

2022 Regulatory Emissions Modeling Platform Quarterly Update

National Emissions Collaborative

November 6, 2024



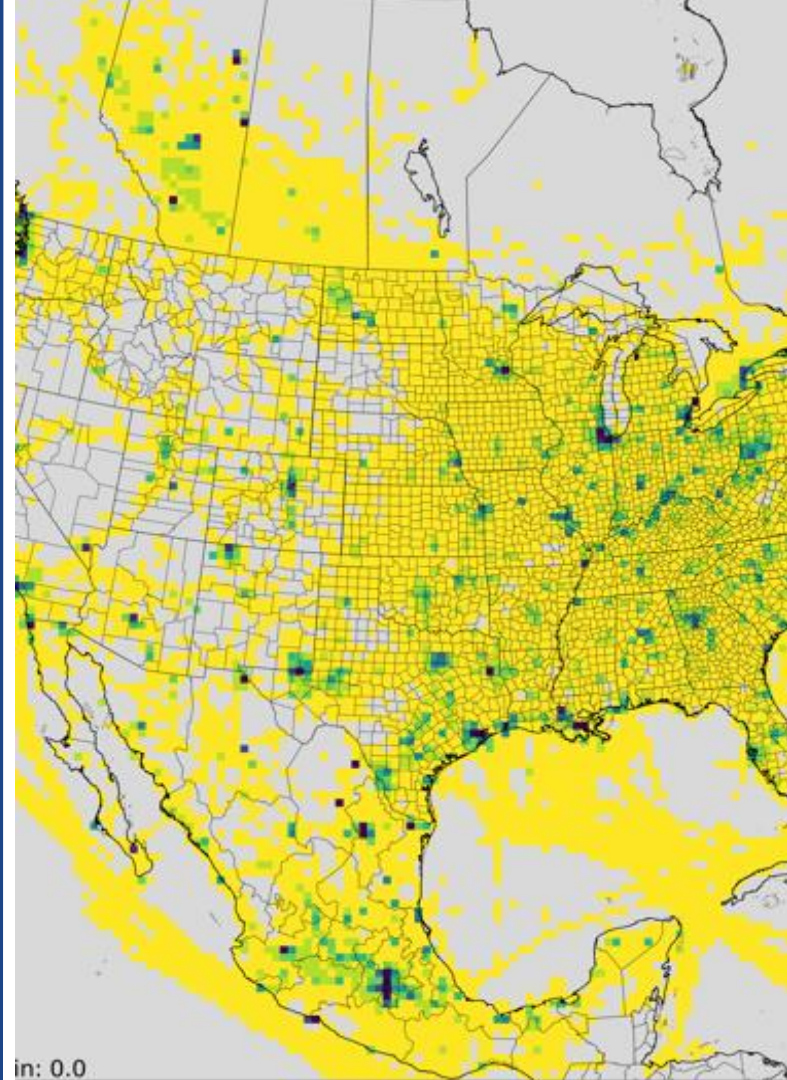
Agenda

- Summary of activities and accomplishments to date
- Communication support update
- 2022v1 draft analytic year platform release
- Draft analytic year emissions summary
- Analytic year data review update
- Schedule reminders
- Next steps



Summary of Activities and Accomplishments

- 2022v1 base year emissions
 - Public data review
 - Modeling platform package release
 - Model-ready emissions are available for 36km and 12km grids
- 2022v1 analytic year emissions
 - The 2022v1 platform includes emissions inventories for 2026, 2032, and 2038
 - EPA and Collaborative members developed approaches for projecting emissions
 - Draft analytic year inventories released
 - Public data review through 11/7



2022 EMP Collaborative

- Co-leads
 - Zac Adelman (LADCO), Mary Uhl (WESTAR), and Jeff Vukovich (EPA OAQPS)*
- Communication support
 - Rhonda Payne (WESTAR/WRAP), Tom Richardson (OK DEQ), Tom Moore (Denver/NFR RAQC)
- Coordination Committee
 - 28 members from MJOs, state agencies, and US EPA staff from OAQPS, OTAQ, and CAMD
 - Monthly calls
 - Quarterly outreach webinars
- Workgroups
 - Leverage existing national emissions workgroups
 - Some 2022-specific workgroups have been created, e.g., fires and projection

