Operational Issues:

Shale Gas

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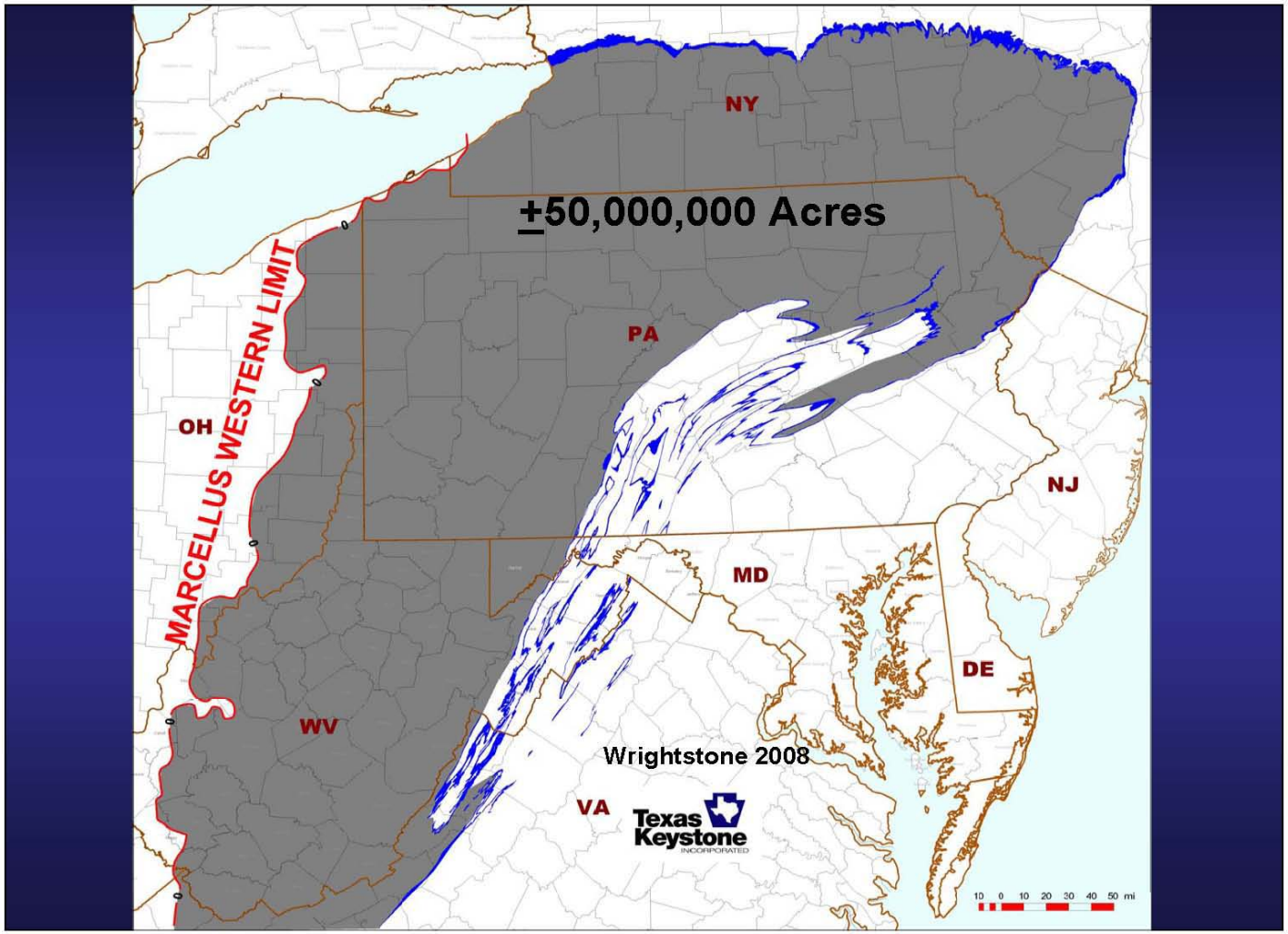
NiSource Gas Transmission & Storage

