

Uses of Photochemical Models for HGB industry: SIP, PSD/NSR, and Inter-Pollutant Trading

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What Are Photochemical Models?

- ▶ Photochemical means chemical reactions driven by light
 - Necessary for secondary PM and ozone
- ▶ Photochemical Grid Models (PGM) have different formulation than Dispersion Models (i.e. AERMOD)
- ▶ PGM are typically “Eulerian” models that break the domain into grid cells, then can track transport, transformation, removal processes in each box
- ▶ Formulation allows for mass conservation

What Are Photochemical Models? (cont.)

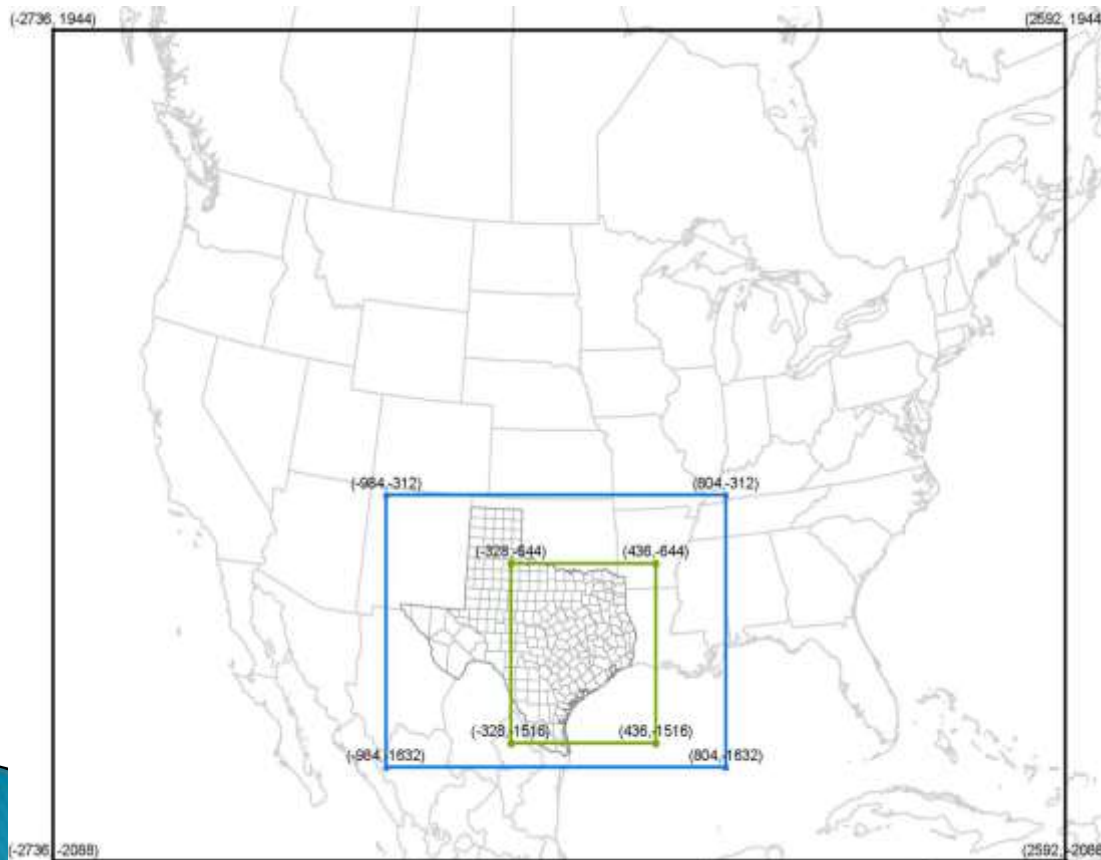
- ▶ To simulate chemistry, must include all sources of emissions i.e.
 - Motor Vehicles
 - Industrial
 - Fires
 - Biogenic
 - Shipping
- ▶ Time and resource intensive
 - Ozone season in Texas requires nearly a week on five 12-core workstations

What Are Photochemical Models? (cont.)

