Vapor Recovery Emissions Reductions

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Topics of Discussion

- Refueling Emissions
  - Status Quo vs Non Stage II (MA DEP example)
- Storage Tank Emissions
  - IEE (Incompatibility Excess Emissions) for Status Quo
  - STBL (Storage Tank Breathing Losses) for MA DEP
- Enhancement of Status Quo and MA DEP
  - Processor on Combined Storage Tank Ullage
- Rhode Island Shared Savings Example

Refueling Emissions Assumptions
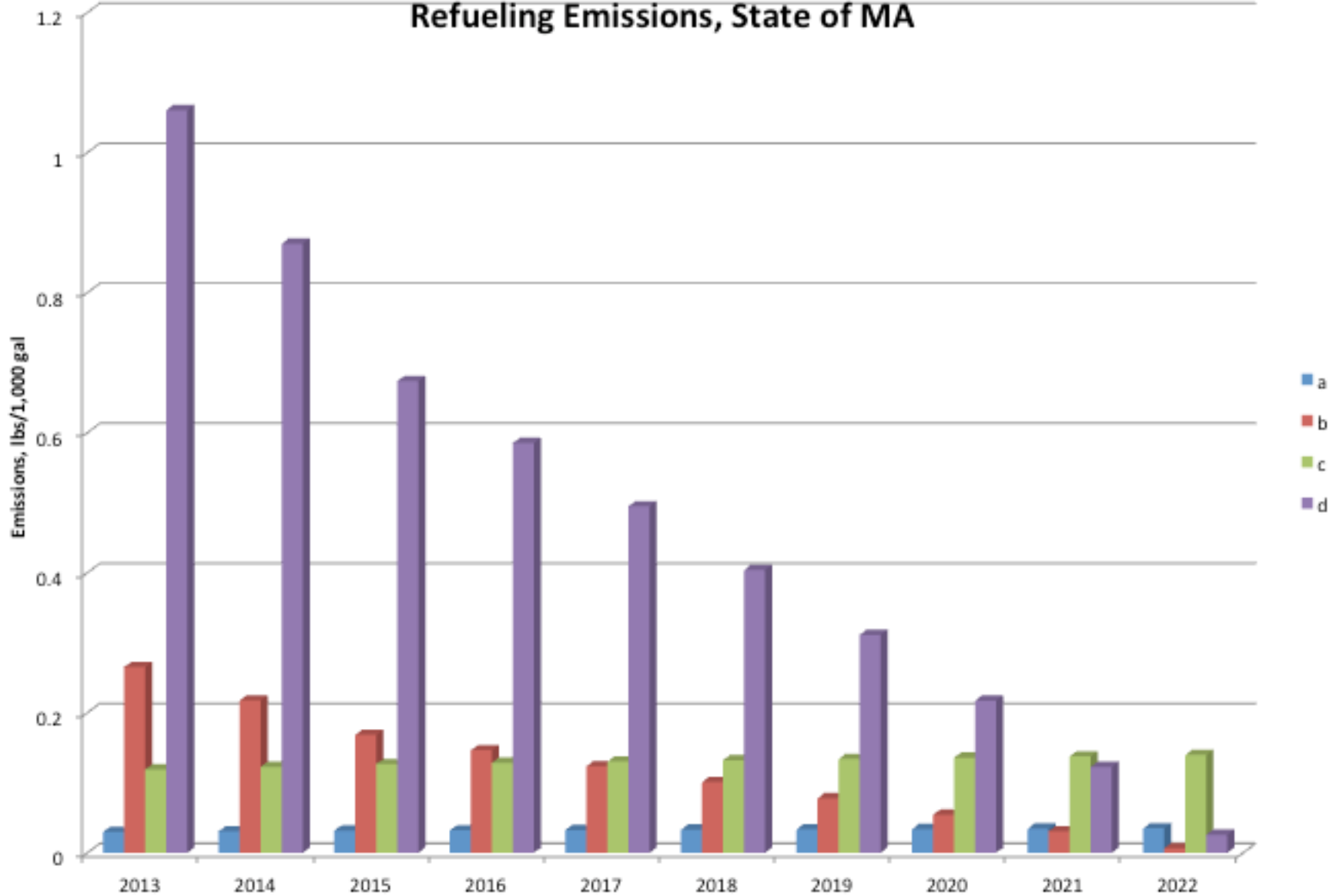
The MA DEP Study was used as an example

