Interregional Planning Update
EIPC non-grant 2014 Analysis

- 2014 Scenario Analysis - update
  - Scenario A - Update rollup case
  - Scenario B - Severe Heat and Drought
  - May – July - target assumptions and model builds
  - July Stakeholder WebEx
  - June – August - target analysis
  - Sept – Oct - target draft report
  - November - target Stakeholder WebEx
EIPC non-grant – Future Work

- Beyond 2014 discussions
  - Winter Scenario
  - Production Cost Analysis
  - DOE Congestion Report Support
  - Synergies between Planning Coordinator MOD standard activities and EIPC model building
Interregional Planning Studies (not including JCM)

• NCTPC - update
  – Study requested by NCUC
  – Reliability and Economic impact of BRA resources
  – Status: Reliability and Economic Studies
  – 2014 target completion

• PJM/MISO Joint Planning Study
  – Futures 1, 2, 3 analysis is complete
  – Stakeholder comments have been incorporated
  – 3 Proposals under further joint review - JOA metric B/C > 1.25
  – Further discussion of lessons learned

• Northeast Protocol Activities
Proposal Windows Update
2014 RTEP Proposal Window #1
- Opened June 27th, 2014
-Scheduled close on July 28th, 2014
-Scope: Baseline N-1 thermal, Generator Deliverability and Common Mode Outage, Load Deliverability Thermal and Voltage, N-1-1 Thermal

2014 RTEP Proposal Window #2
- Schedule: TBD
-Potential Scope: N-1 Voltage, N-1-1 Voltage, Light Load Reliability criteria
2014 RTEP Preliminary Reliability Results
All results in this section are posted for the 2014 RTEP Proposal Window #1 that opened on 6/27/2014 and anticipated to close on 7/28/2014.

The current project need date for these violations is 2019 or later.

These results include Baseline N-1 thermal, Generator Deliverability and Common Mode Outage, Load Deliverability Thermal and Voltage, N-1-1 Thermal.
• Generation Deliverability and Common Mode Outage Violation.

• The Clinch River to Clinch Field 138 kV circuit is overloaded for multiple contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The Clinch River to Lebanon 138 kV circuit is overloaded for multiple contingencies.
AEP Transmission Zone

- Generation Deliverability Violation.
- The Clinch Field to Fletcher Ridge 138 kV circuit is overloaded for multiple single contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The Saltville – Elk Garden 138 kV circuit is overloaded for multiple contingencies.
• Generation Deliverability Violation.

• The Fletcher Ridge to Skeggs Branch 138 kV circuit is overloaded for multiple single contingencies.
• Generation Deliverability Violation.

• The Gavin to Mountaineer 765 kV is overloaded for single contingency loss of the Flatlick – Marysville 765 kV circuit.
• Generation Deliverability and Common Mode Outage Violation.

• The Kammer to West Bellaire 138 kV circuit is overloaded for multiple contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The Lebanon to Elk Garden 138 kV circuit is overloaded for multiple contingencies.
• Baseline, Generation Deliverability and Common Mode Outage Violation.

• The Tiltonsville to Windsor 138 kV circuit is overloaded for multiple contingencies.
• Generation Deliverability Violation.

• The Kyger Creek to Sporn 345 kV circuit #2 is overloaded for multiple single contingencies.
• Common Mode Outage Violation.

• The Nettie – Crupperneck 138 kV circuit is overloaded for line fault stuck breaker contingency loss of the Gilboa – Powell Mt. – Summersville 138 kV circuit and Gilboa 138/23 kV transformer.
- Common Mode Outage Violation.

- The Avon 345/138 kV transformer #92 is overloaded for line fault stuck breaker contingency loss of Avon – Juniper 345 kV circuit and Avon 345/138 kV transformer #91.
• Common Mode Outage Violation.

• The Beaver – Lake Ave. 345 kV circuit #2 is overloaded for line fault stuck breaker contingency loss of Beaver – Carlisle and Beaver – Lake Ave. #1 345 kV circuits.

