



Natural Gas Transportation Resiliency

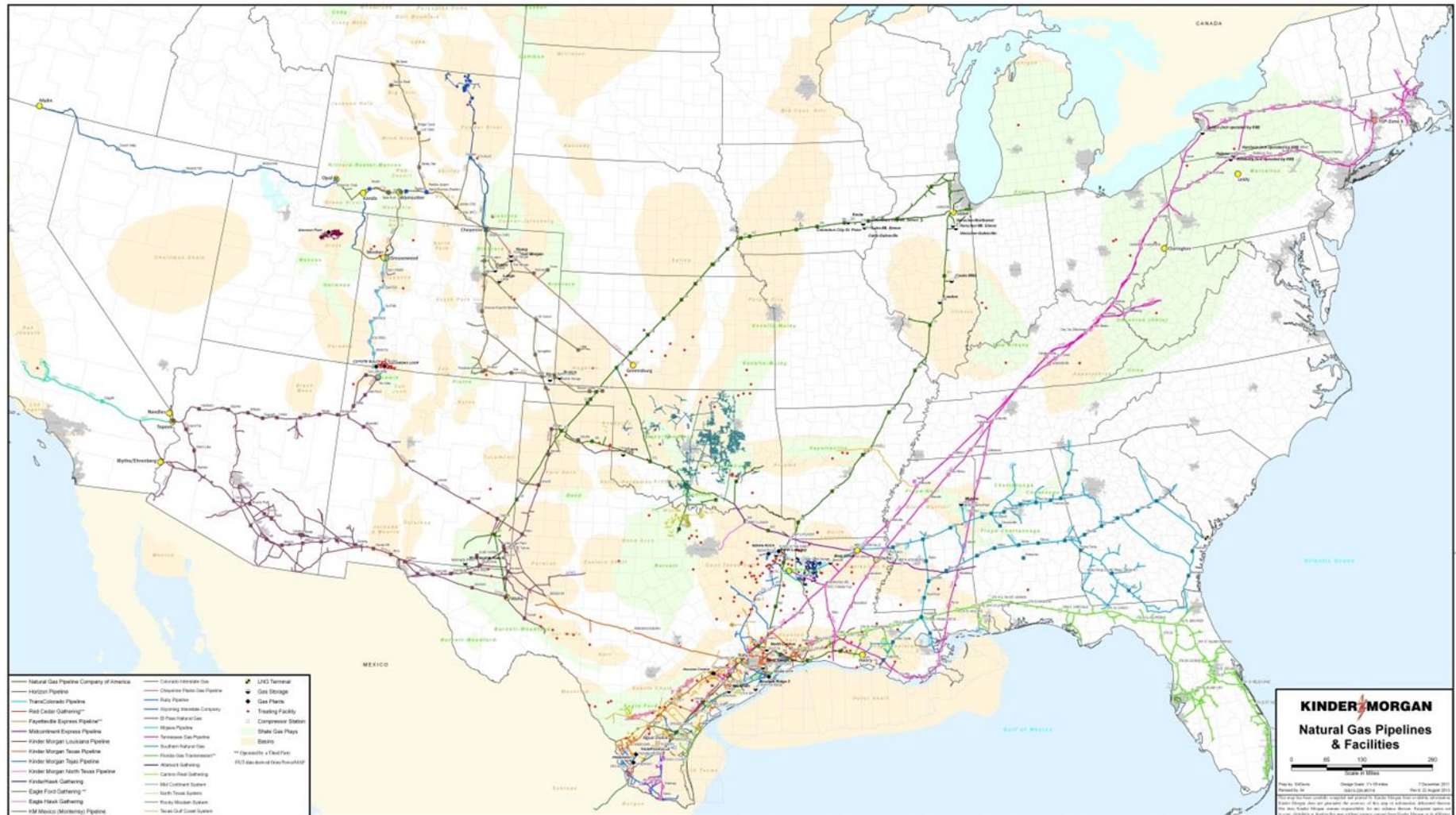
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Pipeline Resiliency Considerations