Agenda

- Extent of Shale Production
- Maturity of Marcellus Shale
- Composition of Marcellus Shale
- TETCo's RP10-30, Holbrook Waiver
- Flame Quality-Weaver Index, AGA Bulletin 36
- LNG Interchangeability
- Incomplete Combustion
- Supplies into TETCo (TCO, DTI, EQT)
- Nitrogen Blending
- Conclusions



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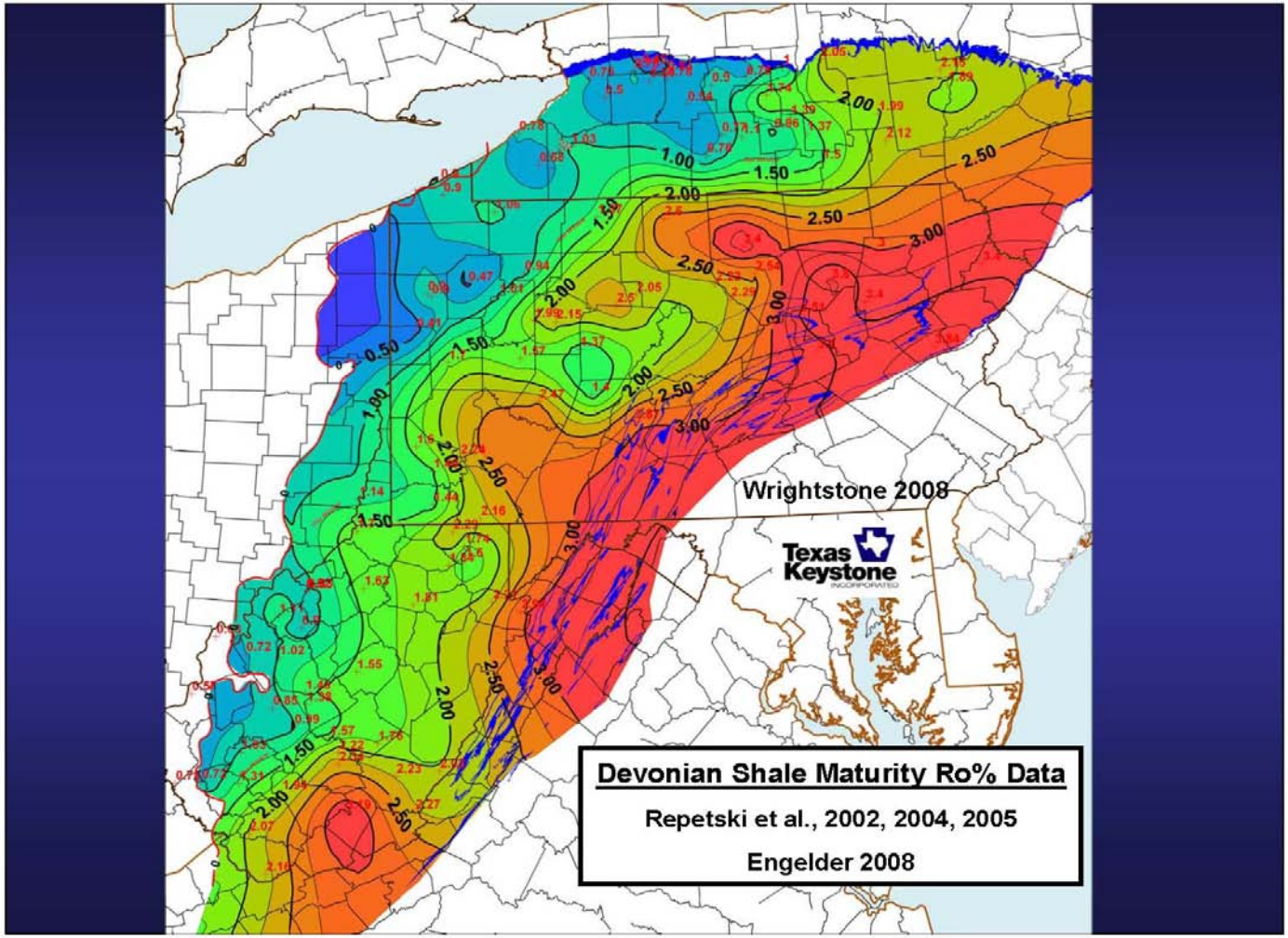