• Update: 6/24/2014 – the correct rating is applied this is no longer an issue
• Baseline and Common Mode Outage Violation.

• The Black River to Lorain 138 kV circuit is overloaded for multiple category C contingencies.
• Common Mode Outage Violation.

• The Lakeview – Greenfield 138 kV circuit is overloaded for tower contingency loss of the Dave Besse – Hayes and Dave Besse – Beaver 345 kV circuits.
• Common Mode Outage Violation.

• The Ottowa - Lakeview 138 kV circuit is overloaded for tower contingency loss of the Dave Besse – Hayes and Dave Besse – Beaver 345 kV circuits.
- Common Mode Outage Violation.
- The Richland to Naomi 138 kV circuit is overloaded for bus contingency loss of the Richland 138 kV bus section.
• Common Mode Outage Violation.
• The Dresden 345/138 kV transformer 83 is overloaded for line fault stuck breaker contingency loss of Dresden – Elwood 345 kV circuit and Elwood bus tie.
• Baseline, Generation Deliverability and N-1-1 Violation.

• The Harlem to Roscoe Bert 138kV Blue line is overloaded for single contingency loss of the Cherry Valley – Belvidere 138 kV circuit and for multiple contingency pairs.
• Baseline and Common Mode Outage Violation.

• The Miami Fort to Willey 138 kV circuit is overloaded for line fault stuck breaker contingency loss of the Miami Fort – Clifty Creek, Miami Fort – Hebron Tap, Miami Fort – Midway, Miami Fort – Morgan 138 kV circuits and one of the Miami Fort 345/138 kV transformer.
• Baseline and Common Mode Outage Violation.

• The Crescent 345/138 kV transformers #1 and #2 are overloaded for multiple category C contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The BL England to Scull 138 kV circuit #1 is overloaded for multiple contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The BL England to Scull 138 kV circuit #2 is overloaded for multiple contingencies.
• Common Mode Outage Violation.

• The BL England to Middle Tap 138 kV circuit is overloaded for tower contingency loss of the BL England – Scull – Mill 138 kV circuits #1 & #2.
• Generation Deliverability and Common Mode Outage Violation.

• The Scull to Mill 138 kV circuit #1 is overloaded for multiple contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The Scull to Mill 138 kV circuit #2 is overloaded for multiple contingencies.
• Generation Deliverability and Common Mode Outage Violation.

• The Mill - Lewis 138 kV circuit #1 is overloaded for multiple contingencies.
• Common Mode Outage Violation.

• The Corson 138/69 kV transformer #1 is overloaded for line stuck breaker contingency loss of the BL England – Middle Tap – Corson and Corson – Dennis 138 kV circuits, plus Corson 138/69 kV transformer #2.
• Baseline and Common Mode Outage Violation.

• The Riverside 115 kV bus section is overloaded for line fault stuck breaker contingency loss of the Brandon Shores to Riverside 230 kV circuit ‘2344’, Riverside 230/115 kV transformer #1 and Brandon Shores 230/115 kV transformer #2.
• Common Mode Outage Violation.

• The Silver Side Road to Darley 69 kV circuit is overloaded for tower contingency loss of the Edgemore – Clay and Edgemore – Linwood 230 kV circuits.
N-1-1 Violation.

The Jackson to North Hanover 115 kV circuit is overloaded for multiple N-1-1 contingencies.
• N-1-1 Violation.

• The Eddystone to Llanerch 138 kV circuit ‘130-45’ is overloaded for N-1-1 contingency loss of Plymouth – Brynmawr 230 kV and Eddystone to Llanerch 138 kV ‘130-42’ circuits.
• Common Mode Outage Violation.

• The Montour – Milton – Sunbury 230 kV circuit is overloaded for tower contingency loss of Montour – Susquehanna 230 kV circuits.
• Common Mode Outage Violation.

• The North Meshoppen – Oxbow - Lackawanna 230 kV circuit is overloaded for line fault stuck breaker contingency loss of Susquehanna generator # 1 and Susquehanna – Mountain 230 kV circuit.
• Common Mode Outage Violation.