- ▶ TCEQ and EPA have large staffs of people plus extensive contractor support
- ▶ Luckily, our friends at TCEQ and EPA have done the heavy lifting and developed “platforms” that industry can use
- ▶ Most commonly used models
 - CAMx – Developed by Ramboll, also used by EPA
 - CMAQ – Developed by EPA

TCEQ Modeling Platform

- ▶ Currently 2012 Base Year and 2017 Future Year



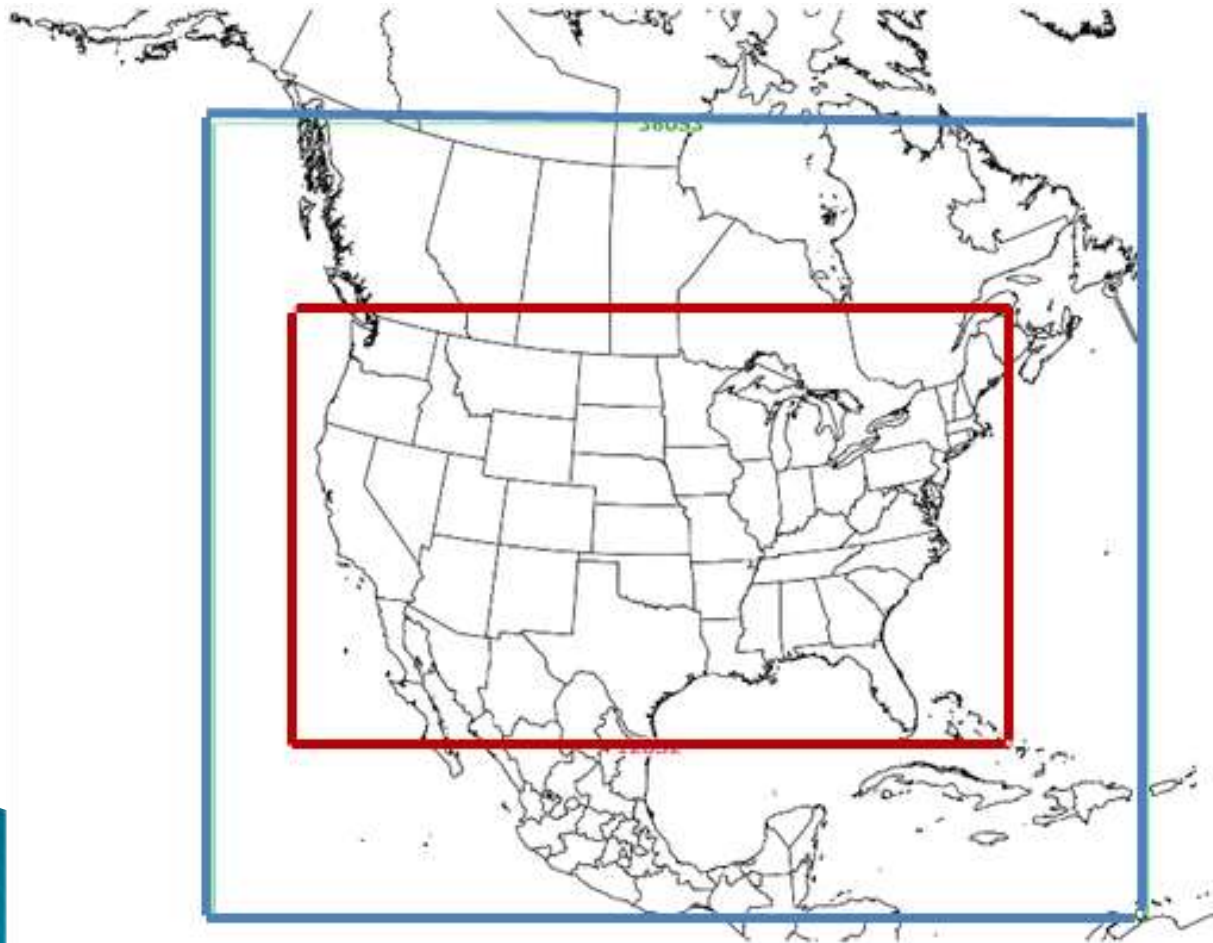
National: 36km

Texas/Border
States: 12km

Eastern Texas:
4km

EPA Modeling Platform

▶ 2016/2023/2028



US/Canada/
Mexico: 36km

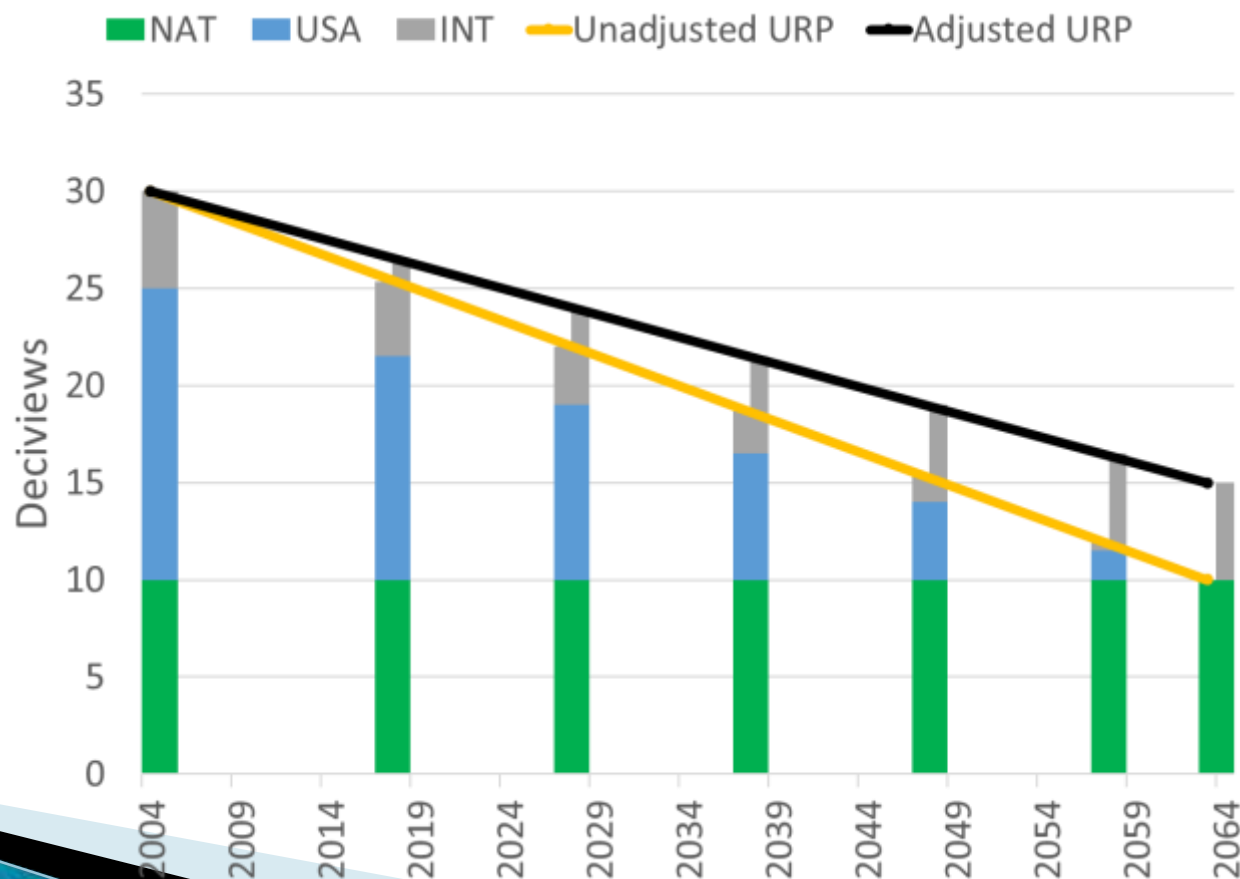
National: 12km

Uses of PGM

- ▶ National Rules (CSAPR)
- ▶ Regional Haze
- ▶ State Implementation Plans (SIPS)
- ▶ Prevention of Significant Degradation (PSD)/New Source Review (NSR)
- ▶ Inter-pollutant Trading

Regional Haze

- ▶ Plans to Improve Visibility in Class 1 areas to Natural Background by 2064



State Implementation Plans

- ▶ Plan on how a non-attainment area will attain the National Ambient Air Quality Standard (NAAQS)
 - HGB 8-hour ozone NAAQS SIP update currently out for comment
- ▶ Setup a model for a base period and evaluate the model against observations
- ▶ Forecast emissions to the future attainment year

SIP (cont.)