*Acting lead for Alison Eyth through Jan 2025



Communication Support Update

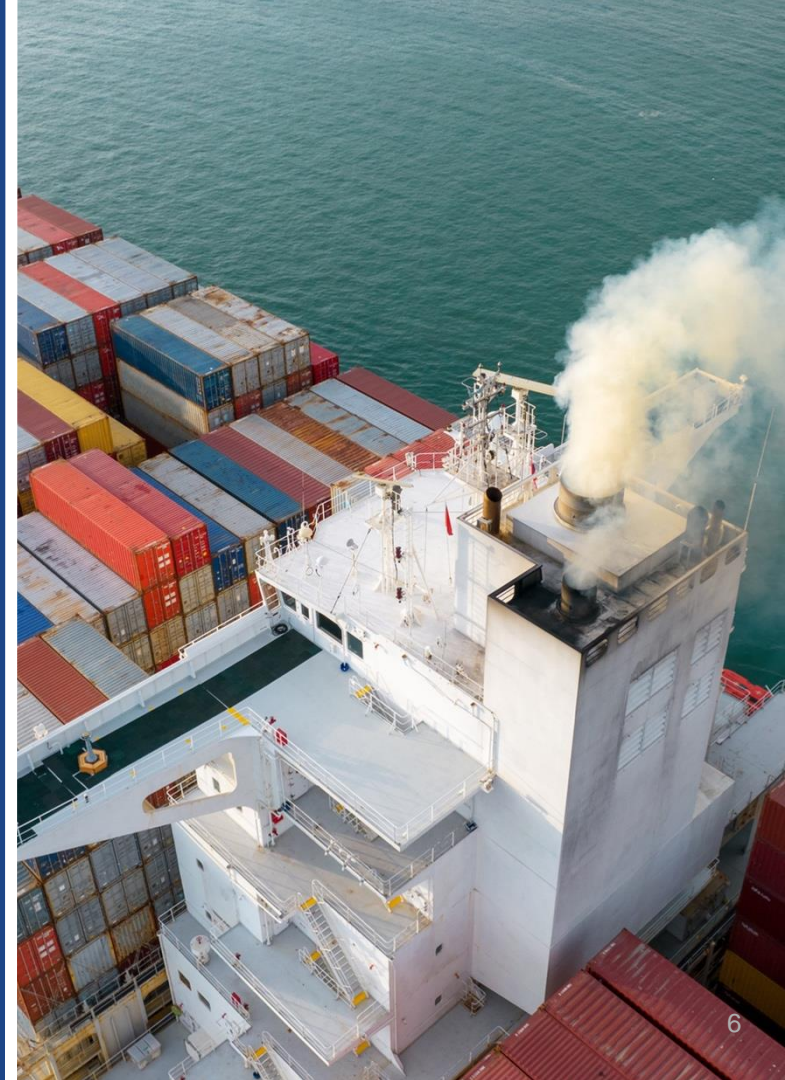


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2022 EMP Communications Plan

Goals of Outreach – v1 completion, moving toward v2!

- Target national and regional groups, continuing to encourage engagement
- Support EMP as communication facilitators and advocates
- Emphasize the need for involvement in EMP data decisions



