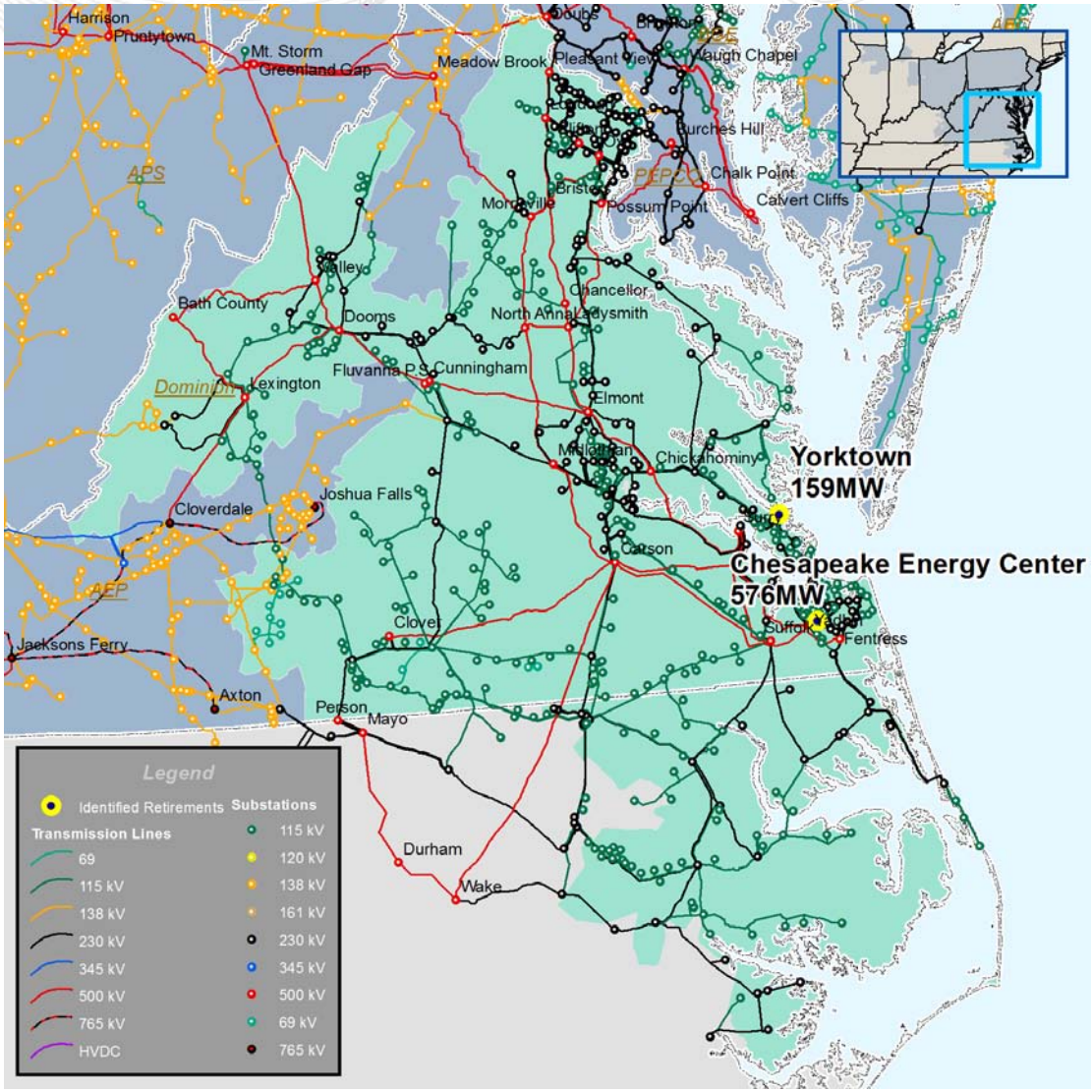
# Sub Regional RTEP Committee – Southern
# Retirement Study Update