- Climate / Weather
- Cyber Issues
- Physical Impacts
- Equipment Reliability
- Interdependence
- Supply Sources
- Business Resumption plans
- Inspection and Measurements
- Staffing
- Delivery Metrics

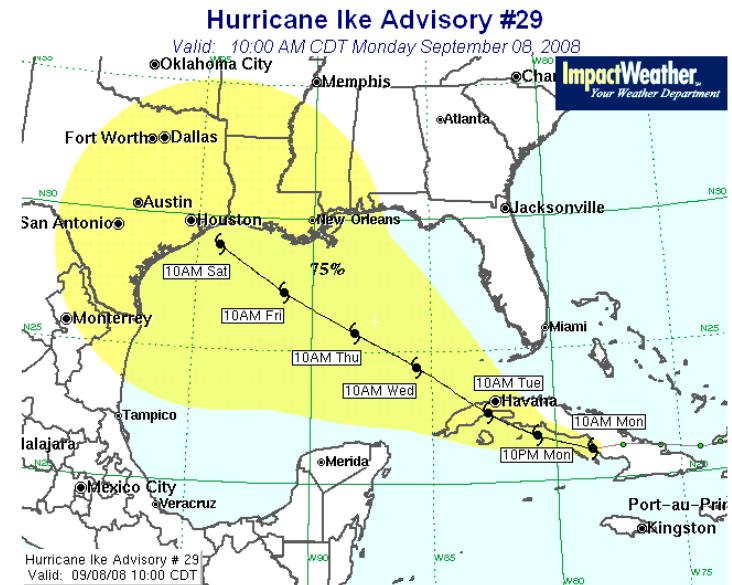
KinderMorgan Gas Pipelines



http://www.kindermorgan.com/asset_map/KM_Natural_Gas_System_Map.pdf

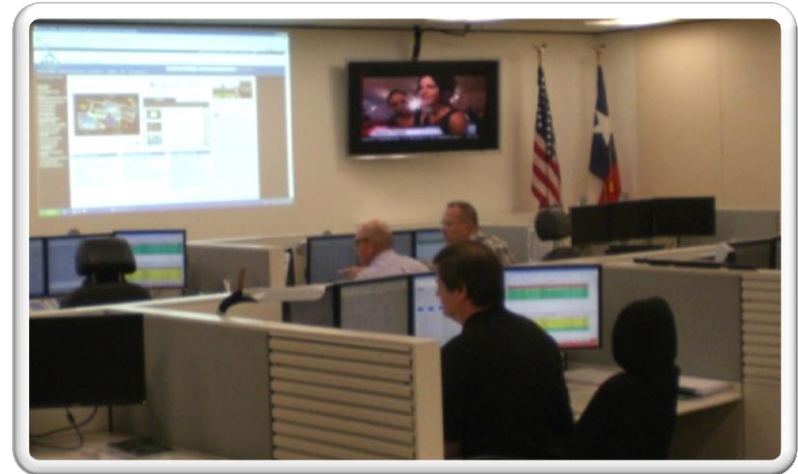
Climate Impacts

- Facilities located in Hurricanes, Floods, Tornados zones
 - Number of facilities
 - Loss of capacity subject to loss of a facility
- Sensitivity to ambient temperature change
 - Capacity change, loss of available power
 - As ambient temperature increases available power decreases
 - Higher ground temperatures reduce pipeline capacity



Cyber issues

- Impact of loss of the internet (data communication)
 - Number of instances annually
- Impact of loss of telecom (voice communication)
 - Number of instances annually
 - Mitigation plan in place
 - Number of mock drills, participants
 - Number of employees trained
- Ability to function in the dark
 - Alternative strategies
- Personnel and level of commitment