- Uncontrolled refueling emissions = 7.01 lbs/1000 gal
- ORVR Efficiency = 98%
- ORVR Penetration = 85% for 2013
- Stage 2 Efficiency = 75%
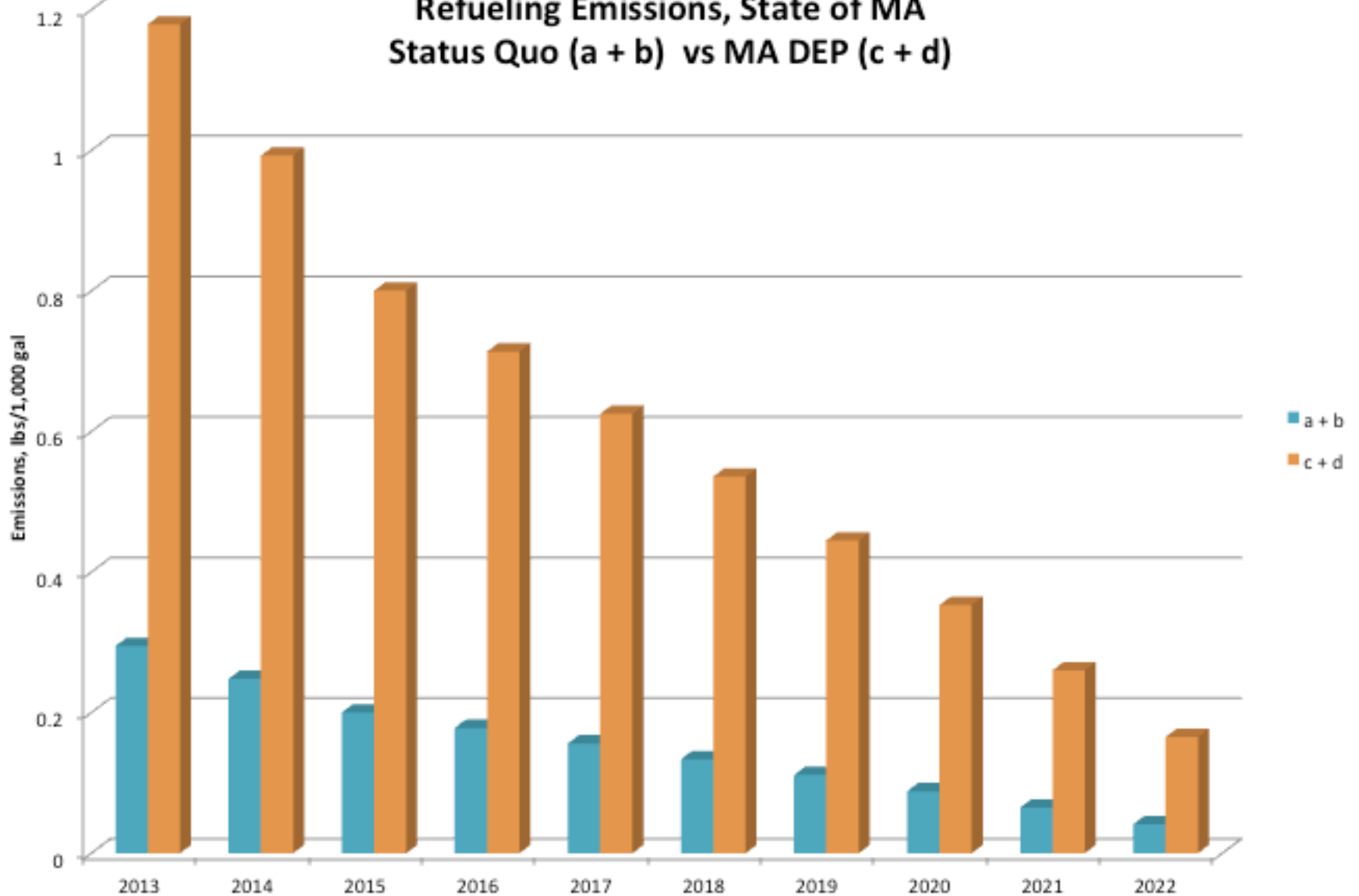
Refueling Emissions (lbs/1000 gal) 2013

	ORVR	No ORVR
Stage II	A 7.01 (0.85) (1- 0.98) (1- 0.75) 0.029	B 7.01 (1-0.85) (1-0.75) 0.263
No Stage II	C 7.01 (0.85) (1-0.98) 0.119	D 7.01 (1-0.85) 1.05