2022 v1 Communications Outreach

Comms team advocates for training & assistance for SLTs

Training and Information Sharing

Sector Work Groups and Task Forces

Comms team helps information exchange between SLTs & EPA

Comms team gather information shared by co-leads

Soliciting Feedback from SLTs

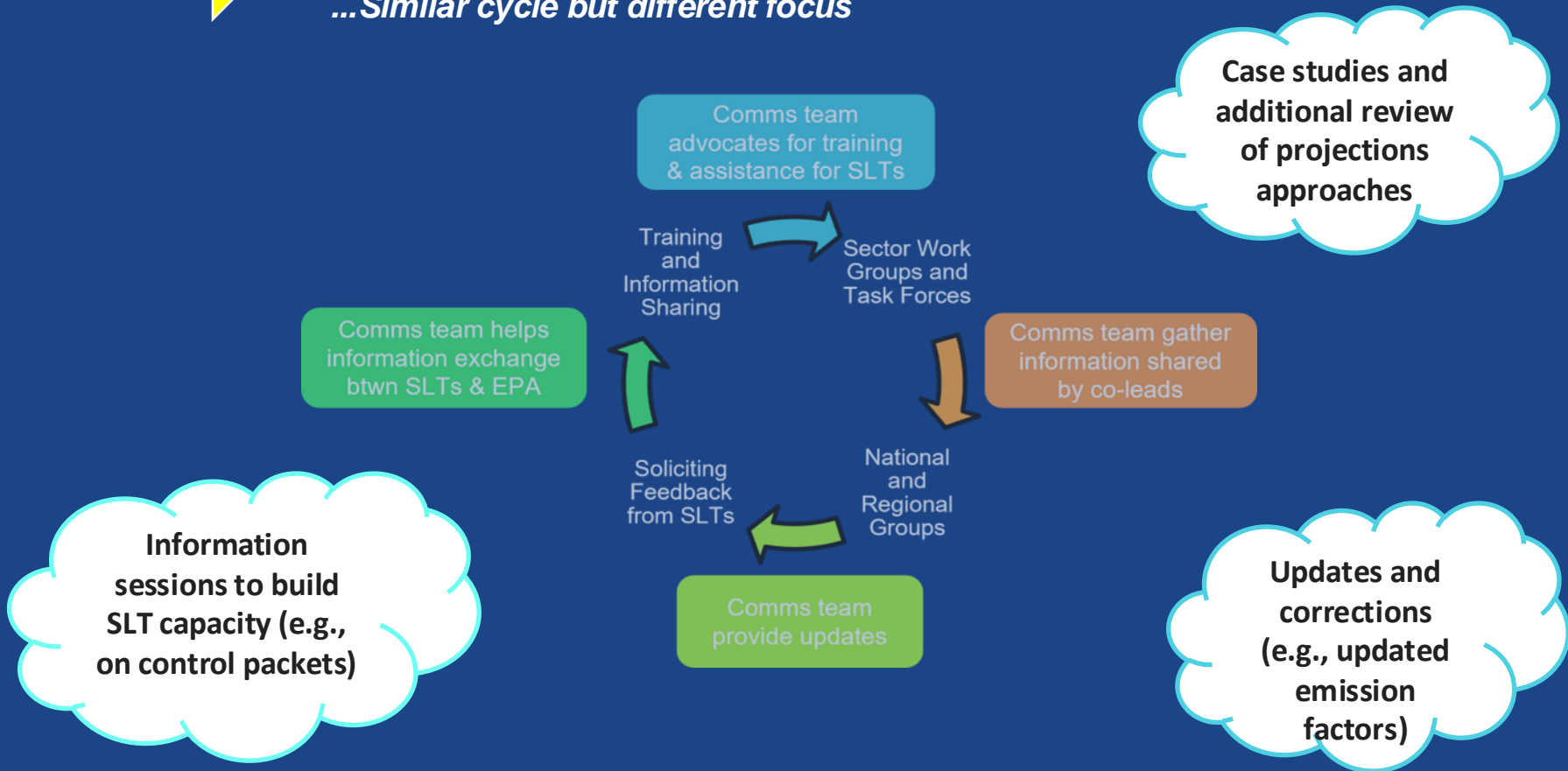
National and Regional Groups

Comms team provide updates

What's new for
Version 2?