February 9, 2012

# Retirement Study Reveiw

# Chesapeake #1-4 & Yorktown #1

- Retirement Notification
- Deactivation by 12/31/2014
  - Chesapeake 1 – 111 MW
  - Chesapeake 2 – 111 MW
  - Yorktown 1 – 159 MW
- Deactivation by 12/31/2015
  - Chesapeake 3 – 147 MW
  - Chesapeake 4 – 207 MW
- 381 MW by 2014
- Additional 354 MW by 2015
- 735 MW total



# Yorktown Unit 1 & Chesapeake Units 1 & 2

# Preliminary Study Results

- N-1 Thermal and Voltage Study
  - No violations identified
- Generator Deliverability Study / Common Mode Outage Test
  - No violations identified
- Load Deliverability Study
  - Study of the Dominion Locational Deliverability Area (LDA)
  - Single contingency loss (NERC Category B) of the Bedington – Black Oak 500 kV line causes a voltage collapse
- N-1-1 Thermal and Voltage Study
  - The Millville- Old Chapel 138 kV line (Allegheny Power) is overloaded for the loss of the Morrisville – Front Royal 500 kV line and the loss of the Meadow Brook – Loudoun 500 kV line
  - The Valley 500-230 kV transformer overloads for the loss of the Dooms – Valley 500 kV and the loss of the Dooms – Lexington 500 kV lines

# Preliminary Study Results

- **Dominion Planning Criteria Analysis**
  - **Critical System Condition (Yorktown #3 offline)**

- **Contingency Analysis**
  - **NERC Category B – Single Contingency**
  - Single contingency outage of Line #548 (Bath – Valley 500 kV) overloads Line #555 (Dooms – Lexington 500 kV)
  - Single contingency outage of Line #214 (Surry – Winchester 230 kV) overloads Line #263 (Chuckatuck – Newport News 230 kV)
  - Single contingency outage of Line #263 (Chuckatuck – Newport News 230 kV) overloads Line #214(Surry – Winchester 230 kV)
  - Single contingency outage of Line #263 (Chuckatuck – Newport News 230 kV) overloads Line #282 (Whealton – Winchester 230 kV)
  - Single contingency outage of Line #2102 (Chickahominy – Waller 230 kV) overloads Line #2113 (Lanexa – Waller 230 kV)
  - Single contingency outage of Line #2102 (Lanexa – Waller 230 kV) and Line #2112 (Chickahominy – Waller 230 kV) overloads Line #263 (Chuckatuck-Newport News 230 kV)
  - Single contingency outage of Line #579 (Septa-Fentress 500 kV) and Line #565 (Yadkin- Suffolk 500 kV) overloads Line #2110 ( Suffolk – Thrasher 230 kV)
  - Single contingency outage of Line #2122 (Chickahominy –Waller 230 kV) and Line #261(Newport News – Shellbank 230 kV) overloads Line #2102 (Lanexa – Waller 230 kV) and also results in voltage violations in North Hampton Roads area.

# Preliminary Study Results

- **Dominion Planning Criteria Analysis**
  - **Critical System Condition (Yorktown #3 offline)**

- **Contingency Analysis**
  - **NERC Category C – Multiple Contingency**
  - Tower Line #214 & #263 outage (James River Crossing) overloads:
    - Line #285 (Chickahominy – Waller 230 kV)
    - Line #2102 (Lanexa – Waller 230 kV)
    - Line #292 (Yorktown – Whealton 230 kV)
    - Line #2112 (Chickahominy – Waller 230 kV)
    - Also identified voltage collapse originating in the North and South Hampton Roads area.

# Preliminary Study Results

- **Dominion Planning Criteria Analysis continued…**

- **Contingency Analysis**
  - **Critical System Condition (Surry #2 (230 kV) offline in base case)**
  - **NERC Category B – Single Contingency**
  - Single contingency outage of Line #548 (Bath – Valley 500 kV) overloads Line #555 (Dooms – Lexington 500 kV)

  - **Critical System Condition (Chesapeake #4 offline in base case)**
  - **NERC Category B – Single Contingency**
  - Single contingency outage of Line #262 (Yadkin – Chesapeake – Greenwich 230 kV) overloads Line #46 (Yadkin – Chesapeake 115 kV)

# Preliminary System Upgrades

- The proposed reactive upgrades identified in the 2016 N-1-1 analysis is expected to mitigate the voltage collapse violations caused by the loss of the Bedington – Black Oak 500 kV line.