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Typical Western Marcellus Composition

Component	Mol%	GPM
Methane	74.22	
Ethane	15.62	4.17
Propane	5.46	1.50
Iso Butane	0.655	0.21
Normal Butane	1.437	0.45
Iso Pentane	0.48	0.17
Normal Pentane	0.54	0.19
Hexanes+	1.06	0.46
Inerts(N2, O2, CO2)	0.52	
Total	100	7.15

Texas Eastern, RP10-30

- C2 Limitation of 12%
- BTU limitation of 1110 Btu/scf
- Wobbe limitation of 1400
- Nitrogen limitation of 2.75%
    - *Grounds*
- BTU fluctuations (+/-5% Wobbe) are problematic for power generation. (Algonquin Argument)
- Higher levels of N2 are problematic for LNG liquefiers
- LDC’s invoice on volume (mcf’s), not energy (dth)

Texas Eastern, RP10-30 Holbrook Exception

- BTU limit: 1150
- Wobbe limit: 1430
- C2 Limit: 17%
- Volume limit: Up to 500,000 Dth/day
- Term: Expires 12/31/2014

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Stringent C2+ Limitation Heavily Impacts Supplies

- Significant amounts of Appalachian supplies have C2+ over 12% after processing
  - Ethane remains in gas stream-No ethylene crackers in NE
  - Over past 4 years, output of DTI's Hastings extraction plant has exceeded 12% C2+ more than 65% of the time.
  - Simulated Residue Outputs at Houston, PA and Majorsville* are 18% C2, 1130 BTU/SCF, 1440 Wobbe
  - Marcellus Shale supplies will increase the level of high C2+ gas
- Texas Eastern's proposed HHV and Wobbe limits would serve to generally restrict C2+ to a more reasonable level of 14%

**Holbrook Exception*

TETLP - Gas Quality Tariff Comparison

Gas Specification	AGT RP07 - 504	Cove Pt	Columbia RP06 - 365	Dominion	TENN	Transco Jan '07 Mtg	Rockies Express
Heat Value Btu / SCF - Min	967	967	967	967	967	980	950
Heat Value Btu / SCF - Max	1110	1100	1110	1100	1100	1110	1150
C2+ / C4+	12% / 1.5%	- / -	- / -	- / -	- / -	- / 1.5%	- / -
Wobbe Number - Min / Max	1314 / 1400	- / -	1295 / 1400	- / -	- / -	1300 / 1400	- / -
Objectionable Matter: H20, Solids, Gums, Dust, Odors…	Commrcly Free	Commrcly Free	Commrcly Free	Commrcly Free	Commrcly Free	Commrcly Free	Commrcly Free
Oxygen Vol %	0.20%	0.20%	0.02%	0.20%	0.20%	0.01%	10 PPM
Inerts - Total Maximum	4.00%		4.00%	5.00%	4.00%	4.00%	3.00%
Carbon Dioxide - Vol % Max	2.00%	1.00%	1.25% -	3.00%	3.00%	2.00%	2.00%
Nitrogen - Vol % Max	2.75% A/	4.00%	- / -	4.00%	- / -	3.00%	- / -
Liquids	Free at Flowing Conditions	Commrcly Free	Commrcly Free	Free at Flowing Conditions	Free at Flowing Conditions	No Free Liq on 1 Phase Lines	Commrcly Free
Liquefiable Hydrocarbons	- / -	- / -	25 Deg F	Free at Flowing Conditions	15 Deg F	C6 + / 0.07%	20 Deg F
H2S - Hydrogen Hulphide Max Gr / 100 CF	0.50 Gr	0.25 Gr	0.25 Gr	0.25 Gr	0.25 Gr	0.25 Gr	0.25 Gr
Total Sulphur - Max Gr / 100 CF	10	20	2	20	20	20	5
Water - Lbs / MMCF	7	7	7	7	7	7	6
Temperature Deg F - Min / Max	- / -	- / -	May Restrict	- / -	- / 120	- / 120	20 / 120