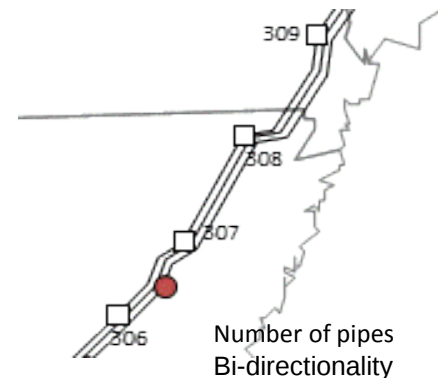


Physical

- Number of facilities in potential earth movement zones
 - Plans in place
 - Repair and replacement material stock available
- Number of attacks (Darwin candidates)
 - Rifles, shotguns (annually)
 - Extent of damage and time to repair
- Number of Line strikes (3rd party)
 - Backhoes, Tractors
 - Extent of damage and time to repair
- Depth of Pipe
 - Cover by zone

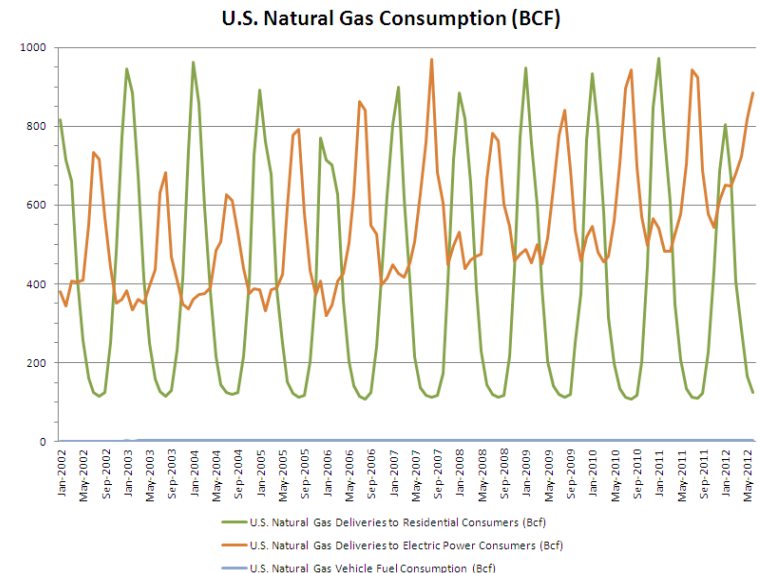
Pipeline Equipment Reliability

- Compressor Stations
 - Annual runtime
 - Station reliability and availability
 - Spare machines
 - Ability to rapidly repair/replace
- Meter Stations
 - Capacity firm versus peak day
 - Redundancy
 - Reliability
- Pipeline(s)
 - Nominal Design Capacity (FERC 567)
 - Load factor by segment
 - Age and type of pipe
 - Level of reticulation, Parallelism
 - Directionality
 - Interconnectivity with other pipelines