• The Gloucester – Cuthbert 230 kV circuit # 2 is overloaded for line fault stuck breaker contingency loss of the Gloucester – Cuthbert 230 kV circuit # 1 and one of the Gloucester 230/69 kV transformers.
• Common Mode Outage Violation.

• The Mickleton – Monroe 230 kV circuit #1 & #2 are overloaded for tower contingency loss of the Gloucester – Eagle Point and Gloucester – Deptford 230 kV circuits.
• Common Mode Outage Violation.
• The Parlin – Williams – Freneau 230 kV circuit is overloaded for multiple tower and breaker contingencies.
• Generation Deliverability Violation.

• The Chichester – Eddystone 230 kV circuit is overloaded for multiple single contingencies.
• Generation Deliverability Violation.

• The Nottingham – Daleville 230 kV circuit is overloaded for single contingency loss of Colora – Conowingo 230 kV circuit.
• Baseline and Generation Deliverability Violation.

• The ACCA to Shockoe 115 kV circuit is overloaded for single contingency loss of Northeast – Shockoe 115 kV circuit.
• Baseline and Generation Deliverability Violation.

• The Northeast to Carver 115 kV circuit is overloaded for single contingency loss of Northeast – Shockoe 115 kV circuit.
Reliability Analysis Update
FE Planning Criteria Violation and Operational Performance:
- Voltage violation in the North Western Pennsylvania (Warren/Buffalo Road) vicinity for multiple contingencies.

Proposed Solution:
- Construct Warren 230 kV ring bus and install a second Warren 230/115 kV transformer (B2494).

Estimated Project Cost:
$15 M

Required IS Date:
6/1/2016
Dominion Transmission Zone

- **B1794 Cost and Scope Change:**
  - **Previous Scope:**
    - Split 230 kV Line #2056 (Hornertown - Rocky Mount) and double tap the line to Battleboro Substation. Expand station, install a 230 kV 3 breaker ring bus and install a 230/115 kV transformer.
  - **New Scope:**
    - Build a new substation near the Edgecombe NUG to be called Morning Star Substation with a 230-115kV Tx, 4-230kV breakers in a breaker and half scheme, 3-115kV breakers in a ring. Re-configure Lines 80 (Battleboro – Anaconda), 229 (Edgecombe – Tarboro) and 2058 to terminate into Morning Star Substation.

- **Estimated Project Cost:**
  - Previous → $8 M
  - New → $14.5 M

- **Expected IS Date:**
  - 5/30/2016
Project cancellation

- Cancel B2287: Loop in the Meadow Lake - Olive 345 kV circuit into Reynolds 765/345 kV station

- This project is no longer needed due to project B2449 to Rebuild the 7-mile 345 kV line section between Meadow Lake and Reynolds 345 kV stations

- Estimated Cost: $1M

- Projected IS Date: 6/1/2018
Cancelation of B1808.2 and B1808.4 upgrades

B1808.2 (replace AVR and rectifier bank on Susquehanna unit 1) and B1808.4 (replace AVR and rectifier bank on Susquehanna unit 2) were identified as part of the overall plan to mitigate a previous stability criteria violation at the Susquehanna generation plant.

However, the stability issue is already mitigated by B1808.1 (install PSS at Susquehanna unit 1) and B1808.3 (install PSS at Susquehanna unit 2).

As a result, B1808.2 and B1808.4 are not required and will be canceled.
15 Year Analysis Result
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<tr>
<th>Fr Bus</th>
<th>Fr Name</th>
<th>To Bus</th>
<th>To Name</th>
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### 2014 RTEP 15 Year Analysis - Tower Contingency Result

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<th>To Name</th>
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Short Circuit Upgrades
The Idylwood 230kV breaker ‘203512’ is overstressed

Significant Driver: Construct new underground 230 kV line from Glebe to Station C (b2443)

Proposed Solution: Replace the Idylwood 230kV breaker ‘203512’ with a 50 kA breaker (b2443.1)