A/ 2.75% Max for O2 + N2 combined

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	Ideal Index Value	Suggested Index Limit	Columbia Lower Limit	Columbia Upper Limit
AGA Bulletin 36 Indicies				
Lifting	1	<1.1		1.1
Flashback	1	<1.34		1.34
Yellow Tip	1	>0.86	0.86	
Weaver Indicies				
Heat Input	1	0.95-1.03	0.95	1.03
Primary Air	1	0.80-1.20	0.8	1.2
Lifting	1	>0.64	0.64	
Flashback	0	<0.26		0.26
Yellow Tip	0	<0.30		0.3
Incomplete Combustion	0	<0.05		0.05
Other Indicators				
Wobbe, Substitue Gas	**1400**	**1295-1400**	**1295**	**1400**
Knoy Criterion	1	0.95-1	0.95	1.05
Specific Gravity	n/a	n/a	n/a	n/a
BTU Content-Dry, btu/scf	**1030**	**1110**	**957**	**1110**

	Cryogenic Houston, PA Residue	Walbridge Kentucky KA Proxy
AGA Bulletin 36 Indicies		
Lifting	1	1
Flashback	1.076	1.098
Yellow Tip	1	1
Weaver Indicies		
Heat Input	1	1
Primary Air	1	1
Lifting	1	1
Flashback	0	0
Yellow Tip	0	0
Incomplete Combustion	0	0
Other Indicators		
Wobbe, Substitue Gas	**1434.3**	**1417.8**
Knoy Criterion	1	1
Specific Gravity	0.6527	0.7222
BTU Content-Dry, btu/scf	**1158.7**	**1204.9**

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LNG Interchangeability Assessment / LNG Compositions

Component	Symbol	Nigeria	Abu Dhabi	Algeria	Qatar	East TCO Winter	East TCO Summer
Methane	CH4	89.60	84.82	92.05	89.18	95.20	94.56
Ethane	C2H6	5.51	13.39	5.50	7.07	2.81	4.07
Propane	C3H8	3.21	1.34	2.00	2.50	0.44	0.77
iso-Butane	iC4H10	0.66	0.28	0.20	0.46	0.07	0.12
n-Butane	nC4H10	0.94	0.00	0.10	0.69	0.08	0.15
iso-Pentane	iC5H12	0.04	0.00	0.15	0.01	0.06	0.08
n-Pentane	nC5H12	0.01	0.00	0.00	0.00	0.05	0.06
Nitrogen	N2	0.03	0.17	0.00	0.09	0.53	0.13
Carbon Dioxide	CO2	0.00	0.00	0.00	0.00	0.76	0.05
Heating Value		1143	1142	1098	1132	1036	1066