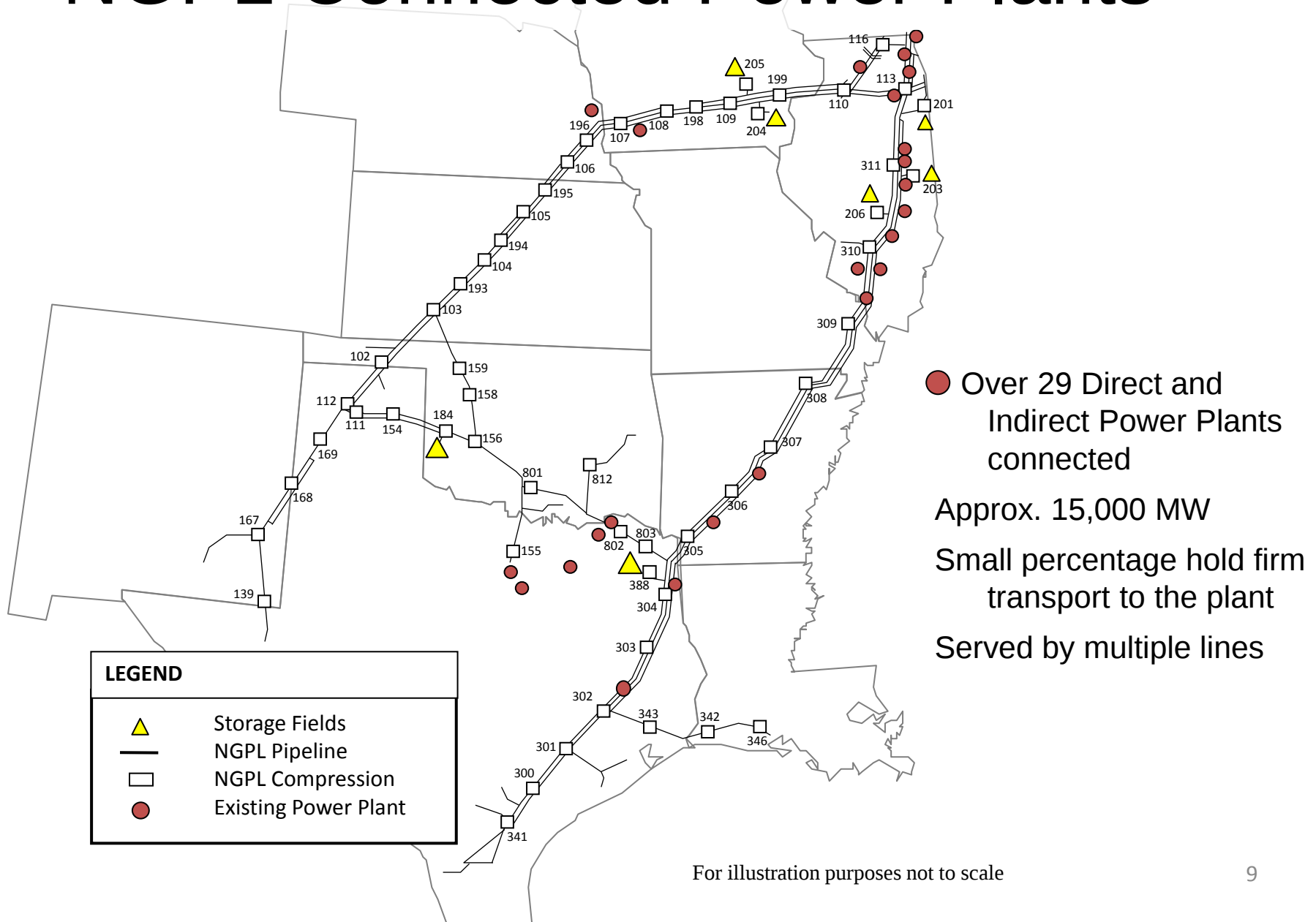


Interdependence

- Power Plants
 - Number of plants served
 - Volume by plant (day/hour)
 - Pressure requirements, % of operating pressure
 - Firm commitment to plant vs Interruptible
- Electric motor driven Compressor Stations
 - Number of units
 - Time to repair
 - Location of units
 - Series
 - Chances of spiral down
- Load Coincidence