Refueling Emissions, State of MA

Refueling Emissions, State of MA
Status Quo (a + b) vs MA DEP (c + d)

Vent and Fugitive Emissions (lbs/1000 gal)

Assumptions

IEE = 0.86 lbs/1000gal at 100% ORVR penetration

STBL = 1.0 lbs/1000 gal

Non Road = 0.223 lbs/1000 gal

TOTAL EMISSIONS (lbs/1000 gal) 2013

|	Refueling	Vent + Fugitives	Non Road	TOTAL
STATUS QUO	0.268	1.126	0	1.39
MASS DEP	1.169	1.0	0.223	2.39

Misconceptions About Non Stage II

- Most Stakeholders believe that Storage Tank is under vacuum 100% of the time
- This assumption leads to view of no Storage Tank Emissions in absence of Stage II
- Reality shows this is not the case, air ingested during busy pumping periods will attempt to re-saturate the vapor space; evaporation of liquid gasoline to vapor phase will increase pressure and lead to vent and fugitive emissions
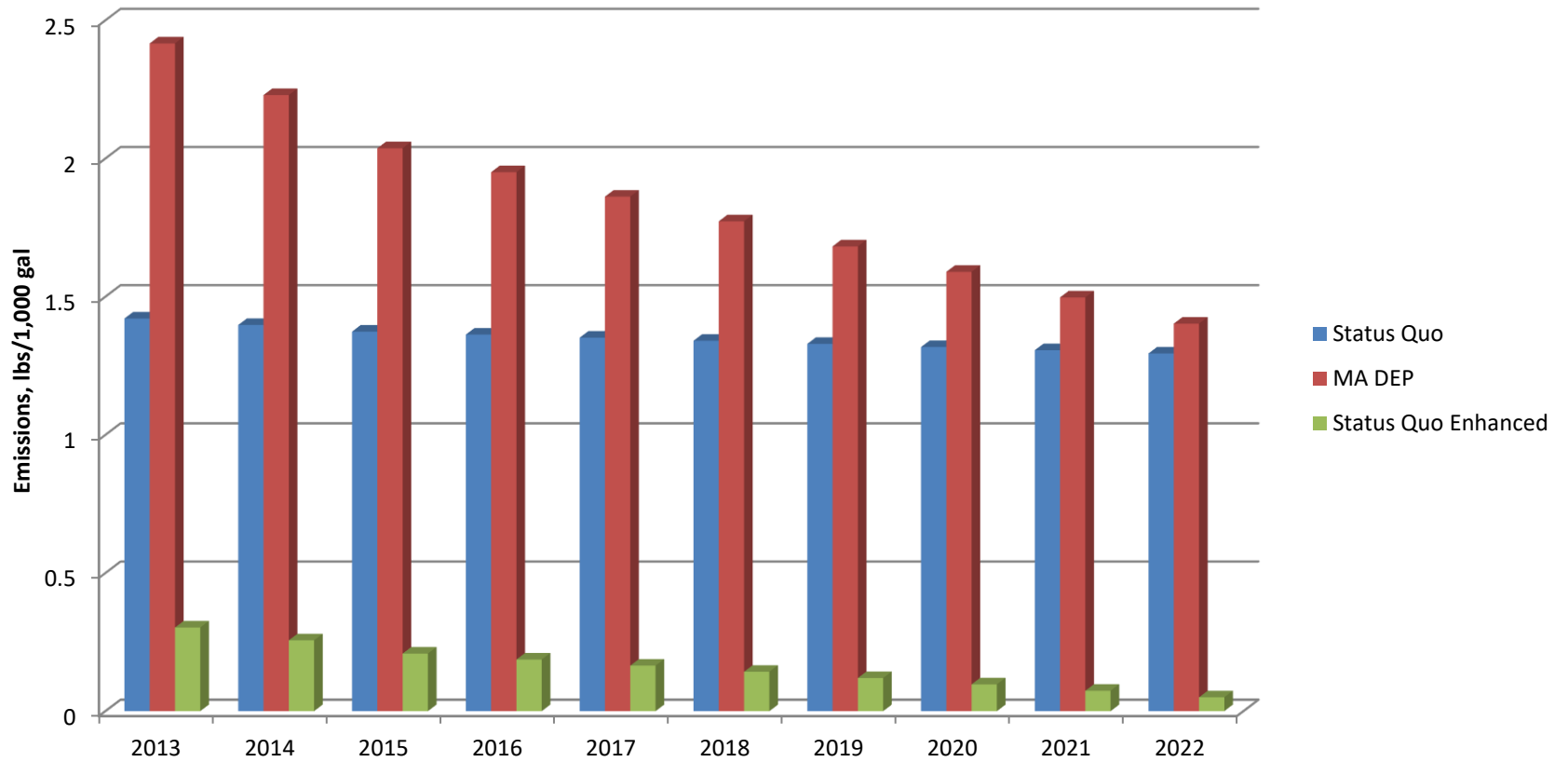- This scenario repeats on a daily cycle