Estimated Project Cost: $255 K

Required IS Date: 6/1/2018
The Ox 230kV breaker ‘206342’ is overstressed

- Significant Driver: Construct new underground 230 kV line from Glebe to Station C (b2443)
- Proposed Solution: Replace the Ox 230kV breaker ‘206342’ with a 63 kA breaker (b2443.2)
- Estimated Project Cost: $270 K
- Required IS Date: 6/1/2018
• The Whitpain 230 kV breakers ‘155,’ ‘525,’ and ‘175’ are overstressed
• Proposed Solution: Replace Whitpain 230 kV breakers ‘155,’ ‘525,’ and ‘175’ (b2527 – b2529)
• Estimated Project Cost: $600 K per breaker
• Required IS Date: 6/1/2016
Winter Peak Study Update
• Base Dispatch
  – Dispatch based on historical average Capacity Factors (5 years of data) by fuel type were applied.
  
  – Nuclear and coal generation are dispatched to 100% capacity

  – Gas unit scaling
    • Gas units scaled uniformly to maintain the target PJM interchange (net of yearly LTF transmission service)
    • Gas units in PJM West and MAAC scaled uniformly to maintain the target MAAC interchange (historical Winter Peak values)
• Test Methodology
  – Similar to Generator Deliverability, Common Mode Outage and Light Load Reliability Criteria, generation is ramped from their base values
    • Wind is ramped up to 80% for single contingencies, 100% for multiple contingencies
    • The ramping limit for the remaining generators of all fuel types is 100%

• Contingencies Considered
  – NERC Category A (no contingency), Category B (single), Category C (tower, bus, line fault with stuck breaker)

• Monitored Facilities
  – All PJM BES and lower voltage market monitored facilities

• Results are preliminary pending TO review
2014 RTEP Winter Study Update – Initial Deliverability Results

- **MAAC (Potential Overloads)**

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<tr>
<th>Fr Bus</th>
<th>Name</th>
<th>To Bus</th>
<th>Name</th>
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2014 RTEP Winter Study Update – Initial Deliverability Results

- **MAAC (Potential Overloads continued)**

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<th>To Bus</th>
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• MAAC (Potential Overloads continued)

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### 2014 RTEP Winter Study Update – Initial Deliverability Results

#### PJM West (Potential overloads)

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2014 RTEP Winter Study Update – Initial Deliverability Results

• PJM West (Potential overloads continued)

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<th>To Bus</th>
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2014 RTEP Winter Study Update – Initial Deliverability Results

- South (potential overloads)

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<th>Fr Bus</th>
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<th>Name</th>
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• The current study assumptions were based in part on historical interchange and capacity factor data. The purpose of the PROMOD simulation was to determine if a sensitivity study is required to adjust these values from the historical values.

• PROMOD Assumptions:
  – Firm interchange levels modeled with PJM neighbors (TVA, LGEE, Carolinas, NY, OVEC and MISO) based on Transmission Planning Assumptions
  – Economic interchange facilitated through hurdle rates
  – Generation model meets reserve requirements in 2019 using only Existing + ISA generation (no FSA’s dispatched for economics)

• Promod results:
  – Average Capacity Factor for generation : Comparable to Historical data
  – Average interchange for MAAC during winter peak hours: importing 1062MW  (Vs. Historical importing 1278MW)

• Conclusion:
  – Based on the comparison of the PROMOD result to the historical data, no capacity factor or interchange sensitivity is recommended at this time
• **CETO Calculations**
  – Work underway to calculate winter CETO values for PJM LDAs
  – Winter CETO values will be calculated for each of three scenarios of natural gas related generation outages

• **CETL Evaluation**
  – PJM will select LDAs to perform Load Deliverability analysis and calculate winter CETL values

• **Develop and analyze gas pipeline contingency events**
• Work with the TOs to validate the winter generator deliverability results

• Finalize winter CETO development

• Calculate winter CETL values
Generation Deactivation Notification Update
Deactivation Update: Deactivation Notifications