- ▶ Determine if the area attains the standard
- ▶ If necessary, use model to determine impact of control strategies
- ▶ TCEQ makes the SIP modeling platforms available

PSD/NSR

- ▶ Process to determine if a new source, or a source modification will significantly impact air quality
- ▶ Must examine PM_{2.5} and ozone
- ▶ Can either use existing modeling (i.e. Modeled Emission Rates for Precursors (MERPS)), or can perform new modeling

PSD/NSR (cont.)

- ▶ EPA Guidance has analysis hierarchy
 - Tier 1 – Base analysis on existing modeling (i.e. Modeled Emission Rates for Precursors (MERPS))
 - EPA has performed modeling for hypothetical sources across U.S. that can be scaled
 - No actual source is the same as the hypothetical source
 - Tier 2 – Perform new project specific modeling
 - More expensive since requires new modeling
 - Removes ambiguity since it is a judgement call if the existing modeling is appropriate for the specific project

PSD/NSR (cont.)

- ▶ Steps in Tier 2 PSD/NSR Modeling
 - Install modeling platform
 - Process project emissions into format for model
 - Temporalize
 - Speciate
 - Possibly grid
 - Merge project emissions into all other emissions
 - Run model with new merged emissions
 - Subtract model output without the source from the run with the source to determine source impact

Inter-pollutant Trading (IPT)

- ▶ In non-attainment area must offset new emissions with credits generated from an emission reduction in the area
- ▶ Ozone formed from both NO_x and VOC emissions
- ▶ IPT can offset VOC emissions using NO_x credits, NO_x emissions using VOC credits

Why Inter-pollutant Trading?

- ▶ May be cheaper/easier to get NO_x rather than VOC credits in Houston
- ▶ May require retirement of fewer NO_x credits than VOC credits to offset project VOC emissions

Basis of Inter-Pollutant Trading

- ▶ 30 TAC 101.306(d)
- ▶ “With prior approval from the executive director and the United States Environmental Protection Agency, a nitrogen oxides or volatile organic compound emissions credit may be used to meet the offset requirements for the other ozone precursor if photochemical modeling demonstrates that the overall air quality and the regulatory design value in the nonattainment area of use will not be adversely affected by the substitution.”

