LARRY HENRIKSEN, P.E.

BUSINESS UNIT DIRECTOR

YEARS OF EXPERIENCE
35

EDUCATION
> M.E., Electrical Engineering, University of Idaho, 2001
> B.S., Electrical Engineering, Washington State University, 1975
> B.S., General Engineering, Idaho State University, 1968

LICENSING
> Electrical Engineer: Washington
> Electrical Engineer: Idaho

AREAS OF EXPERTISE
> Electrical system protection
> Transmission and substation planning, design, and construction
> Transmission line routing, siting and permitting
> Protective relaying
> Expert testimony
> Installation and operation of computer-based SCADA systems
> Distribution engineering
> Electrical systems studies
> Testing and commissioning
> Project management and budgeting
> Specification and procurement of major electrical equipment
> Right of way
> Construction management and inspection
> Establishing maintenance and operations procedures

PUBLICATIONS
> With Jon Leman, P.E. and Brian Berkebile, P.E. of POWER Engineers, "Fault Current Rating of Optical Ground Wires" presented to the POWER Engineers Line Conference, 2008
> With John Kumm, P.E. and Sivasis Panigrahi, P.E. of POWER Engineers, "Protective Relaying Considerations with Wind Generation Substations and Collection Systems" presented to the

EXPERIENCE SUMMARY

Mr. Henriksen has been responsible for a broad range of electric power system engineering activities at the detailed design, supervisory, and management levels. In addition to his design and management experience at POWER, he has served as Chief Engineer for an electric utility, and Director of Systems and Services for a major manufacturer of electrical relays. Mr. Henriksen maintains a technical focus on electrical system protection and related electrical studies activities in addition to participating in planning and special projects. His experience includes electrical system protection; transmission and substation planning, design, and construction; transmission line routing, siting and permitting; distribution system protection, expert testimony, installation and operation of computer-based SCADA systems; distribution engineering; electrical systems studies; testing and commissioning; project management and budgeting; specification and procurement of major electrical equipment; right of way; construction management and inspection; and establishing maintenance and operations procedures.

Specific experience includes:

SCADA and Analytical Services Business Unit Director, POWER Engineers, Idaho

Responsible for technical and administrative supervision of the SCADA and Analytical Services Business Unit. Specific responsibilities include management of the business unit, technical support, scheduling, quality control, and personnel matters. Services provided include protective relay system design and settings; power flow and transient stability analyses; planning studies; SCADA system design and commissioning; communication system studies; communication network design; grounding studies; AC interference studies and time domain simulation (EMTP) analyses and EMF calculations.

Entergy, Plum Point 500 kV Transmission Line Interference Analysis, Arkansas

Technical Advisor responsible for technical assistance and quality control. POWER performed an interference analysis to determine the effects of a planned 500 kV transmission line extension on an existing railroad line. The two-mile, double circuit line is parallel to the Burlington Northern Santa Fe railroad and connects to a new 500 kV switching station. POWER created a 3-D model of the transmission and railway systems and used the HIFREQ module of Safe Engineering Service's CDEGS software for analysis. Mitigation recommendations were provided.

PB America, Alaskan Way Viaduct Replacement, Washington

Georgia Tech Protective Relaying Conference, 2008

> With Patrick Bradshaw and Vincent Duong, Public Service Company of New Hampshire, Vernon Padaca, P.E., POWER Engineers. "Protection System for a 115 kV Double-Wye Fuseless Undergrounded Capacitor Bank", Georgia Tech Protective Relaying Conference, 2006

> With Daren Phelps, Calpine Corporation; Greg Rauch, Schweitzer Engineering Laboratories; and Aaron Wilson, POWER Engineers. “Three Terminal 230 kV System Protection and Restoration at Calpine’s Creed and Goose Haven Energy Centers,” Western Protective Relaying Conference, Spokane, Washington, 2003

> With David Gardner. “Value Engineering Strategies for Wind Generation Projects,” IBC Wind Conference, Boston, 2002

Technical advisor for electrical system studies associated with the relocation of utilities for the project. Responsible for coordinating and scheduling resources. POWER is the Utility Engineer responsible for the planning and design of temporary and permanent relocations of Seattle City Light’s transmission, distribution and service lines impacted by the replacement of the Alaskan Way Viaduct along Seattle's waterfront district. The $3 billion project will replace the deteriorating viaduct with either an underground tunnel or a rebuild of the above ground structure. The project will impact lines at 115 kV, 26 kV and 13.8 kV, and 480 Volts. POWER's on-site team, assisted by staff engineers, is involved in planning, conceptual design, system modeling, and system studies for the two design options.

Montana Alberta Tie Limited, Marias Switchyard, Montana

Responsible for developing conceptual protective relaying systems and consulting on specifications for the series capacitors. POWER is responsible for an engineer-procure-construct (EPC) contract for the Marias Switchyard, a key component of the Montana Alberta Tie Ltd. (MATL) transmission line, a 215 mile, 230 kV AC transmission line that will interconnect the energy markets of Alberta and the U.S. Marias Switchyard serves as the interconnect point for 300 MW of wind generation and provides voltage control for the project with two series capacitor banks, 150 Mvar and 84 Mvar, and four 40 Mvar shunt capacitor banks.