NGPL Connected Power Plants

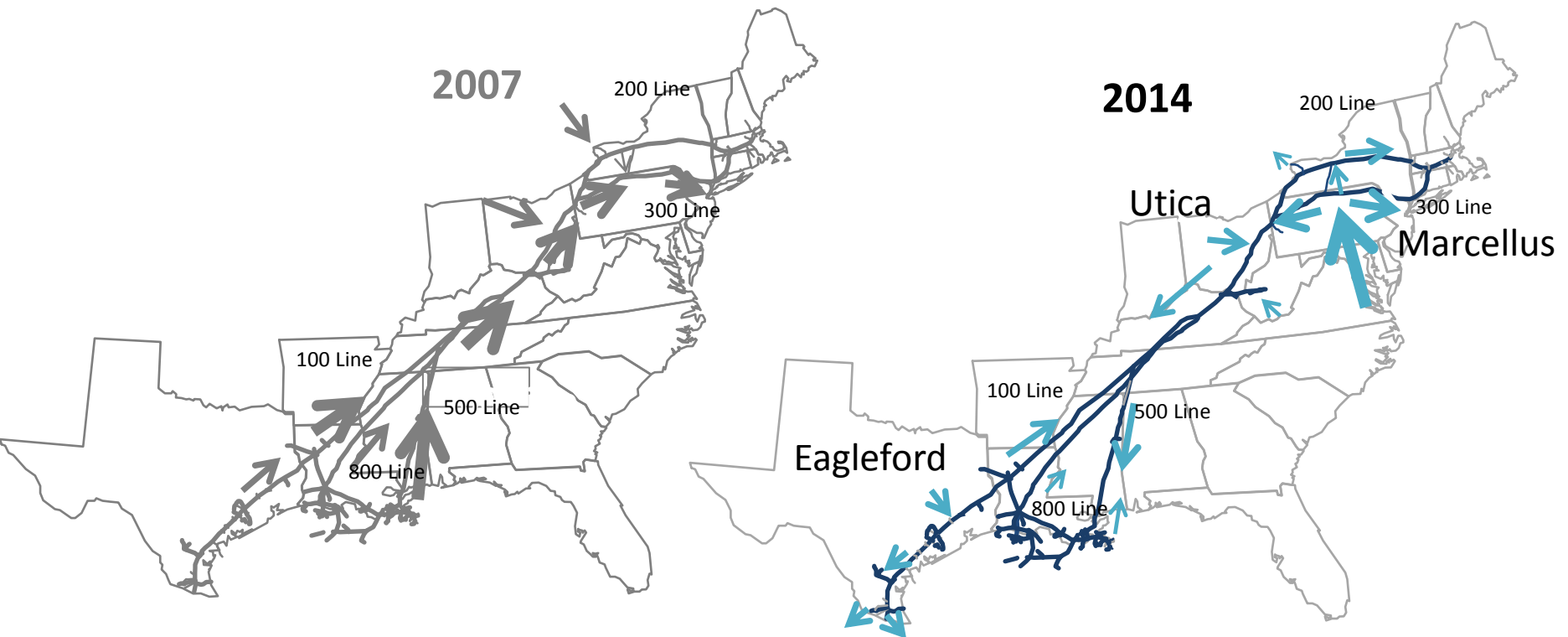


Supply Sources

- Location of major receipts relative to major deliveries
- New sources of supply
 - Supply infrastructure dependence on power
 - Supply independence of power
- Storage
 - Daily deliverability
 - Deliverability curves

Shale Supply and Pipeline Reversals

Tennessee Gas Pipeline



Example of new sources of supply increasing pipeline resilience and capacity

Business Resumption Plans

- Business Continuity
- Mock scenarios
- Number of backup centers
- Resources
- Staffing
- Training

Commitment to PL Safety, Reliability, and Awareness

- Aerial Patrols & Leak Surveys
- Commitment to In Line Inspection
- Managing Gas Quality
- Managing Equipment Health
- Monitoring of PL System by Gas Control Center and Operations (24/7; 365 day/year)

Incident Prevention & Mitigation Measures



Pipeline Staffing

- # employees / compressor station
- # employees / meter station
- # employees / pipeline mile
- # employees relative to automation
- Ability/plan to support employee's family
- Ability/plan to staff up

Delivery Metrics for Consideration

- How often does the shipper received the scheduled volume
- How often is a pipeline segment restricted
- What percentage of the nominated flow by segment is delivered to the meter
- Percentage of time information is available in a timely fashion
- How often is scheduled information available to the market

Restriction Point	Percent Days Restricted (Nov – Mar)	
	2009/2010	2010/2011
MLV 223/STA 224	0.00%	27.81%
Niagara Spur Backhaul	0.66%	38.41%
STA 245	41.72%	96.03%
STA 307	0.00%	1.32%
STA 315 M/S	0.00%	25.17%
STA 321	37.75%	47.68%
STA 325	0.00%	86.75%
MLV 335 M/S	26.49%	49.67%
MLV 335 S/M	0.00%	28.48%

Example of scheduling restriction of lower priority services
Firm primary volumes delivered

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