- Sunbury units
  - Unit 1 – 80 MW
  - Unit 2 – 80 MW
  - Unit 3 – 94 MW
  - Unit 4 – 128 MW
  - PPL Transmission Zone
  - Deactivation date: 07/18/2014
N-1 Common Mode Voltage Violation

- Several voltage magnitude violations on PPL 69 kV buses for the stuck breaker contingency loss of Sunbury 500/230 kV transformer #24 and Sunbury – Milton – Montour 230 kV line (‘PL101001’).
N-1 Common Mode Voltage Violation

- Several voltage drop violations on PPL 69 kV buses for the tower contingency loss of Montour – Elimsport – Lycoming 230 kV line and Montour – Clinton 230 kV line (‘PL100487’).
N-1-1 Thermal Violation

- The Susquehanna 500/230 kV transformer#21 is loaded to 100.34% of its emergency rating (1165 MVA) for the N-1-1 loss of Sunbury - Susquehanna 500 kV line (‘PJM50’) followed by Susquehanna-Wescosville 500 kV line (‘200022(SUSQHANA)-200023(WESCOVLE)_1’).
N-1-1 Voltage Magnitude Violation

- The voltage magnitude on Sunbury 138 kV bus is below 0.92 pu (0.8184 pu) for the N-1-1 contingency loss of Milton 230/69 kV transformer T1 ('PL100453') followed by loss of Sunbury 230/69 kV transformer T22 ('PL100448').
N-1-1 Voltage Drop Violation

- Several voltage drop violations on PPL 138 kV buses for the N-1-1 loss of Juniata-Sunbury-Susquehanna 500 kV line (‘PJM69’) followed by Susquehanna-Wescosville-Alburtis 500 kV line (‘PJM66’).
• Upgrade to mitigate the violations in PPL area due to Sunbury deactivation:
• Existing baseline upgrade Susquehanna – Roseland with in-service date 06/01/2015
• PPL b0487 and b0487.1
• PSEG b0489 and b0489.1 through b0489.9
Supplemental Projects
Supplemental Project:
- To improve reliability due to aging infrastructure.

Proposed Solution:
- Replace Waldwick 230 kV PAR #2 (S0698).

Estimated Project Cost:
- $12 M

Projected IS Date:
- 12/31/2016
Supplemental Project

- Reconductore 10 miles of 345 kV line 2107 between Lanesville and Brokaw (S0731)
- Estimated Project Cost: $17M
- Projected IS Date: 12/31/2014
Supplemental Project

- Replace Electric Junction 345 kV circuit breaker on line 11120 (Electric Junction – Lombard 345kV line), replace 345 kV circuit switcher on Electric Junction 345/138KV transformer 83 with a circuit breaker. (S0712)

- Estimated Project Cost: $3.6M

- Projected IS Date: 12/31/2014
• **Supplemental Project**
  - Replace the 345 kV MOD on Prospect Heights 345/138kV TR 84 with a circuit breaker. (S0713)
  - Estimated Project Cost: $1.8M
  - Projected IS Date: 12/31/2014
• **Supplemental Project**

• Replace Silver Lake 345 kV bus tie 5-6, 12/31/14. (S0714)

• Estimated Project Cost: $1.8M

• Projected IS Date: 12/31/2014
Supplemental Project

- Replace Calumet 345 kV inductor 1 circuit breaker. (S0715)
- Estimated Project Cost: $1.8M
- Projected IS Date: 12/31/2014
• Supplemental Project

• Replace Plano 345 kV bus tie 9-12 and 765/345KV transformer 93A. (S0716)

• Estimated Project Cost: $6.5M

• Projected IS Date: 12/31/2014
ComEd Transmission Zone

- **Supplemental Project**
- Replace Wempletown 345/138KV transformer 84. (S0717)
- Estimated Project Cost: $4.5M
- Projected IS Date: 12/31/2014
• **Supplemental Project**

• Replace Burnham 345 kV circuit breakers 2-4 and 4-5. (S0718)

• Estimated Project Cost: $3.6M

• Projected IS Date: 12/31/2014
• **Supplemental Project**

• Replace Northbrook 345/138KV transformer 81 and its 138 kV circuit breaker, replace its 345 kV MOD with a circuit breaker. (S0720)