2022 v2 Communications Outreach

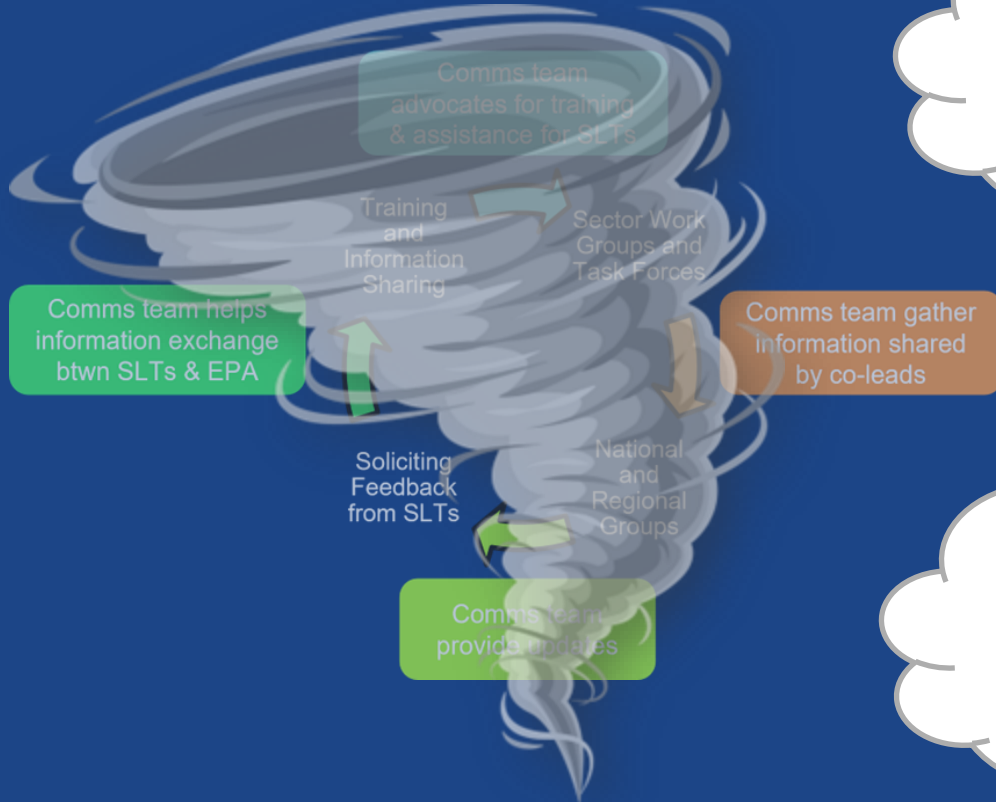
...Similar cycle but different focus



What's next?

2022 Post-v2 Communications Outreach

...Again, similar, but different!



Stepping back and thinking about the big picture. What questions did we ask but didn't have time to answer?

Recognize interconnectedness between sectors

Step outside the usual path: What needs to change? How can the process evolve to address new challenges?

Communications Outreach Plans for the Next Quarter

Review updates and corrections:

- Comms team to share sector-specific corrections made to emission factors, updated projections approaches, and changes informed by modeling work.
- Goal: facilitate communication across sectors.

SLT Retrospective Analysis and Review of v1 Analytic Year Emissions:

- Comms team encourage SLT analysis of final Analytic Year data.
- Solicit and track feedback on the process and recommendations for improvements for v2.

SLT Participation in Case Studies (Not All Sectors):

- To improve Version 2, what alternative approaches should we consider (e.g., basin trend forecasts for Oil and Gas growth projections, different data sources to inform emission unit turnover (retirement) rates, etc.) ?
- Share information and status of on-going work.