Mirant California, LLC, Power Plant Protection Review, California

Senior Project Engineer responsible for evaluating the protective relaying performance for selected generation units at the Pittsburg, Contra Costa, and Potrero power plants. The evaluation included a field survey and testing of existing relaying systems; analysis of existing system performance; and the development of a range of recommendations to improve performance of the protective relaying. Led a team of system studies engineers who reviewed protection schemes, analyzed current transformer performance using IEEE formulas validated by Alternate Transients Program (ATP) modeling, analyzed existing protective relay performance, and created a range of recommendations to improve protective relaying performance. Recommendations included replacement of the existing sudden pressure transformer relays with present-day design rapid pressure rise relays.

Public Service of New Hampshire, Scobie Pond 345 kV Substation Upgrade, New Hampshire

Electrical Engineer responsible for preparing and reviewing the protective relay settings for the 345-115 kV transformer and adjacent 115 kV bus protection. Protective elements set for this project included primary and back up transformer differential, bus differential, bus distance, and breaker failure. Relay types included SEL 387E, SEL 321, SEL 551, and ABB TPU. POWER was responsible for the addition of a 450 MVA 345/115 kV autotransformer into an existing Public Service of New Hampshire substation. Services included design, relay settings, oil containment design, and commissioning.

City of Vernon, Leonis Substation Condition Assessment, California

Technical Advisor responsible for consulting the project team on technical and

operational considerations. POWER was contracted to assess the condition of the Leonis Substation including the underground civil and electrical facilities up to the transmission overhead buswork and equipment. A formal assessment report and cost estimate were provided to Vernon which included recommendations for oil containment and SPCC plans, battery system, equipment aging and operation, insulated cable condition, relaying recommendations, switches, bus, capacitor banks, foundations and grounding.

Perini Corporation, Buzurgan Substation, Amarah, Iraq

Engineer responsible for relay coordination for the fast-track development of the new 132 kV Burzurgan Substation in southern Iraq. This U.S. Army Corps of Engineers project was part of the Iraq reconstruction effort. The substation is a five-breaker ring bus configuration designed to interconnect a new combustion turbine generating facility (also designed by POWER) with three existing transmission lines. POWER provided project management, physical and electrical design, equipment procurement, relay coordination, testing of relay panels, field engineering and construction inspection. Design and material purchase were completed in eight weeks.

Emerald Performance Materials, LLC, Breaker Rating and Arc Flash Study, Washington

Project Manager for a study to determine the potential for arc flash hazards at the client's Kalama, Washington, facility. POWER was contracted to gather data (field survey, old studies, system drawings, etc.), and to create a computer model of the system. POWER then used the model to calculate the fault currents at each bus (480 V and higher) in the system. These results were compared to device ratings to identify insufficiently rated equipment. The fault currents, along with the nominal breaker ratings, were used to calculate the arc flash energy that could be seen if a breaker were to fail (based on IEEE-1584 and NFPA equations). The protective clothing required for each of these energy levels was then listed.

Mitsubishi Electric Power Products, Camp Williams Substation SVC, Utah

Lead Studies Engineer responsible for review and oversight of protective relay design and settings. POWER provided engineering services for the installation of a static var compensator (SVC) at PacifiCorp’s Camp Williams 345 kV substation. The project was needed to correct transient voltage criteria violations. The new system provides -125 to +350 Mvar continuous compensation using one TCR branch, two TSC branches and 5th and 7th harmonic filters. POWER's scope included complete physical arrangement, busing, foundation, structures, static protection, lighting, grounding, protection and control, wiring, control shelter, station service, testing and commissioning, and fiber optic communications. Project in design.

Entergy, Hartburg 500 kV Substation Expansion, Texas

Studies Engineer who provided technical support including breaker failure relay settings and CT application analysis for the expansion of this 500 kV substation from a four terminal ring bus to an eight terminal inverted breaker

and one-half station. The project required the installation of six 500 kV breakers, a new control building and extensive protection and control work. POWER's scope as the design-build entity included engineering and procurement and managing the construction contractor. Construction was completed on a fast track schedule to meet the in-service requirements of two independent power producers planning to construct plants near the station.

Southwest Transmission Cooperative, Hackberry 230/69 kV Substation, Arizona

Senior Project Engineer who provided conceptual design and technical consultation for the protective relaying and control system for a new 230/69 kV substation. The new substation provides 69 kV electrical service to Phelps Dodge's new Safford Mine, and an additional 69 kV source to Graham County Electric Cooperative (GCEC).

Confidential Client, Western U.S.

Provided technical support and project coordination to owner/developer in gaining interconnection of a 60 MW wind project to the utility grid.

