

# SUBSTATION ENGINEERING COURSE

Sargent & Lundy's Power Delivery Services Group conducts four days of training in substation design for our clients in the utility industry. Training is conducted in our Chicago, Illinois office by engineers engaged in substation design and engineering. Since the course was first introduced in 1994, it has been attended by more than 1000 utility professionals from throughout the United States and overseas.

## **Who Should Attend?**

The course is intended for utility engineers, project managers and other professionals involved with substation projects. In particular, entry level engineers or experienced professionals who are new to this area of the electric utility business will benefit from the course.

## **What You Will Learn**

The 4-day course offers a comprehensive treatment of the fundamentals of substation physical design, protection and control systems, civil/structural design and electrical testing and commissioning. The course is tailored to address specific tasks and applications of substation design. For example, in the grounding session, course participants learn how to perform a grounding calculation and lay out a ground grid. In the equipment session, each type of equipment is addressed, the manufacturers currently supplying each type of equipment are identified, and the requirements for a complete technical equipment specification are discussed. Throughout the course participants will complete calculation and design exercises, applying the principles learned. Each attendee receives a supporting copy of all classroom exhibits for future reference.

Throughout all the sessions, new information derived from recent experience on a wide variety of projects, including enclosed GIS substations in urban locations and extensive upgrades to existing facilities is shared with the participants.



## **Course Fees...**

The 4-day course in Sargent & Lundy's Chicago office is offered at the cost of \$1,925. The price will be reduced to \$1,825 if payment is received by Sargent & Lundy one week prior to course start date. Credit card payment is now accepted through our website. The fee covers supporting text, course materials, continental breakfasts and lunches.

Participants receive a certificate of completion and one Professional Development hour for every 1 hour of classroom instruction. Refer to specific state requirements for applicable Professional Development Hour (PDH) credits. Utility on-site sessions for 15 or more students are also available. Please call for information.

## **32 Professional Development Hours**

### **For registration information, contact...**

Mary J. McNamara at 312-269-2117  
[mary.j.mcnamara@sargentlundy.com](mailto:mary.j.mcnamara@sargentlundy.com)

or

Bettie J. Kidd at 312-269-7820  
[bettie.j.kidd@sargentlundy.com](mailto:bettie.j.kidd@sargentlundy.com)





## Day 1 Power System Analysis and Electrical Design, Part 1

Session 1 will provide students with an introduction to electric power systems and factors influencing substation design. Session 2 will introduce students to functions and design of various substation components.

### Session 1 – Electric Power Systems and Substation Components

Instructor: Thomas B. Thorsell

- Electricity Basics
- Power Grid Operation
- Types of Studies
- Power Grid Configuration

### Session 2 – Substation Components

Instructor: Thomas B. Thorsell

- Substation Types
- Substation Equipment
- Equipment Standards and Ratings
- Substation Materials

## Day 2 Substation Electrical Design

Session 3 will provide the fundamentals of relay protection and will introduce principles of protection schemes for major substation equipment. Session 4 will cover single line development process including in-class development of a single line.

### Session 3 – Protective Relaying Principles

Instructors: Michael Roessler / Romulus Berzescu

- PLC components
- Transformers
- Buses
- Lines
- Breaker failure

### Session 4 – Single Line Development

Instructors: Michael Roessler / Romulus Berzescu

- Bus arrangements
- One-line diagram
- Protection zones

## Day 3 – Substation Physical Design, Grounding, and Communications

Session 5 will present design inputs, layout options and selection, and air and gas insulated substation design. Session 6 cover grounding principles and substation grounding design. Sessions 7 and 8 will present SCADA concepts and telecommunications methods. Session 9 discusses the use of voltage control and power flow equipment in power grid operation.

### Session 5 – Substation Layout

Instructor: Thomas Thorsell

- Design inputs
- Substation layout selection
- Air insulated substations
- Gas insulated substations

### Session 6 – Substation Grounding

Instructor: Thomas Thorsell

- Purpose of the grounding system
- Touch and step potentials
- Grounding system design

## Day 3 – (Cont.)

### Session 7 – SCADA Concepts

Instructor: Matthew LaCourt

- Typical network
- Equipment
- Communication protocols

### Session 8 – Telecommunications

Instructor: Matthew LaCourt

- Telecommunications network functions
- Main types of communication
- Substation telecom networks and components

### Session 9 – Voltage Control/Power Flow Equipment

Instructor: Thomas Thorsell

- Capacitors and reactor
- Phase shifting transformers
- Synchronous Condensers
- Static VAR Compensators and STATCOMs
- HVDC

## Day 4 – Civil/Structural/Commissioning and Testing

Sessions 10, 11, 12, 13, and 14 will cover the principle elements of tasks performed by civil/structural engineers in the design of a substation. Session 15 will identify the steps required to verify the functionality of equipment, demonstrate that equipment is ready to be energized and enable safe energization and commissioning of newly installed equipment.

### Session 10 - Site Development

Instructor: Nathaniel Roth

- Grading and drainage

### Session 11 – Foundations

Instructor: Nathaniel Roth

- Typical designs
- Soils

### Session 12 – Bus Structural Design

Instructor: Nathaniel Roth

- Strain bus
- Rigid bus

### Session 13 – Structures

Instructor: Nathaniel Roth

- Types
- Loadings

### Session 14 – Substation Buildings

Instructor: Nathaniel Roth

- Construction alternatives
- Cost factors

### Session 15 – Commissioning and Testing

Instructor: Dan Sleezer

- Objectives of commissioning and testing
- Testing and commissioning caveats
- Coordination and support requirements
- Equipment and component testing
- Equipment and circuitry functional testing
- In-service testing/commissioning