Non-Stage II Site Pressure Profile
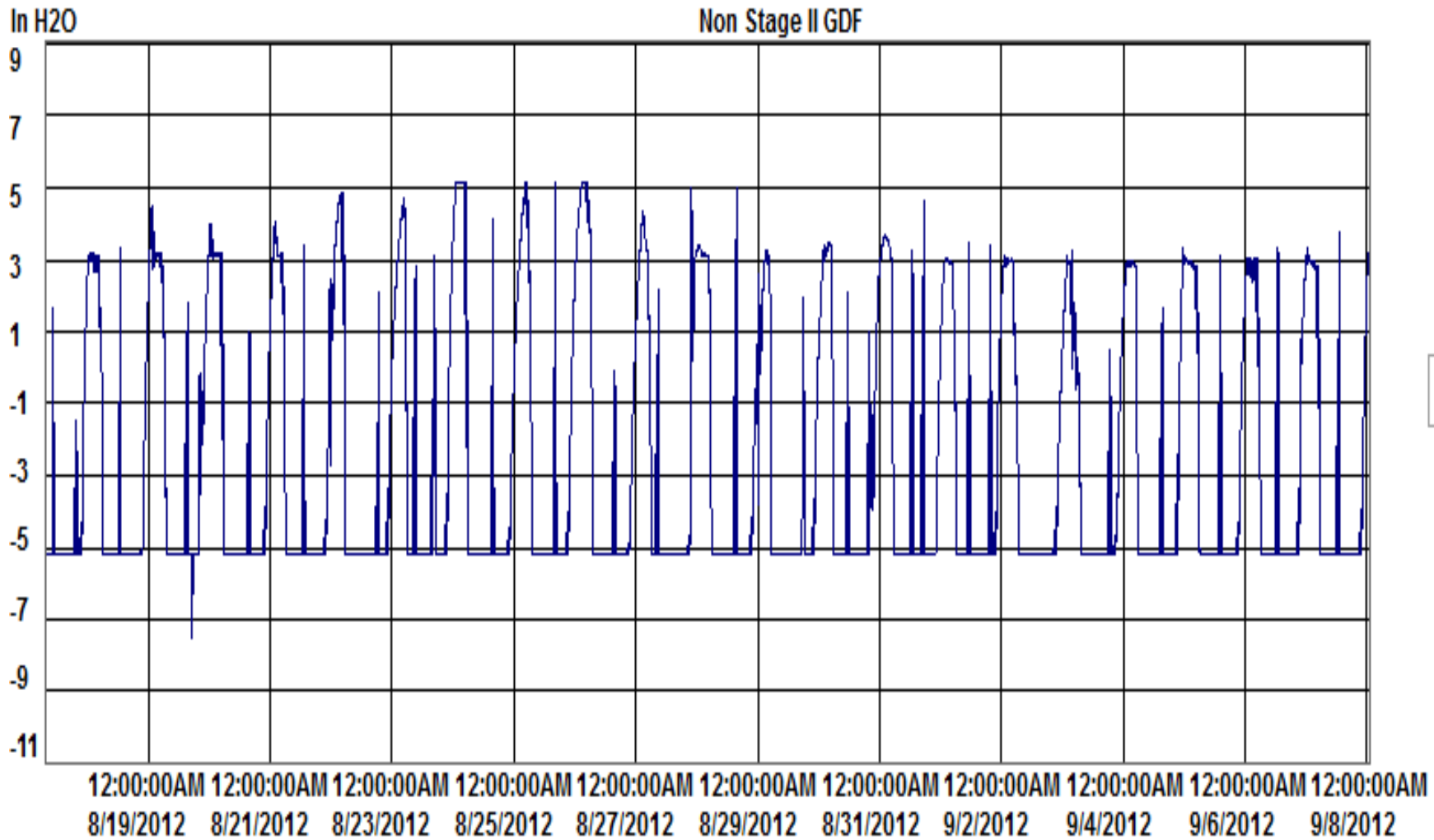
