Associate Engineer Training Series
Training Modules

♦ **Orientation (1 Hour)**
The Orientation module provides general knowledge of all business functions directly relating to distribution work processes now under the umbrella of Distribution Services.

♦ **Safety (1 Hour)**
The Safety module provides an overview of the District and Distribution Services Safety Manuals that have been developed to meet the District's Goal of creating an injury and drug free workplace that ensures the safety of employees and the public.

♦ **Process (2.5 Hour)**
The Process module provides an overview of the District and Distribution Services' Process Centered organization. In addition, the District's Goal of creating a process centered workforce through ongoing department reengineering efforts will be described, and the successes and challenges of these efforts will be investigated.

♦ **System Overview (2.5 Hour)**
The Districts power system is laid out to provide highly reliable power with a modest investment in facilities. The system overview module covers Generation, Transmission, Network and radial Distribution system design philosophies. This module will also review the common components used in the design of overhead and underground, primary and the secondary distribution systems.

♦ **Rates, Rules & Regulations (2 Hours)**
The Rates, Rules, & Regulations module will introduce the basic rate, rule, and regulation information applicable to the daily duties of the Engineering Designer and communications with customers.

♦ **Power Relationship (4.0 Hour)**
A building block of system engineering is an understanding of 3-phase power, sine waves, Watts, VARs, Amps, and power factor. The Power Relationship module will review these concepts and test for ability to perform the related calculations.

♦ **LTC Settings (2.5 Hour)**
Distribution feeder voltage is controlled automatically by Load Tap Changers located on the Distribution Substation banks. The settings that determine this automatic control are developed by system engineers in response to the needs of the substation loads. The LTC Settings module will review these concepts and test for ability to perform the related calculations.

♦ **Economics (2.5 Hour)**
The basis for the District's decision making is economics. Often called least cost planning, Distribution Services addresses proposed capacity modification by comparing the available options using adjusted Net Present Value (NPV). The Economics module will review these concepts and test for ability to perform the related calculations.

♦ **Protection 1 - Coordination (3 Hour)**
The District's Protection Guidelines specify the desired coordination between various protective devices. Good coordination reduces the number of customers exposed to an outage and reduces the trouble-locating time. The Coordination module will review these concepts and test for ability to perform device curve coordination.

♦ **Protection 2 – Fault Duty (4 Hour)**
The District utilizes various software tools to efficiently model the system for faulted conditions. To confirm these results and to understand the impact of system components the ability to calculate fault duties manually is necessary. The Fault Duty module will review these concepts and test for ability to perform the related calculations.

♦ **Voltage Drop & Flicker (4 Hour)**
Loads cause voltage drop on the facilities that that serve them, both during start (flicker) and during steady state operation. The District evaluates the loads characteristics, and then designs facilities that to the extent possible reduce the potential for flicker and excessive voltage drop to within acceptable standards. The Voltage Drop & Flicker module will review these concepts and test for ability to perform the related calculations.

♦ **Transformer Loading, Configurations & Connections (2 Hours)**
The Transformer Loading, Configurations & Connections module provides general knowledge of how to identify the correct size and configuration of transformers used in the distribution system.

♦ **Load Forecasting (2.5 Hour)**
Distribution System Engineering forecasts the loads for the next 5 years based on the most current years data, and the past 5 years. This data is temperature adjusted, corrected for load transfers, and adjusted for block loads. The Load Forecasting module will review these concepts and test for ability to perform the load forecasts using the District's model.

♦ **Standards Application & Applicable Codes (2.5 Hour)**
The General Order 95, 129, and 165 module provides general knowledge of uniform requirements for underground electrical supply and communication systems, and to establish minimum requirements for electric distribution facilities, regarding inspection, condition monitoring, scheduling and performance of corrective action, and record keeping. In addition this module will cover the National Electric Safety Code (NESC) and how it is utilized in system design.

♦ **Distribution Apparatus / Nameplates (2.5 Hour)**
The Distribution Apparatus / Nameplate module will discuss how to determine the critical information for determining equipment limitations from the information found on the nameplates and from other indications. Some limitations include continuous load carrying capacity, short term / emergency overload capacity, maximum current interrupting (load / fault break), maximum current closing (fault testing), and other thermal and mechanical limitations.

♦ **OH Sags & Tensions (3 Hour)**
The OH Sags & Tensions module reviews how overhead facilities are analyzed for standard District distribution system conductor and typical environmental conditions encountered. The Guying module provides an explanation of the need for guying poles and to instruct in the proper procedures for determining solutions to guy related problems.

♦ **Structural Analysis (pole strength) (4 Hour)**
The Pole Size and Class module provides general knowledge on the criteria of sizing and classing poles used in the distribution system.

♦ **Cable Loading / Design and Pulling (2.5 Hour)**
The loading of Underground cables is limited by its thermal characteristics, trench design and the cable's proximity to other cables (mutual heating). Cable substructures (conduit and pull boxes) are sized and located so that the friction and tensions generated while pulling the cable in does not damage the cable, substructures, or cable pulling equipment. This module will cover the basic calculations used in calculating cable loading for multiple cables in the same trench and basic pulling tensions.

♦ **Substation Design Configuration (2 Hour)**
The Substation Design Configuration module will cover the layout of typical distribution substations for ease of maintenance, operability and service reliability.

♦ **Substation Grounding (2 Hour)**
The Substation Grounding module will present the safety issues (principally step and touch potential) that are mitigated by an appropriately designed, installed, and maintained the ground grid.

♦ **Print Reading (2.5 Hour)**
The Print Reading module will cover the types of substation drawings that the District uses, their purposes, the common symbols used, and the typical substation control wiring identification conventions. In addition, the Design Change Notice or DCN process will be presented.

♦ **Substation Design Process (2.5 Hour)**
The Substation Design Process module will present the key specifications used in the construction of new Distribution Substations. The discussion will include current protective relay equipment and the SCADA hardware design.

♦ **SCADA /EMS (2.5 Hour)**
The SCADA / EMS module will cover the system operators tools for Supervisory Control and Data Acquisition, the underlying Energy Management System hardware, maintenance and support requirements, and communications requirements.

♦ **Cogeneration / DG (2.5 Hour)**
The Cogeneration / DG module will introduce the rules for interconnecting third party Distributed Generation with the Districts distribution system. The discussion will follow the revised rule 19 and SMUD's electric service requirements.

♦ **Meter and Service (4 Hours)**
The Meter and Service module provides general knowledge applicable to residential, commercial, temporary or agricultural meter and service type jobs.

♦ **Testing Equipment (Fault location, Doble, Megger, TTR) (4 Hour)**
The Testing Equipment module will cover the variety of testing technologies utilized by the District's technicians in evaluating the serviceability of various distribution facilities.