for the project. The line featured wood and steel pole structures at 138 kV, both single and double circuit. The project involved existing lines that were re-conductored and/or involved the installation of a fiber optic communication wire.

Oncor Electric Delivery, Rockwall - East Richardson 138 kV Line, Texas

Design Engineer responsible for challenging foundation designs on this 138 kV project. Designed foundations through approximately 2-1/2 miles of marsh and lake area. Some foundations had to be constructed in depths of 10-40 ft of water. Foundations required were drilled piers and vibrated steel piles. The transmission line features single circuit and double circuit steel pole structures.

American Transmission Company, North Randolph - Mackford Prairie, 69 kV, Wisconsin

Design Engineer for this new 10 mile, 69 kV transmission line. Responsible for engineering and design while also coordinating with survey and construction management teams. The line is single circuit wood pole structures involving distribution underbuild.

Wisconsin Public Service Corp., Sherman Street – Wausau West Hydro 115 kV Transmission Line, Wisconsin

Design Engineer for this 1.2 mile transmission line rebuild from 46 kV to 115 kV. Responsible for engineering and design while also coordinating with surveyors. The line is double circuit steel pole structures involving distribution underbuild with special consideration given to structure spotting.

Southern Mississippi Electric Power Association, 161 kV Transmission Lines, Mississippi

Design Engineer on this project that involved six different transmission lines. The lines are all 161-69 kV double circuit lines with future capacity to become 161-161 kV circuits. These lines comprise approximately 75 miles and use single pole concrete structures.

PREVIOUS WORK HISTORY