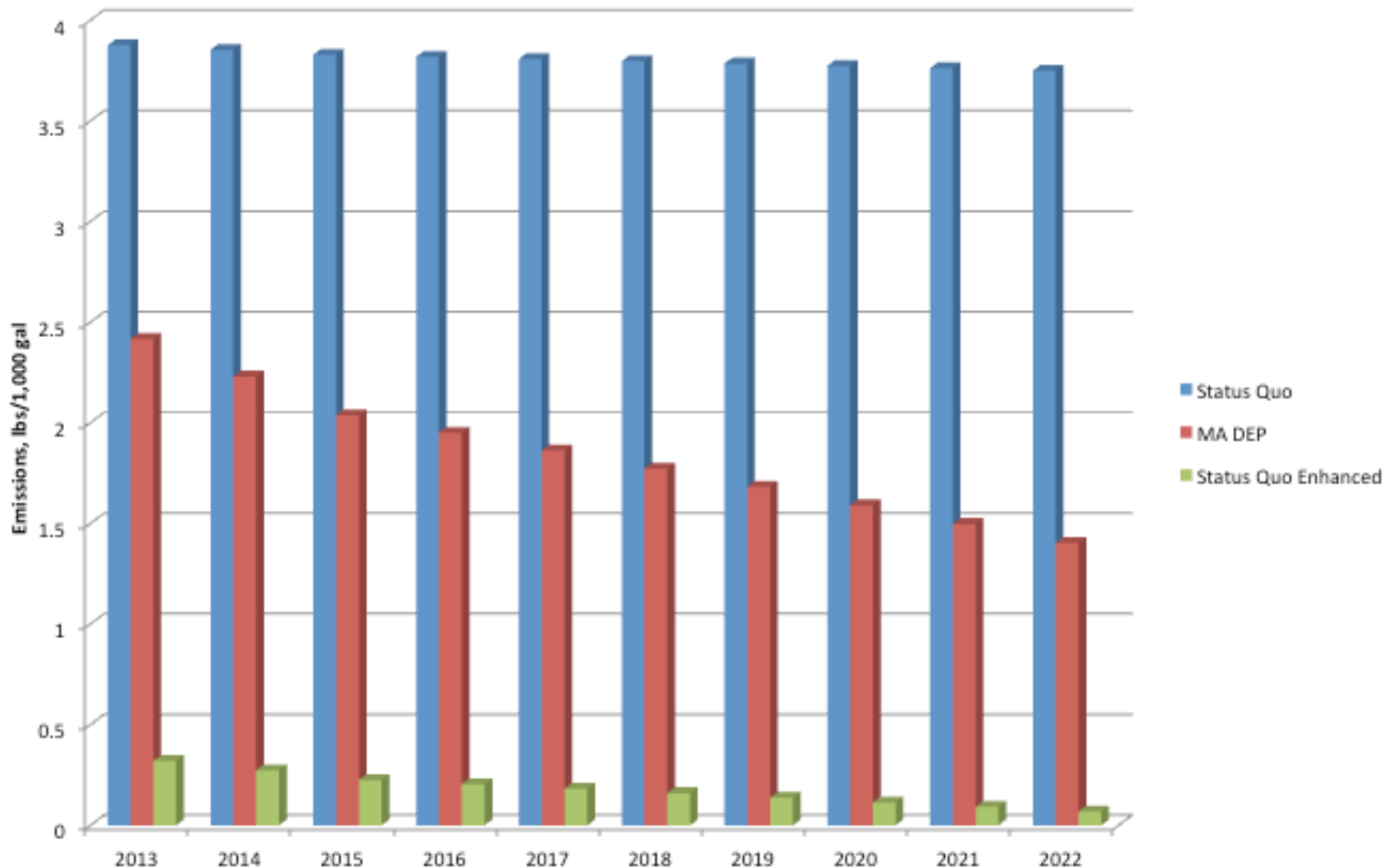# Non-Stage II Site Pressure Profile
Expanded Scale