• Estimated Project Cost: $8M

• Projected IS Date: 6/1/2015
ComEd Transmission Zone

- **Supplemental Project**
  - Replace Plano TR 94(A,B,&C) and 345 kV bus tie 2-5 (S0721)
  - Estimated Project Cost: $15M
  - Projected IS Date: 6/1/2015
ComEd Transmission Zone

- **Supplemental Project**
- Replace Davis Creek 345 kV bus tie 3-4 (S0722)
- Estimated Project Cost: $1.8M
- Projected IS Date: 6/1/2015
Supplemental Project

- Replace McCook 345/138KV TR 82, replace high-side MOD with 345 kV circuit breaker (S0723)
- Estimated Project Cost: $4.5M
- Projected IS Date: 6/1/2015
- **Supplemental Project**

- Replace Bloom 345/138KV TR 84, replace high-side MOD with 345 kV circuit breaker (S0724)

- Estimated Project Cost: $4.5M

- Projected IS Date: 6/1/2015
• **Supplemental Project**

  • Replace Skokie 345/138kV TR 84, replace high-side MOD with 345 kV circuit breaker (S0725)

  • Estimated Project Cost: $4.5M

  • Projected IS Date: 6/1/2015
• Supplemental:
  • Dominion Distribution (DVP) has submitted a Delivery Point (DP) Request for a proposed Pacific Substation (site acquired near Moran Rd and Pacific Blvd) for 60 MW load growing to over 100 MW by 2020.

• Proposed Solution:
  – Loop (in-and-out) an overhead, double-circuit, 230kV transmission line extension approximately 2 miles (along new right-of-way) from either Line #2137 (Brambleton-BECO) or Line #2081 (Beaumeade-Sterling Park) (S0744.1).
  – Install four 230kV breakers in a six-breaker ring arrangement to accommodate the connection of DVP 230-34.5kV transformers (S0744.2).

• Estimated Project Cost:
  $15 M

• Projected IS Date:
  5/31/2016
• Supplemental:
• Northern Virginia Electric Cooperative (NOVEC) has submitted a Delivery Point Request for a proposed Runway Substation for 8 MW load growing to over 15 MW by 2020.

• Proposed Solution:
  – Tap Line #2137 (Brambleton-BECO) between structures 2095/57 and 2095/59. Install appropriate 230 kV transmission structures to accommodate tapping to DVP’s backbone structure, including 2 – 230 kV air-break switches with vacuum bottle attachments (S0745).

• Estimated Project Cost:
  $ 0.75 M

• Projected IS Date:
  5/30/2015
Supplemental:
- Replace existing 115kV Delivery Point with 230kV Delivery Point for greater capacity.
- Transfer 8 MW from Newport News to the new 230kV delivery point. DP also needed to support Newport News transformer contingency.
- Projected load is 24.5MW in 2015 growing to 30 MW by 2025.

Proposed Solution:
- Copeland Park 230kV Delivery - Install 230kV Backbone, associated equipment and transformer high side circuit switcher (S0752).

Estimated Project Cost:
$ 0.8 M

Projected IS Date:
5/31/2015
Supplemental:

- Transferring 31 MW (winter) from Locks 115 kV to the new 230kV DP needed for transformer contingency (exceeds mobile transformer rating).
- Projected load is 38 MW by 2025.

Proposed Solution:

- Relocate section of Lacks 230 kV bus and install high side switch and circuit switcher (S0754).

Estimated Project Cost:

- $0.5 M

Projected IS Date:

- 11/30/2014
Questions?

Email: RTEP@pjm.com
Revision History

- 7/9/2014 - Original version distributed to PJM TEAC.
- 7/14/2014 – Updated slide #33 and added slides #42- #48 to align with the list of facilities posted for the 2014 RTEP Proposal Window #1.
- 7/22/2014 – Updated contingency description in slides #24, #25 to align with the contingency definition for the 2014 RTEP Proposal Window #1.