Basis of Inter–Area Trading

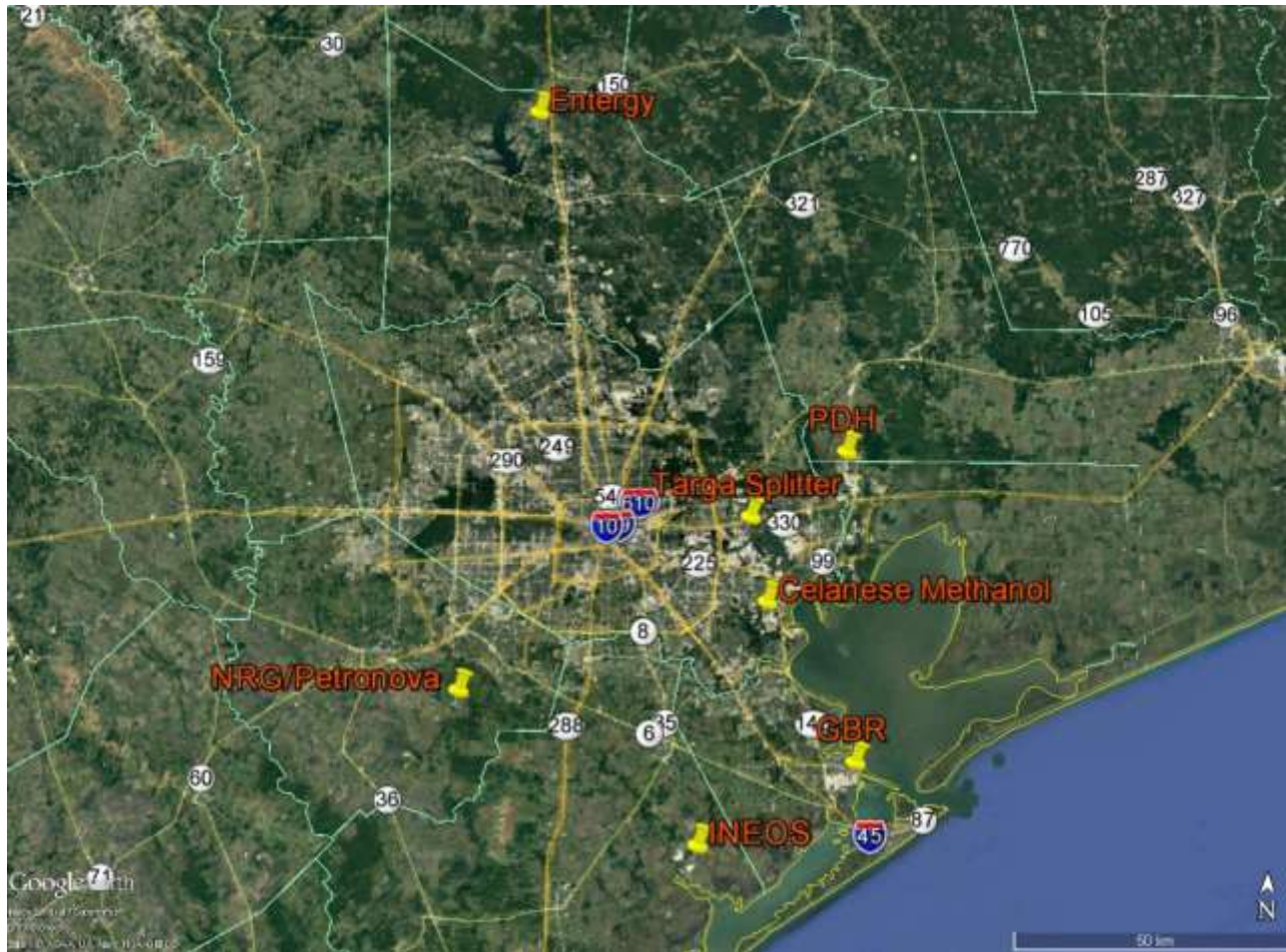
30 TAC 101.302(h)

- ▶ (h) Geographic scope. Except as provided in §101.305 of this title (relating to Emission Reductions Achieved Outside the United States), only emission reductions generated in nonattainment areas can be certified. An emission credit must be used in the nonattainment area in which it is generated unless the user has obtained prior written approval of the executive director and the EPA; and
 - ▶ • (1) a demonstration has been made and approved by the executive director and the EPA to show that the emission reductions achieved in another county or state provide an improvement to the air quality in the county of use; or
 - ▶ • (2) the emission credit was generated in a nonattainment area that has an equal or higher nonattainment classification than the nonattainment area of use, and a demonstration has been made and approved by the executive director and the EPA to show that the emissions from the nonattainment area where the emission credit is generated contribute to a violation of the national ambient air quality standard in the nonattainment area of use.

Past Approvals

- ▶ Texas Approved Trades
 - Celanese Methanol (HGB)
 - NRG Carbon Capture (HGB)
 - Entergy (HGB)
 - Targa (HGB)
 - INEOS Oligomers (HGB)
 - Blanchard Refining (HGB)
 - Several other projects underway
- ▶ Louisiana Approvals
 - Shintech