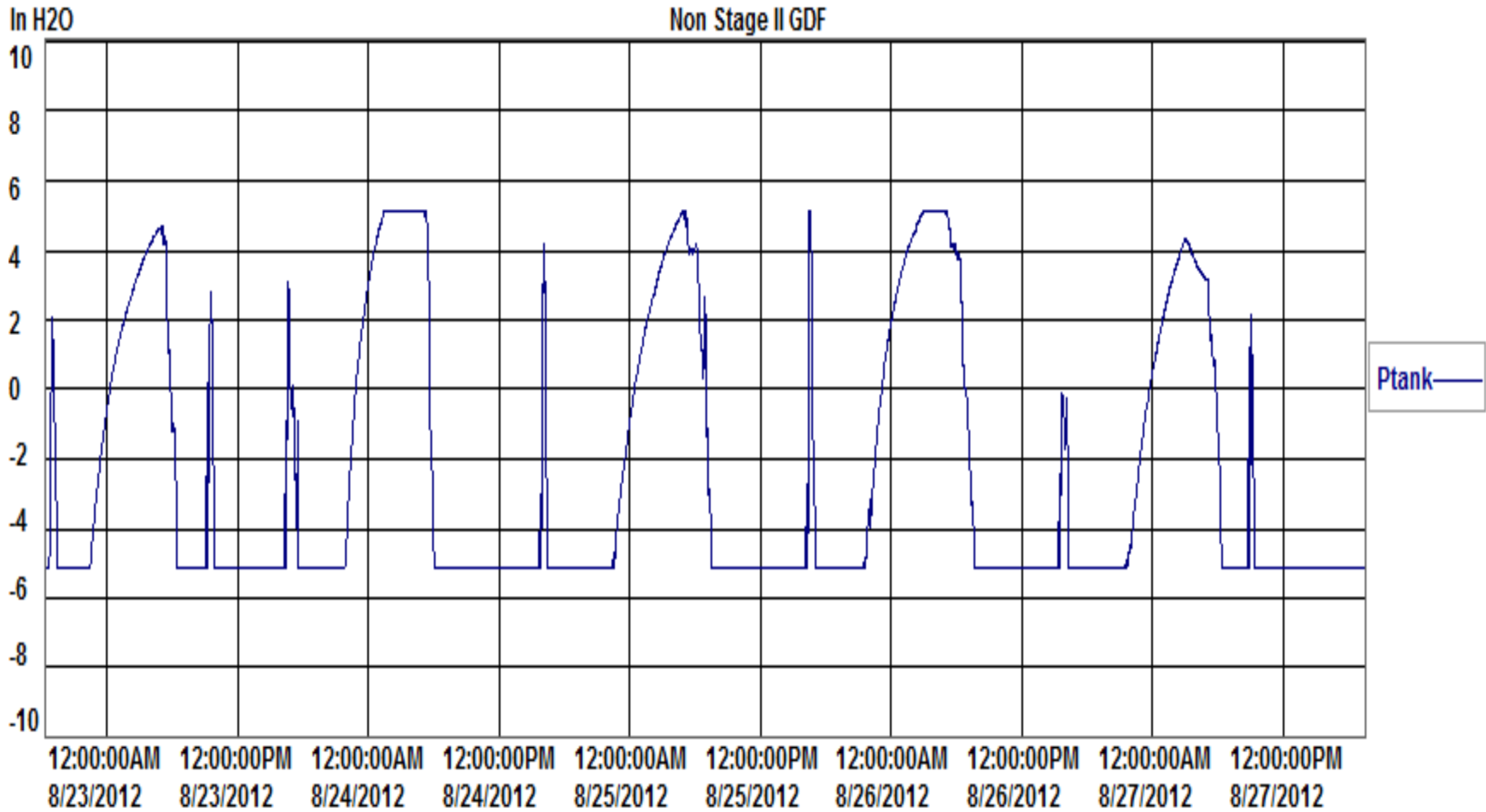
Refueling + Tank Emissions, State of MA