- Re-conductor 14.3 miles of 556 ACSR with 795 ACSR from Old Chapel to Millville 138 kV
- Upgrade line risers at Old Chapel and Millville
- Replace a 1200 Amp wave trap at Millville with a 1600 Amp wave trap.
  - Projected In-service Date is 6/1/2015.

- Skiffes Creek 500 kV Line and 500 -230 kV Switching Station
  - Construct a 38 mile long 500 kV line from Chickahominy Substation
  - Install two 500-230 kV Transformer at Skiffes Creek Switching Station
  - Install one 230-115 kV Tx at Skiffes Creek Switching Station.
  - Install three 500 kV breakers at Chickahominy Substation and six 230 kV Breakers at Skiffes Creek and four 115 kV Breakers at Skiffes Creek Switching Station.
  - Estimated Project Cost: $215 million
  - Expected IS Date: May 2015.

- Install 2nd 230/115 kV Transformers and Yadkin & Chesapeake Substations

# Preliminary System Upgrades

- Uprate Line #46 (Yadkin – Chesapeake 115 kV)
  - Estimated Project Cost: $20 M
  - Expected IS Date: May 2015

- Build a new Suffolk – Yadkin 230 kV Line
  - Construct a 14 mile long 230 kV line from Suffolk to Yadkin Substation along existing right-of-way and primarily existing towers.
  - Install two 230 kV breakers at both Suffolk and Yadkin Substation to interconnect.
  - Estimated Project Cost: $40 M
  - Expected IS Date: May 2015

- Rebuild Line #555 (Lexington – Dooms 500 kV)
  - Rebuild the 40 mile long Line # 555 with a 5-2 Tower design.
  - Estimated Project Cost: $120 M
  - Expected IS Date: May 2015.

# Chesapeake Units 3 & 4

# Preliminary Study Results

- N-1 Thermal and Voltage Study
  - No violations identified

- N-1-1 Thermal and Voltage Study
  - The (AP-DOM) Doubs – T157 500 kV line is over its emergency rating (2598 MVA) for the loss of the Loudoun – Meadow Brook 500 kV line + loss of the Morrisville – Front Royal 500 kV line.
  - The (DOM) Huntsman - Thresher 230 kV line is over its emergency rating (788 MVA) for the loss of the Suffolk - Yadkin 500 kV line + loss of the Fentress - Septa 500 kV line.

- Generator Deliverability Study / Common Mode Outage Test
  - The (AEP) Clinch River – Freemont 138 kV line is over its emergency rating (250 MVA) for the single contingency loss (NERC Category B) of the Clinch River – LOCKHA 138 kV line.
  - The (AEP) J. Ferry – Cloverdale 765 kV line is over its emergency rating (3176) for the multiple facility contingency loss (NERC Category C) of :
    - The Belmont – Kammer 765 kV line, Belmont – Mountaineer 765 kV line, Belmont 765/500 kV transformer, Kammer 765/500 kV transformer, and 502 Junction – Kammer 500 kV line.

- Load Deliverability Study
  - No violations identified.

- **Dominion Planning Criteria Analysis**

- **Contingency Analysis**
  - **NERC Category B – Single Contingency**
  - Single contingency outage of Line #262 (Yadkin – Chesapeake – Greenwich 230 kV) overloads Line #46 (Yadkin – Chesapeake 115 kV) and the Yadkin 230-115 kV Tx
  - Single contingency outage of Line #2038 (Greenwich – Reeves Ave 230 kV) overloads Reeves Ave 230-115 kV Tx #2
  - Single contingency outage of Line #46 (Yadkin – Chesapeake 115 kV) overloads the Chesapeake 230-115 kV Tx (PS)
  - Single contingency outage of Chesapeake 230-115 kV Tx (PS) overloads Line #46 (Yadkin – Chesapeake 115 kV) and the Yadkin 230-115 kV Tx
  - Single contingency outage of Reeves Ave 230-115 kV Tx #1 overloads Reeves Ave 230-115 kV Tx #2
  - Single contingency outage of Yadkin 230-115 kV Tx31 overloads the Chesapeake 230-115 kV Tx #1 (PS)