Map of Approved HGB Trades



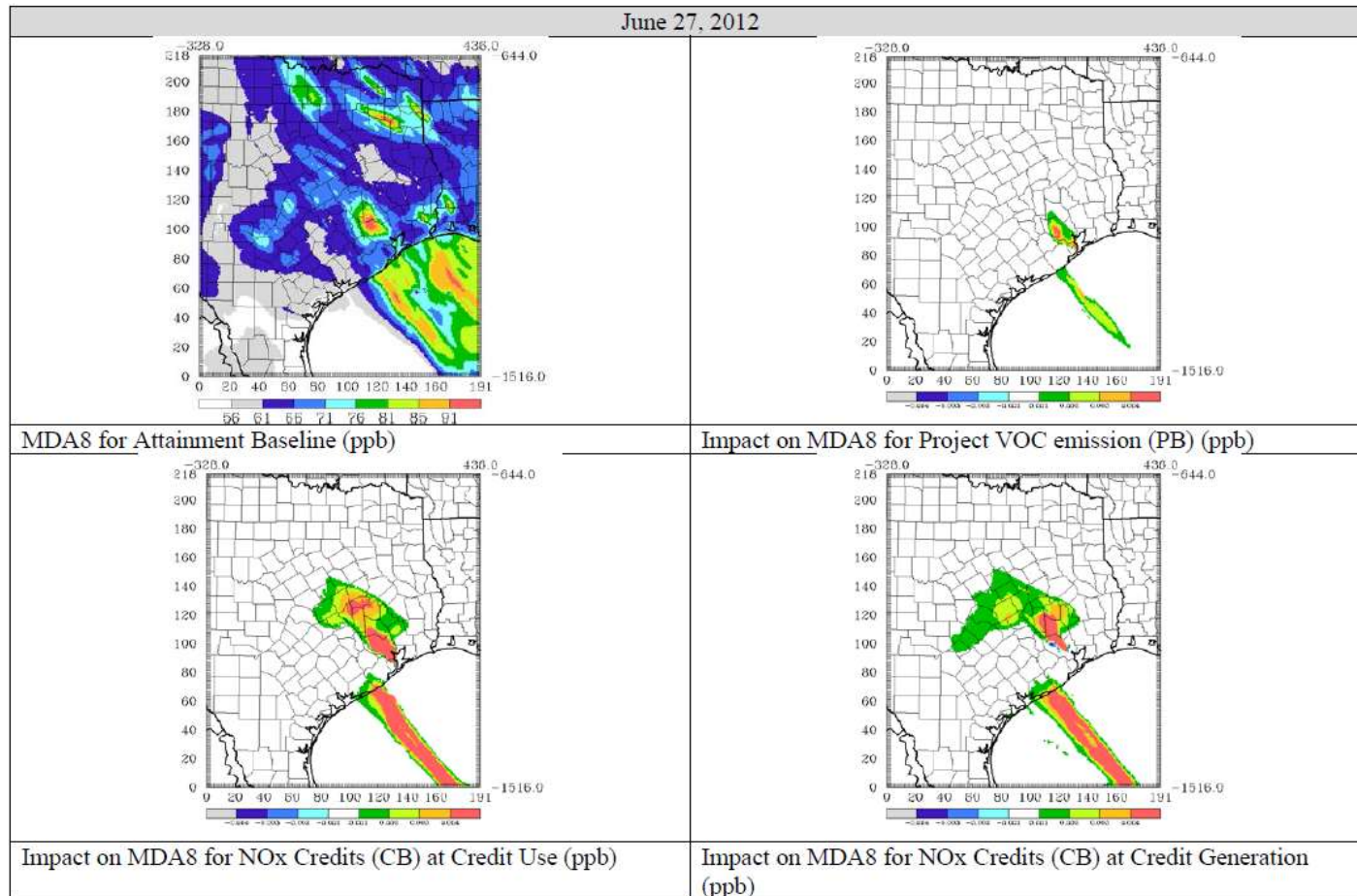
TCEQ Guidance

- ▶ TCEQ Emissions Banking and Trading (EBT) have prepared Guidance Documents for Inter-Pollutant and Inter-Area Trades.
- ▶ Common Theme
 - Requires use of Photochemical Grid Model to quantify that the trade will not degrade air quality

Elements of Modeling Study

- ▶ Perform screening analysis to determine if trade makes sense
- ▶ Prepare a modeling protocol for approval by TCEQ and EPA
- ▶ Model Base AQ
- ▶ Model Project VOC emissions
- ▶ Model NOx Credit emissions
- ▶ Compute TCEQ and EPA impact metrics
- ▶ Document and Submit Results
- ▶ Receive approval/Get Permit/Build Project