2022v1 Emissions Modeling Platform Analytic Year Emissions



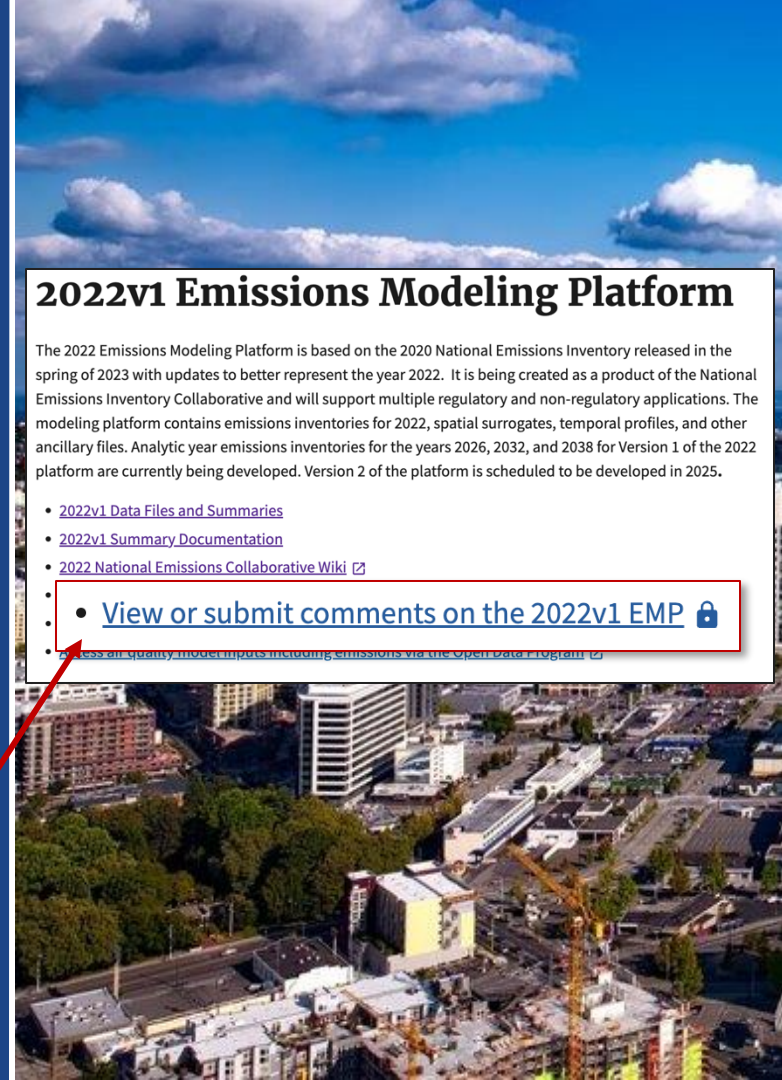
Activities Since August Webinar

- Various projection workgroups assisted in projection methodology development for numerous emissions sectors
- Draft analytic year emissions released and additional summary reports
- Comment period for analytic year emissions is Oct 7 – Nov 7
- Uploaded data to the [2022 platform AWS site](#)
 - 12US1 & 36US3 model-ready CMAQ emissions
 - 12US2 model-ready CAMx emissions
 - MCIP, WRF, and wrfcamx outputs; boundary conditions, and CAMx ancillary inputs
- Base year 2022v1 air quality model runs



Draft Analytic Year Data Release

- Summary reports and gridded plots have been posted to the 2022v1 web page
 - <https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform>
- Data Retrieval Tool includes emissions for 2022v1 base year and draft emissions for analytic years (2026, 2032 and 2038)
- Summary documentation has been updated that includes analytic year emissions information
- Review period ends Nov 7, 2024
- Submit comments on the platform **here**



2022v1 Emissions Modeling Platform

The 2022 Emissions Modeling Platform is based on the 2020 National Emissions Inventory released in the spring of 2023 with updates to better represent the year 2022. It is being created as a product of the National Emissions Inventory Collaborative and will support multiple regulatory and non-regulatory applications. The modeling platform contains emissions inventories for 2022, spatial surrogates, temporal profiles, and other ancillary files. Analytic year emissions inventories for the years 2026, 2032, and 2038 for Version 1 of the 2022 platform are currently being developed. Version 2 of the platform is scheduled to be developed in 2025.

- [2022v1 Data Files and Summaries](#)
- [2022v1 Summary Documentation](#)
- [2022 National Emissions Collaborative Wiki](#) 

- [View or submit comments on the 2022v1 EMP](#) 

- [Access air quality model outputs including emissions via the Open Data Platform](#) 

Typical Ways to Perform Projections to Analytic Years

- Apply factors that represent changes in activity between years
 - Factors can be derived from Annual Energy Outlook (AEO), other economic data, human population projections, etc.
- Apply factors to reflect controls or technology changes between years
- Apply any closures to facilities or units
- Run a model with updated inputs for the analytic year (e.g., IPM or ERTAC EGU, MOVES for onroad and nonroad)

Basic Emissions Projection Method

Base Year Emissions x
Activity Change Factor x
Control Factor(s)

2022 EIC Projections Workgroup

- 2022v1 work focused on understanding recent US EPA and MJO/state methods and data to project activity
- Identify alternative methods and data for projections
- Workgroup goal: make recommendations to U.S. EPA about data sources or methodology changes for projecting emissions in each version of the 2022 platform
- Emissions Collaborative facilitated the collection of state control program, facility retirement, and consent decrees

Projection Task Forces

- Electricity Generating Units
- Industrial Point
- Nonpoint
- Onroad/Nonroad
- Marine/Airports/Rail
- Oil & Gas

Electric Generating Unit Projections

- EPA developed a 2026 inventory using an engineering analytics approach
 - Uses 2023 NOx and SO2 emissions
 - Incorporates known changes from the January 2024 [National Electric Energy Data System \(NEEDS\)](#)
 - PM, VOC, NH3, CO emission factors are linked to 2022 level and U.S. Energy Information Administration (EIA) forms 860 and 923
 - No additional Good Neighbor Plan changes are reflected in 2026 – in 2023 all but two states are in compliance (and those two states are under assurance levels)
- EPA ran the [Integrated Planning Model](#) (IPM) 2023 to develop EGU emissions for 2032 and 2038
- The ERTAC EGU group is also preparing analytic year emissions for EGUs

Questions?