- **Dominion Planning Criteria Analysis**
  - **Critical System Condition (Yorktown #3 offline in base case)**
  - Single contingency outage of Line #262 (Yadkin – Chesapeake – Greenwich 230 kV) overloads Line #46 (Yadkin – Chesapeake 115 kV) and the Yadkin 230-115 kV Tx
  - Single contingency outage of Line #2038 (Greenwich – Reeves Ave 230 kV) overloads Reeves Ave 230-115 kV Tx #2
  - Single contingency outage of Line #46 (Yadkin – Chesapeake 115 kV) overloads the Chesapeake 230-115 kV Tx (PS)
  - Single contingency outage of Chesapeake 230-115 kV Tx (PS) overloads Line #46 (Yadkin – Chesapeake 115 kV) and the Yadkin 230-115 kV Tx
  - Single contingency outage of Reeves Ave 230-115 kV Tx #1 overloads Reeves Ave 230-115 kV Tx #2
  - Single contingency outage of Yadkin 230-115 kV Tx31 overloads the Chesapeake 230-115 kV Tx #1

- **Dominion Planning Criteria Analysis**
  - **Critical System Condition (Yorktown #3 offline in base case)**
  - Single contingency outage of Line #553 (Elmont – Cunningham 500 kV) overloads Line #2027(Bremo – Midlothian 230 kV)
  - Single contingency outage of Clover 500-230 kV Tx #2 overloads Clover 500-230 kV Tx #1
  - Single contingency outage of Line #548 (Bath – Valley 500 kV) overloads Line #555 (Dooms – Lexington 500 kV)
  - Single contingency outage of Line #214 (Surry – Winchester 230 kV) overloads Line #263(Chuckatuck – Newport News 230 kV)
  - Single contingency outage of Line #263 (Chuckatuck – Newport News 230 kV) overloads Line #214(Surry – Winchester 230 kV)
  - Single contingency outage of Line #2102 (Chickahominy – Waller 230 kV) overloads Line #2113 (Lanexa – Waller 230 kV)
  - Tower Line #214 & #263 outage (James River Crossing 115kV) overloads Line #285 (Chickahominy – Waller 230 kV) and Line #2102 (Lanexa – Waller 230 kV) and Line #292 (Yorktown – Whealton 230 kV)
  - Also identified voltage collapse that originates in the North and South Hampton Roads area.

# Preliminary Study Results

- **Dominion Planning Criteria Analysis**
  - **Critical System Condition (Surry #2 offline in base case)**
  - Single contingency outage of Line #262 (Yadkin – Chesapeake – Greenwich 230 kV) overloads Line #46 (Yadkin – Chesapeake 115 kV) and the Yadkin 230-115 kV Tx
  - Single contingency outage of Line #2038 (Greenwich – Reeves Ave 230 kV) overloads Reeves Ave 230-115 kV Tx #2
  - Single contingency outage of Line #46 (Yadkin – Chesapeake 115 kV) overloads the Chesapeake 230-115 kV Tx (PS)
  - Single contingency outage of Chesapeake 230-115 kV Tx (PS) overloads Line #46 (Yadkin – Chesapeake 115 kV) and the Yadkin 230-115 kV Tx
  - Single contingency outage of Reeves Ave 230-115 kV Tx #1 overloads Reeves Ave 230-115 kV Tx #2
  - Single contingency outage of Yadkin 230-115 kV Tx31 overloads the Chesapeake 230-115 kV Tx #1 (PS)
  - Single contingency outage of Line #553(Elmont – Cunningham 500 kV) overloads Line #2027(Bremo – Midlothian 230 kV)
  - Single contingency outage of Clover 500-230 kV Tx #2 overloads Clover 500-230 kV Tx #1
  - Single contingency outage of Line #548 (Bath – Valley 500 kV) overloads Line #555 (Dooms – Lexington 500kV)
  - Single contingency outage of Yadkin 500-230 kV Tx #1 overloads Yadkin 500-230 kV Tx #2
  - Single contingency outage of Yadkin 500-230 kV Tx #2 overloads Yadkin 500-230 kV Tx #1