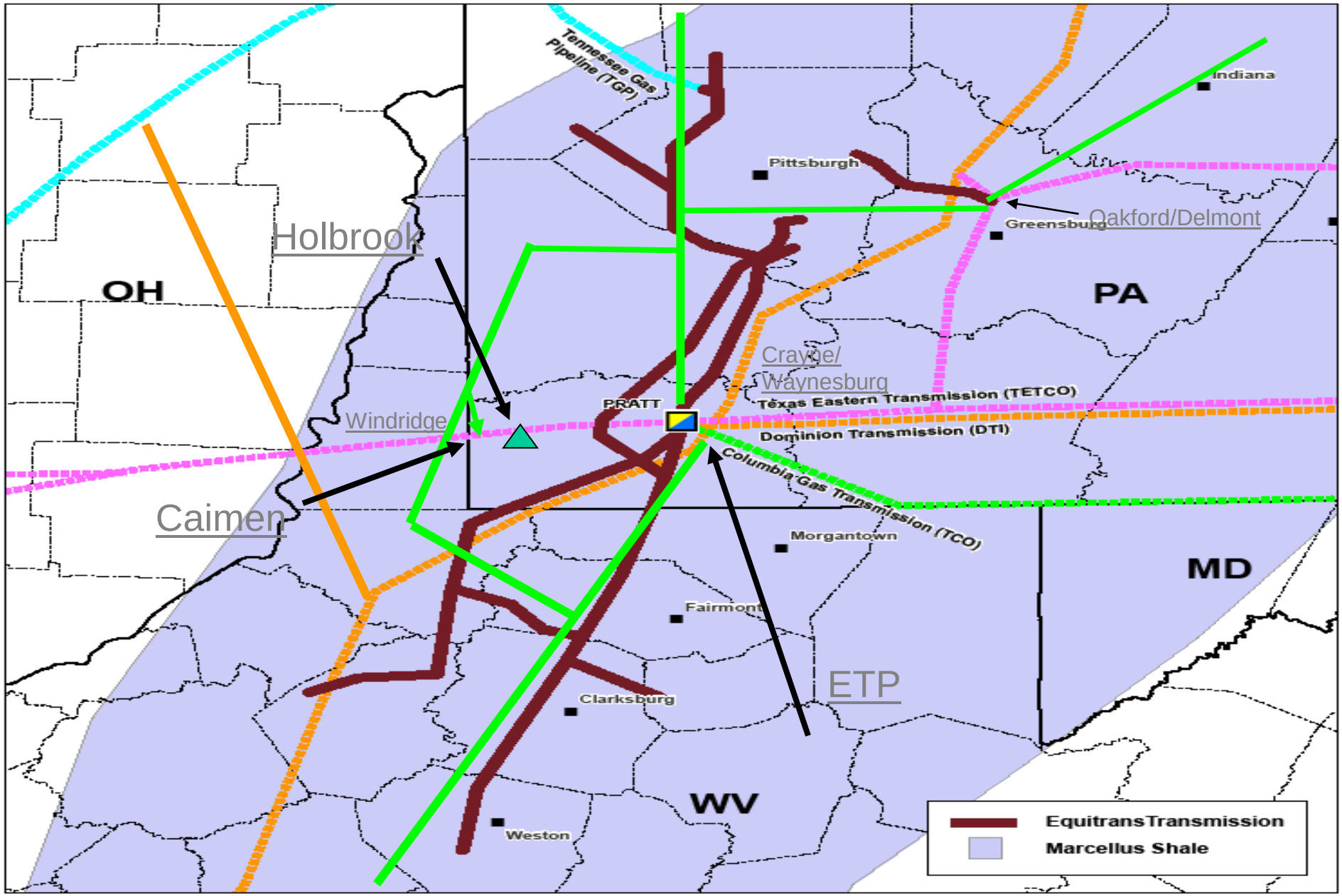
Sources of CO

Concentration-PPM	Source
0.1	Natural background atmospheric level [1]
0.5 to 5	Average background level in homes[1]
5 to 15	Levels near properly adjusted gas stoves in homes[2]
100 to 200	Mexico City central area from automobiles[3]
165	**WGL Furnace w/1066 BTU/SCF w/o N2 Blending from TIAX Study-7/7/2003**
225	**LNG #2 (1142 BTU/SCF) w/13.3% C2-TIAX Study-7/7/2003**
5000	Residential Wood Burning Chimney[3]
7000	Undiluted warm car exhaust[3]
30,000	Undiluted cigarette smoke[3]

Symptoms of CO Exposure

Concentration-PPM	Symptoms[4]
35	Headache and dizziness within 6-8 hours of constant exposure.
100	Slight headache in 2-3 hours
200	Slight headache in 2-3 hours
400	Frontal headache within 1-2 hours
1600	Dizziness, nausea, and convulsions with 45 minutes. Insensible within 2 hours.
3200	Headache, dizziness and nausea in 5-10 minutes. Death within 30 minutes
6400	Headache and dizziness in 1-2 minutes. Death in less than 20 minutes.
12,800	Unconsciousness after 2-3 breaths. Death in less than 3 minutes

Western PA Interconnects w/ TETCO



Current TETCo-PA Receipts (Deliveries)

	DTI	EQT	TCO+
Windridge*			**-100,000**
Pratt		**100,000**	
Crayne	**796,000**		
Waynesburg			**140,000**
Oakford	**140,000**		
Delmont			**70,000**
Total	936,000	100,000	110,000