Citizens Utilities Company, Kingman - Havasu Transmission Project, Arizona

Project Manager for a new 70-mile 230 kV transmission line, the expansion of two existing substations, and a new generation interconnection substation. The project required route selection, environmental permitting and design services. Mr. Henriksen coordinated with the environmental subconsultant and supervised POWER's responsibilities, which included system studies, economic analysis, right of way acquisition, substation design, line design and construction management services. POWER also supported the environmental permitting process with preliminary engineering. The preliminary and final designs were supported by a number of system studies, including system load flow, protective relaying and coordination studies.

Lewis County PUD No. 1, Glenoma-Mossyrock Transmission Line and Substations, Washington

Project Manager responsible for survey, design, procurement, and construction management for a new 21-mile-single circuit 230 kV and double circuit 230/69 kV line and two substations. The project was needed to deliver power from the Cowlitz Falls hydro generation facility to a point of interconnection at the Tacoma Public Utilities Mossyrock Switchyard. The single pole tubular steel transmission line design was complicated by extremely soft soils and a river crossing. The Mossyrock Switchyard addition included a new position in a four terminal 230 kV ring bus with relaying and communications. The new Glenoma Substation included a 230 kV-69 kV autotransformer, 69-12.5 kV transformer, one 230 kV circuit breaker position, two 69 kV circuit breakers, two 12.5 kV circuit breakers, relaying, fiber optic communication, and oil containment.

Cowlitz Falls Transmission Line Study, Washington

Project Manager for the economic feasibility study of all facets of transmission development and design to integrate the 80 MW Cowlitz Falls hydroelectric

project output into either the utility's or Bonneville Power Administration's existing transmission system. The analysis specifically addressed design alternatives to develop the most advantageous and economical transmission plan.

Citizens Utilities Co., Santa Cruz 115 kV Reconductoring Project, Arizona

Project Engineer for a technical and economic study investigating options to upgrade or replace a 54-mile wood pole H-frame transmission line which was at capacity and was suffering significant woodpecker damage to the structures. The study included a structure by structure inspection, investigation of reconductoring with specific attention being paid to ground clearance/loading/conductor tension trade-offs required due to the relatively short existing structures, and investigation of alternatives for new line construction.

Hercules-Bacchus Works Electrical Power Supply and Distribution Study, Utah

Project Manager for a power supply and distribution study for a major defense contractor and aerospace manufacturer in the Salt Lake City area facing a projected load growth from 14 MW 40 MW over a six year period. The study addressed the adequacy of existing utility and in-plant transmission and substation facilities at current and projected loadings; the addition of on site generation; reliability of the existing and alternative systems; identification of alternative systems; preparation of cost estimates for the alternative systems; and analysis of the alternatives.

Idaho Power Company, Midpoint – Borah 345 kV Transmission Line Reliability Assessment, Idaho

Reliability assessment of Idaho Power Company's 85-mile Midpoint to Borah 345 kV line. The line was upgraded from 230 kV to double-bundled 345 kV configuration in the 1960s. The assessment included a structure-by-structure field inspection; non-destructive pole strength evaluation; development of actual historical wind and ice loading; and an evaluation of historical and predicted lightning performance of the line. The study concluded that with minor modifications and limited pole replacements, the line could continue to serve with acceptable reliability.

Western States Intertie 500 kV Project

Project Engineer for the transmission system portion of the Western States Intertie, a 500 kV transmission line project that would have connected southern Idaho to a terminus point in the southwest. Responsibilities included evaluation of transmission line routes, meeting with federal and state agencies to discuss scoping and EIS preparation, and preparing alternative transmission structures for evaluation. The two primary system alternatives considered included two single-circuit 500 kV AC lines and a single + 500 kV DC line. Construction cost estimates and economic analyses were completed for the proposed project. Preliminary designs for the transmission line facilities and interconnecting 500kV substations were prepared.

Transmission and Distribution Department Manager, POWER Engineers, Idaho

Responsible for technical and administrative supervision of the transmission line design group. Specific responsibilities included technical support for the group, scheduling, quality control, and personnel matters. Projects ranged from distribution through EHV with project sites throughout the United States and included underground facilities as well as wood, tubular steel, and lattice steel structures.

PREVIOUS WORK HISTORY (OTHER FIRMS):

Director of Systems and Services, Schweitzer Engineering Laboratories, Washington

Management and supervision of the group responsible for relay setting projects and substation integration. Work included numerous relay setting projects for clients throughout the United States, as well as substation integration projects. All work emphasized SEL technology and solutions and included the full range of SEL relays and equipment.

Chief Engineer, Cowlitz County PUD, Washington

Chief Engineer for an electric utility with 36,000 consumers and 600 MW of peak demand. The engineering department, under Mr. Henriksen's management, provided design, construction, and operations support for the transmission system, distribution system, and substations. Permitting, right-of-way activities, extension of facilities to new customers, short range system planning, and budgeting for capital expenditures were also part of Mr. Henriksen’s responsibilities.