Realistic IEE, 2013 =3.58 lbs/1000gal

Refueling + Tank Emissions, State of MA

Legend:
- Status Quo
- MA DEP
- Status Quo Enhanced

Y-axis: Emissions, lbs/1,000 gal

X-axis: 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022

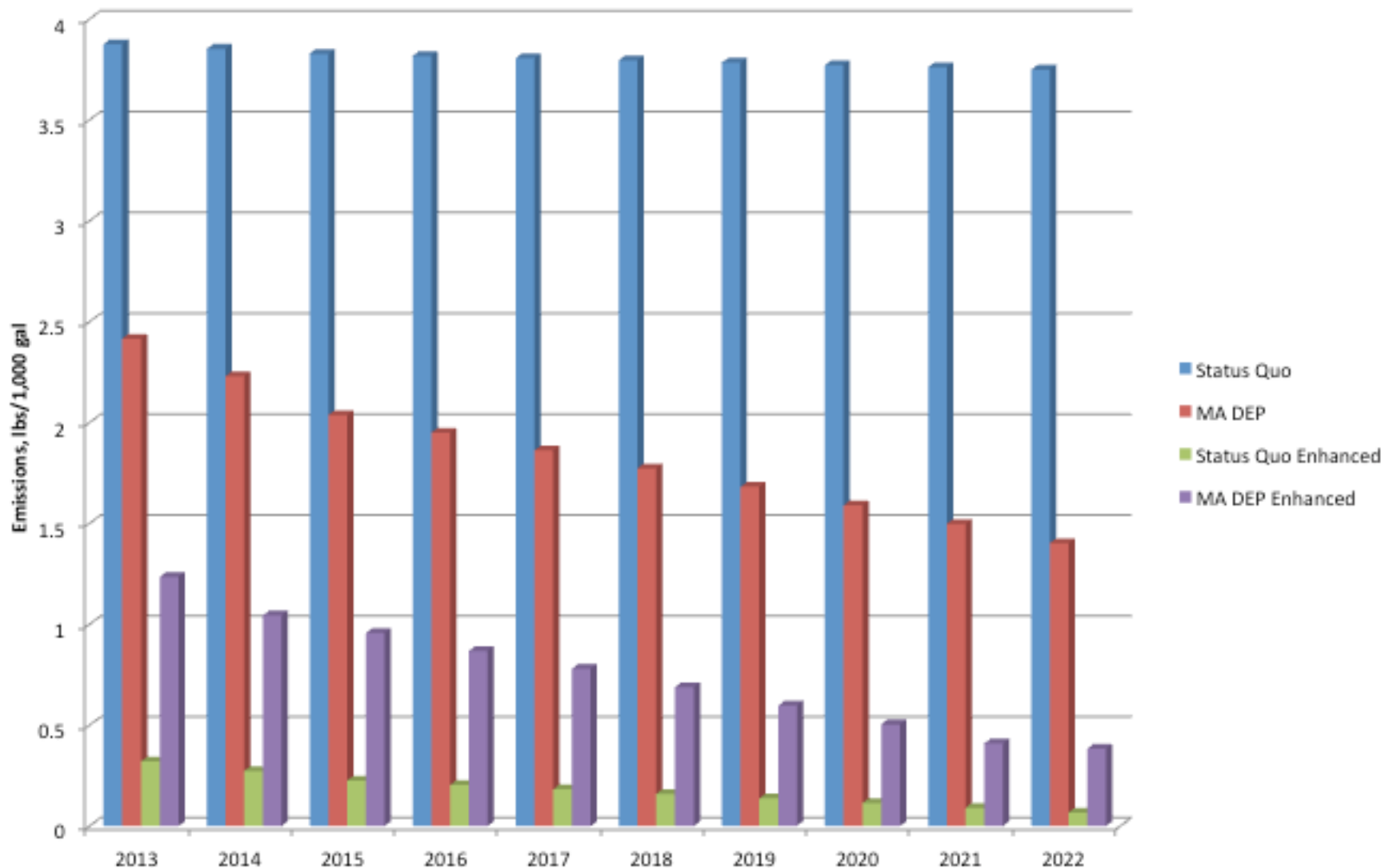Realistic IEE, 2013 =3.58

Refueling + Tank Emissions, State of MA

Realistic IEE, 2013 =3.58

Refueling + Tank Emissions, State of MA, Cumulative

Legend:
- Status Quo Cumulative
- MA DEP Cumulative
- Status Quo Enhanced Cumulative
- MA DEP Enhanced
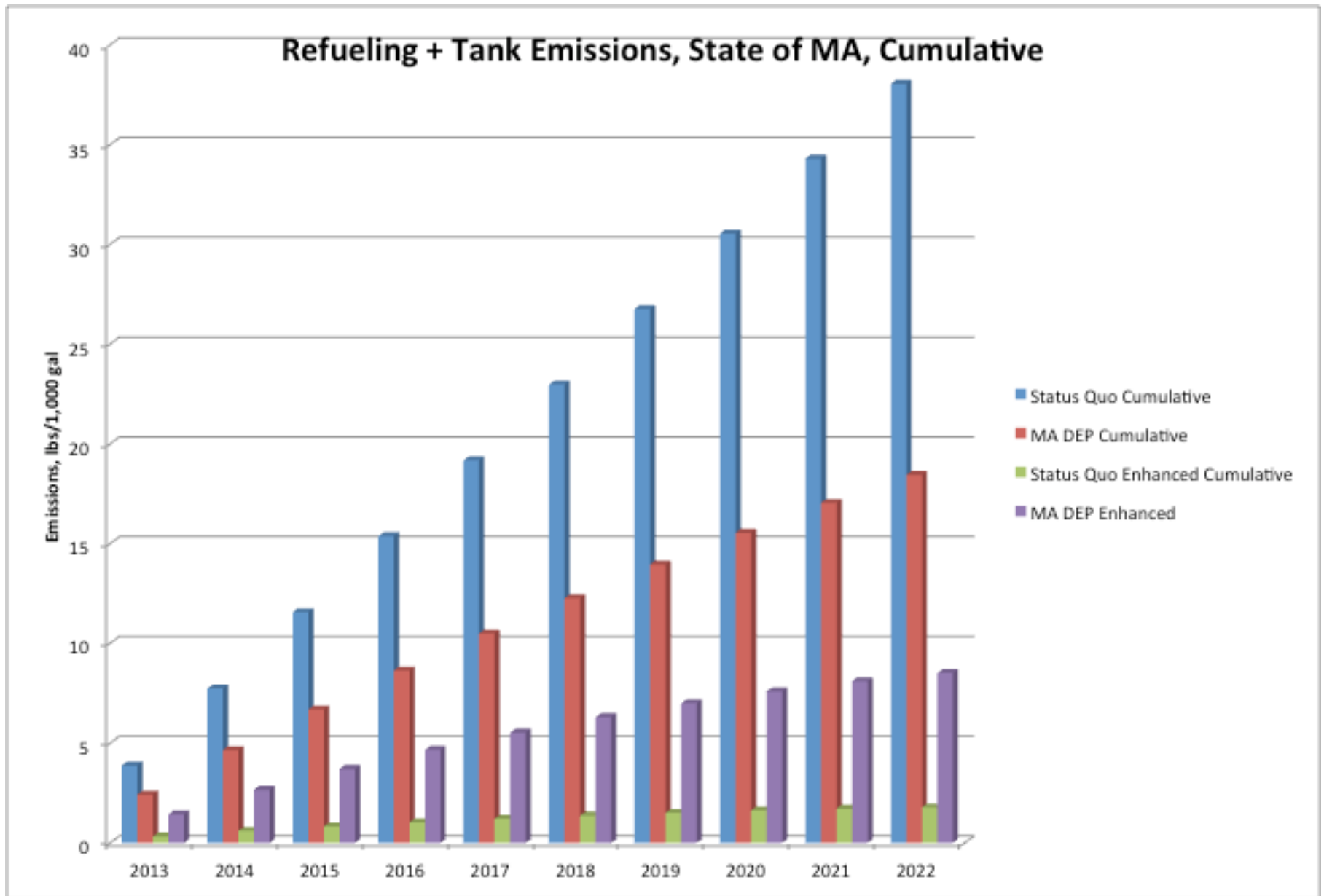
GDF in Austin Texas

Stage II not required in Austin

Customer proactively installed Stage II and ARID Processor

To maximize fuel savings and reduce emissions

Why a Processor?

- Actively Controls Pressure
- Eliminates almost all Vent and Fugitive Emissions
- Reports Anomalies Immediately (vapor leakage)
- Returns Saleable Product to the storage tank
- Cost neutral (or cash flow positive) to GDF using shared savings program

Energy, Emissions & Fuel Savings Example

**Rhode Island, GDF Throughput Data Supplied by Barbara Morin
For 70% of RI throughput**

- Net Energy Savings = 15,592,072,799 Btu/yr   (16 Billion Btu/yr)
- Tons/yr of emissions Reduced = 353.12
- Gallons/yr of saved fuel = 141,250
- No Net Cost
  - Under a Shared Savings Program, the GDF owner/operator generates positive cash flow and pays nothing for the processor
- Where else can the above savings be generated for a positive cash flow !
- This technology is a game changer !