DEDSTF Update

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Planning Committee
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Issue Charge/Problem Statement

- Issue Charge/Problem Statement:
  - Develop minimum engineering design standards, which would take into consideration geography, and physical and other local needs (noise level, undergrounding requirements, etc.) of the project. The design standards would apply to projects that are competitively solicited and address the following areas.
    - a. Transmission Lines
    - b. Substations
    - c. System Protection and Control Design and Coordination
  - http://pjm.com/~/media/committees-groups/task-forces/dedstf/postings/20150818-dedstf-issue-charge.ashx

Organization

- Q1 2016 the DEDSTF elected via informal poll to divide into the following three subgroups to focus attention on specific minimum design standards:
  - Transmission Lines
  - Substations
  - System Protection and Control Design and Coordination
- These groups are currently in the process of utilizing existing documentation, M07 and TSS guidelines as a strawman to develop minimum design standards.

Transmission Lines Subgroup Update

Transmission Lines Subgroup

- Scope and Guiding Principles Document
- Work Plan
  - Spreadsheet review
  - Targeted discussions (ex, live line)
- 3 month look ahead
  - Spreadsheet review
  - Development of preliminary standards format

Lines Documentation

500 KV OH DESIGN STANDARDS

Criteria Items	NESC 2012	PJM 2002 TSDS Guidelines
ENVIRONMENTAL/GENERAL		
Ambient Temperature Range	N/A	-30°C to +40°C (from -40°C N & W of Blue Mountain)
Keraunic Level		40
Minimum Extreme Wind Loading		25 pdf
Heavy Ice Load (No Wind)		1 1/2"
Code Requirements		NESC Grade "B"
Provisions for Live Line Maintenance		As required by the TO
Access Requirements		Construction and maintenance access is required to each structure
Line crossings		
Line cascade mitigation		
ELECTRICAL		
RIV Level @ 350 kV line to ground		300uV @ 1MHz
Switching Impulse Withstand level (3™)		990 kV
250 x 2500μs minimum critical flashover		1200 kV
1.2 x 50 μs minimum critical flashover (lightning)		2145 kV
Lightning Trip out Performance (line)		1/100 miles (160km) per year
Line trip out performance from all other causes		1/100 miles (160km) per year
Sag and tension Calculation method		Alcoa Sag & Tension Software or
		Provide adequate clearance so that 12" of clearance exists

PJM DEDSTF Lines Sub-group

Environmental/General

Ambient Temperature Range

No mention in the NESC. The PJM TSDS Guidelines state (-30 C to + 40 C, from -40 CN&W of Blue Mountain)

Status: validate closed

Keranuic Level

PJM TSDS = 40.

Conversation at 4/14/16 meeting centered around viability of this parameter as there is better data available as described below:

The **keraunic number** is a system to describe lightning activity in an area based upon the audible detection of thunder. It is defined as the average number of days per year when thunder can be heard in a given area, and the likelihood thereby of a thunderstorm. An isokeraunic map plots contours of equal keraunic number. The keraunic number has been used to set standards for safe design of electrical systems in structures connected to the local power grid.

Before technology was developed to accurately detect and record lightning flashes, keraunic measurements were the standard means to assess the probability of lightning at a location. However, a keraunic number does not distinguish between forms of lightning, such as cloud-to-cloud, or cloud-to-ground, and is limited by the requirement for the thunder to be audibly detected. For these reasons, the keraunic number has been replaced by more accurate Flash Density maps, which collect data from both ground-based and satellite lightning detectors.

Status – Use software based programs such as TFlash which utilize flash density data to model performance.

Minimum Extreme Wind Loading

NESC and PJM TSDS recommend NESC 250C WIND MAP

Status: Still in discussion

Lines Next Steps

- Continue spreadsheet review
- Develop targeted deeper discussions
- Develop preliminary standards document

System Protection and Control Design and Coordination Subgroup update

Protection Subgroup update

- General consensus that PJM Manual M7 is a strong starting point
- Additional items, not covered in PJM Manual 7 to be discussed
  - Rack design (terminal block reqs, wire sizing, general rack layout/arrangement
  - Protection design (CT,VT selection, supervisory relays, test switches, etc)
  - Metering requirements
  - SCADA
  - Alarm requirements
  - Commissioning procedures
  - Disturbance Monitoring Equipment (PRC-002, 018??)
  - 69kV solutions

Protection Next steps

- Continue review of PJM Manual 7
- Review of SPP and MISO Minimum Requirements Document
  - Generally simplistic approach leaning towards requiring the Competitive bidders to meet standards dictated by incumbent T.O.
- Develop preliminary standards document

PJM DEDSTF Substation Subgroup

Substation Subgroup update

- Develop path to manage assignment
- Review of Transmission Owner Guidelines
- Engaged support from the TSS committee
- Detailed review of TO Guidelines
- Key areas of focus
  - Different voltages – 69kV, 138kV, etc.
  - Criteria based design
  - Functional layout
  - Future expansion
  - Minimum outages

Substations Documentation

I. Transmission System Design Criteria

A. Environmental Lines and Substations
1. Ambient Temperature
2. Wind loading Substations (no ice)
3. Ice load substations (no wind) 25mm radial ice
4. Wind coincident with 13mm radial ice 40mph (64km/h)
5. Seismic Substations
6. Flood Plain

B. Substations General
1. AC Station Service
   - Required Number Independent Sources
   - Quality of Sources
   - Need for Back up Generation
2. DC Supply
   - Required Number of Independent Batteries and Chargers
   - Capacity/Duty Cycle
   - Fusing/Protection
   - Quality/independence of Charger AC Supplies
3. Ground Grid Resistance

C. Substation Electrical
1. Line Terminal and Equipment Continuous Current
2. Short Circuit Current
3. Operating Voltage
4. RIV
5. Lightning Impulse Withstand Voltage (with and without arresters)
6. Switching Impulse Withstand
7. Surge arresters
8. Breaker Line closing Switching Surge Factor
9. System Grounding
10. Lightning trip out Performance (station)
11. Fault performance (circuit failure, including momentary) all other causes

I. Design, Application, Maintenance & Operation Technical Requirements

A. Overhead Transmission Lines
B. Power Cables
C. Large Power Transformers
D. Circuit Breakers
E. Load Interrupting Switches (Circuit Switches)
F. Disconnects & Switches
G. Shunt Capacitors
H. Instrument Transformers
I. AC Station Service
J. Substation Batteries & Chargers
K. DC Substation Service
L. Substation Operation & Maintenance
M. Carrier Current Line Traps
N. Insulation Coordination & Surge Protection
O. Relay and Control Building Requirements
P. Bus Design
Q. SVC's
R. Series Capacitors
S. Gas Insulated Substations
T. DC Inverters
U. HVDC Transmission

Substation Subgroup Next Steps

- Continue review of existing TSS guidelines
- Review DEDSTF recommendations with TSS committee
- Develop overreaching preliminary document
    - Reference TSS guidelines where feasible

Timing

- The DEDSTF has completed three monthly meetings since the formation of the three subgroups.
- Additional webex meetings will begin in June to address specific detailed issues
- September 2016 PC Update with expected timeline for deliverables

Questions

- Please direct all questions to the PJM DEDSTF facilitation team:
  - Facilitator: Michael.Herman@pjm.com
  - Secretary: Anisha.Fernandes@pjm.com
  - Lead SME: Suzanne.Glatz@pjm.com