Sample Results (Daily)



Sample Results (Design Value)

Monitor	Monitor	AIRS ID	CAMS ID	Attainment Baseline (ppb)	Project Baseline DVP _m (ppb)	Credit Baseline DVC _m (ppb)	Trade Impact IP _m (ppb)	Trading Ratio
BAYP	Bayland Park	482010055	C53/A146	74.23385	74.23451	74.23667	0.00216	4.25
C35C	Clinton	482011035	C403/C304/A113	72.27932	72.27995	72.28381	0.00386	7.19
CNR2	Conroe Relocated	483390078	C78	73.03948	73.04021	73.04558	0.00537	8.37
DRPK	Deer Park	482011039	C35/C1001/A139	74.88308	74.88389	74.89160	0.00771	10.56
HALC	Aldine	482010024	C8/A108/X150	72.62303	72.62387	72.63092	0.00705	9.39
HCHV	Channelview	482010026	C15/A115	69.99311	69.99393	70.00008	0.00616	8.56
HCQA	Croquet	482010051	C409	73.51689	73.51715	73.51864	0.00148	6.62
HLAA	Lang	482010047	C408	71.93844	71.93973	71.94162	0.00189	2.47

Practical Considerations

- ▶ TCEQ has established detailed procedures
- ▶ EPA has guidance and treats projects on a case-by-case basis

- ▶ Possible differences in TCEQ and EPA approaches
 - TCEQ specifies credits modeled where used
 - EPA specifies credits modeled where generated
 - TCEQ specifies examination of attainment at monitors and at grid cells near or above the NAAQS throughout the non-attainment area
 - EPA prefers examination of day by day impacts

Practical Considerations

- ▶ Precursors have very different ozone forming potentials in different portions of HGB and DFW
 - Experience has shown that NO_x in ship channel better for IPT than outlying NO_x
 - Not every credit makes sense for a trade
- ▶ Ozone forming potential varies by VOC emissions reactivity
 - Alkane emissions better for IPT than alkenes
- ▶ Depending on project and credit source, may require fewer tons of NO_x to offset project VOC emissions. Blanchard Refining approved to offset 2.4 tons of project VOC per NO_x credit

Practical Considerations

- ▶ May be faster to get approval for NO_x credits equal to project VOC emissions
- ▶ TCEQ Guidance and EPA Regulation makes a pure inter-basin trade very difficult
- ▶ TCEQ monitor specific impacts often the limiting metric for IPT ratio

Practical Considerations

- ▶ Don't be afraid of photochemical modeling!
 - Our friends at TCEQ have already done the heavy lifting to provide the platform that we can use
- ▶ If contemplating IPT, get started early
 - Each model run takes nearly a week on 5 12-core workstations. Analysis takes many runs.

Baton Rouge Trades

- ▶ Since Baton Rouge is in attainment, trading is conducted under state rule
 - State seems to want to follow EPA approach
 - EPA does not explicitly approve trade, but EPA does comment on the permit so consult with EPA.

Risks for Inter-pollutant trade

- ▶ Requests must be submitted before permit comment period so analysis can go through comment
- ▶ Requests take time for approval (plan several months)
- ▶ Challenge filed on EPA rule
 - TCEQ rule part of an adopted SIP

Legal Challenge to IPT

- ▶ In March 2015 EPA took final action to add IPT to 2008 ozone standard implementation rule
 - Challenged due to lack of comments and that purported to be prohibited by Clean Air Act
- ▶ EPA reaffirmed IPT policy in 2015 ozone standard implementation rule published December 2018 including new guidance for technically defensible analyses
 - Challenge continues in July 2019 in D.C. Circuit
 - TCEQ is intervenor

D.C. Circuit Case 15-1465

Legal Challenge to IPT

▶ Challenge Schedule

- Respondents' Brief Nov. 1, 2019
- Intervenor for Respondents Brief Nov. 26, 2019
- Petitioners' Reply Brief Jan. 10, 2020
- Deferred Appendix Jan. 24, 2020
- Final Briefs Jan. 31, 2020