# Preliminary System Upgrades

- Existing Mt. Storm – Doubs 500 kV Reconductor
  - There are existing baseline upgrades (b1507, b1507.1, b1507.2, and b1507.3) to reconductor the Mount Storm – Doubs 500 kV line that would mitigate the overload on the Doubs – T157 500 kV line. These baseline upgrades are currently projected to be in-service by 6-1-2015.

- New Suffolk – Yadkin 230 kV line
  - The Thrasher to Huntsman 230 kV overload (Line #2110) is conductor limited and will be resolved by building a new Suffolk-Yadkin 230 kV line.
  - Construct a 14 mile long 230 kV line from Suffolk to Yadkin Substation along existing right-of-way and primarily existing towers.
  - Install two 230 kV breakers at both Suffolk and Yadkin Substation to interconnect.
  - Estimated Project Cost: $40 million.
  - Expected IS Date: May 2015.

- Clinch River – Freemont 138 kV
  - Upgrade the Clinch River – Freemont 138 kV line.
  - The new emergency rating will be 310 MVA.
  - Expected IS date: 6/1/2016.

- The Jackson Ferry – Cloverdale 765 kV line will have a new increased emergency rating of 4055 MVA by 6/1/2015 as a result of existing baseline upgrade b1660.

# Preliminary System Upgrades

- Skiffes Creek
  - Install a new Skiffes Creek 500 kV Line and 500-230 kV Switching Station
  - Construct a 38 mile long 500 kV line from Chickahominy Subtstation
  - Install two 500-230 kV Transformer at Skiffes Creek Switching Station
  - Install one 230-115 kV Tx at Skiffes Creek Switching Station.
  - Install three 500 kV breakers at Chickahominy Substation
  - Install six 230 kV Breakers at Skiffes Creek
  - Install four 115 kV Breakers at Skiffes Creek Switching Station
  - Estimated Project Cost: $215 million
  - Expected IS Date: May 2015

- Yadkin 500 kV
  - Install six 500 kv breakers at Yadkin 500 kV
  - Install a third 500-230 kV Tx at Yadkin
  - Estimated Project Cost: $25 million
  - Expected IS Date: May 2016

# Preliminary System Upgrades

- Yadkin & Chesapeake Substations
  - Install 2nd 230-115 kV Tx(s) at Yadkin & Chesapeake Substations
  - Uprate Line #46
  - Estimated Project Cost: $20 million
  - Expected IS Date: May 2015.

- Landstown SVC
  - 500 MVAr - to resolve the voltage collapse associated with the N-1-1 (Line #579 & #565) install a 500 MVAr svc at Landstown Substation (may need to be split into two smaller units)
  - Estimated Project Cost: $60 million
  - Expected IS Date: May 2016.

- Install 3rd 500-230 kV Tx at Clover
  - Estimated Project Cost: $16 million
  - Expected IS Date: May 2016

- Rebuild Line #555 (Lexington – Dooms 500 kV)
  - Rebuild the 40 mile long Line # 555 with a 5-2 Tower design
  - Estimated Project Cost: $120 million
  - Expected IS Date: May 2015.

- Line #2027 Rebuild (Bremo – Midlothian 230 kV)
  - Uprate Line #2027 to obtain a rating of 862 MVA
  - Estimated Project Cost: $10 million
  - Expected IS Date: May 2016.

# Alternate Proposals to Preliminary System Upgrades

- Alternate study and reinforcement proposal Submitted by Northeast Transmission Development, LLC. / LS Power
- Power flow study work and findings
- Alternate proposed system upgrades