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- Upstream of Holbrook
- + 375,000 Dth/day on FTS

Proposed TETCo-PA Receipts

	DTI	EQT	TCO
Windridge*			**400,000**
Pratt		**900,000**	
Crayne			
Waynesburg			
Oakford	**95,000**		
Delmont			**60,000**
Total	95,000	900,000	460,000

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* Upstream of Holbrook

Flow of Marcellus Production from DTI, Columbia and EQT to Texas Eastern

- DTI, Columbia, Equitable, ETP, Caimen, Williams Midstream, Superior will deliver increasing amounts of Appalachian supply to TETCo with C2+ levels in excess of 12%. The points that will be affected are
  - DTI: Crayne and Oakford
  - TCO: Majorsville Waynesburg, and Delmont
  - EQT: Pratt
  - Caimen, ETP, Williams Midstream, Superior-Waynesburg Area

- If Texas Eastern or other long haul's non-confirm
  - It may slow Marcellus Development
  - It may force the construction of a ethane line to the GOM
  - It may force DTI, Columbia, and EQT to shut-in Appalachian Supply when blending volumes are not available.

Upstream/Midstream pipes encourage flexibility on C2+

- Flow studies demonstrate that C2+ remains at 8% or less at Lambertville even if 14% C2+ deliveries are accepted from DTI
- Allowing proposed HHV and Wobbe limits to restrict C2+ places all Appalachian gas on equal footing
  - "Holbrook waiver", as proposed by Texas Eastern provides an advantage to M-1 and M-2 receipts in Ohio and WV.
  - Texas Eastern is soliciting large quantities of Marcellus supplies with its "TEAM" projects

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Texas Eastern's Proposed Nitrogen Limitation

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Supply Impact of a Stringent N2 Limitation

- N2 is used by some Appalachian producers to lower Btu to meet pipeline specs
  - Overly restrictive N2 levels remove this option
- Cove Point injects up to 4% N2 into vaporized LNG, as needed, to satisfy Weaver Indices and its 1100 Btu limit
  - N2 injection allows LNG importers the flexibility to source LNG from a wide variety of sources
  - High Btu cargos are infrequent but do occur

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Expert Analysis – Peak Shaving Process

- DTI's expert analyzed impact of C2+ and N2 content on LNG peak shavers, using six different gas compositions (including 14% C2+ and 4% N2) and a peak shaving process simulation model
- Quantified impact of changes in gas composition on key performance issues:
  - Energy required for liquefaction and vaporization
  - Rate of energy storage, total energy stored
  - Heavy-ends knock-out flow rate, flash vapor flow rate
  - Potential for freezing of constituents in the cold box, and density and N2 content of the LNG produced

Analysis Results

LNG Peak Shavers Can Handle Gas with C2+ up to 14% and N2 up to 4%

LNG Peak Shavers Can Handle Gas with C2+ up to 14% and nitrogen up to 4%

- Analysis demonstrates peak shaving facilities can accommodate expanded range of C2+ and N2
  - Only potentially significant change is increased knockout and flash vapor flow rates
- Given that gases on high end of C2+ and N2 ranges are not likely to be delivered often, no operating or equipment modifications should be required
- If existing equipment is not adequate, increased flow rates can be accommodated through modification in operating practices or minor equipment modifications
- C2+ changes from 12% to 14% and N2 from 2.75% to 4% do not present rollover concerns that cannot be handled with standard methods

Conclusions

- Producers, Supply Pipes do not believe support TETCo's assertion that there is an operational or other need to justify the proposed C2+ and N2 restrictions
- Producers, Supply Pipes believe these restrictions would limit access to supply, interfere with the grid, and threaten service to customers of DTI and Columbia
- The Commission has accepted the C2+ and N2 restrictions but scheduled a tech. conference and a 6 month waiver on the standards
- TETCo has filed tariff sheets and asked for FERC approval. WGL vs. DCP CP05-130 ruling should provide precedence. 3/18 FERC approved tariff sheets and waived requirements for 6 month's and set April 6 technical conference.