Contact Serpil Kayin
(kayin.serpil@epa.gov)

US EPA Rules with Controls: EGU Point

- EPA's 2032 and 2038 EGU emissions projections uses [EPA's 2023 Reference Case](#) with additional updates:
 - Reflecting IRA provisions, Final GNP (impact is minor in 2032 and beyond), Final OTAQ GHG Vehicle Rules, Final MATS RTR, Final [Greenhouse Gas Standards and Guidelines for Fossil Fuel-Fired Power Plants](#), Final ELG/CCR,
 - Standard IPM outputs are for 2028, 2030, 2035, 2040, 2045, 2050. A specific IPM run was conducted reflecting known retirements for analytic years 2032 and 2038.
 - Emissions factors for post processing (PM, VOC, NH₃, CO) are calculated using NEI 2022 and EIA 860/923 generation data (same as 2026 post-processing).
- IPM is a linear programming model that accounts for variables and information such as energy demand, planned unit retirements, and planned rules to forecast unit-level energy production and configurations.

US EPA Rules with Controls: EGU Point

- Some of the key parameters used in the IPM run are:
 - Demand: AEO 2023 non-EV demand + on-the-books OTAQ GHG LMDV and HDV Rules
 - Gas and Coal Market assumptions: Gas market assumptions as of end of 2021 (with LNG export assumptions from AEO 2023) and coal market assumptions as of end of 2021 with adjustments for historic consumption
 - Cost and performance of fossil generation technologies: AEO 2023
 - Cost and performance of renewable energy generation technologies: NREL ATB 2023 (mid-case)
 - Fleet: NEEDS rev 06-06-2024 (xlsx)
 - EPA's 2023 Reference case using IPM reflects current and existing state regulations, Renewable Portfolio Standards and Clean Energy Standards as of end of 2023.

ERTAC EGU Projections – v22.0

- Approach: conservative generation & emissions projections appropriate for state air quality planning from hourly base year data and state-supplied information
- Analytic years 2026, 2032, 2038
- Annual growth rates by region – AEO 2023 HOG
- Peak growth rates by region – NERC 2023
- Draft results outreaches October 29 & 31
 - Comments due November 29
- Final ERTAC EGU runs will reflect state feedback on shutdowns, controls, emission rates, etc.
 - Final runs target: January 2025

Questions? Access to
outreach materials?

Contact Susan McCusker
(smccusker@marama.org)

Industrial Point Projections

- The goal of the task force was to recommend to EPA methods for projecting industrial point source emissions from 2022 to 2026, 2032, and 2038
 - These methods would be used as the national default approach for these sources
- Reviewed past projection methods and data from EPA, MARAMA, New Jersey, and North Carolina
- The task force sought a method that used industry-specific, regional-scale (rather than national) information to inform the projections
- Reached consensus in the task force to use a method developed by NC DAQ

Questions?

See the [Industrial Point projections wiki page](#) for more information

Contact Zac Adelman
(adelman@ladco.org)

Industrial Point Projections

- Fuel Use Categories (combustion and storage)
 - National energy consumption and value of shipments (revenue) from the U.S. Annual Energy Outlook (AEO) combined with regional revenue from AEO
 - Mapping from AEO tables to inventory sources using NAICS and SCC codes, where applicable
- Non-Fuel Use Industrial Categories
 - Regional-scale employment and revenue projections from the U.S. Energy Information Administration (EIA)
- Projection Limits
 - Cap annual change at +/- 2% per year
 - Equates to a max growth (+/-) of 8% (2026), 22% (2032), and 37% (2038)

Details

[2022v1 Industrial Point Projections Recommendations](#)

Submitted Control Data Summary

- 18 organizations submitted closure and control data by the July 19 deadline
 - Allegheny, DE, GA, HI, IA, IL, MT, NC, ND, NH, OK, SC, TN, TX, UT, VA, WA, WI
- The majority of information provided was for closures, with some control data
- EPA collated the data into packets to use with the Control Strategy Tool
- EPA pulled additional closures from the Emissions Inventory System (EIS)



US EPA Rules with Controls: Industrial Point

- Included in 2022v1

Table 4-7. Rules with CoST packets implemented

Rule	Pollutant Controlled	Compliance Date
HON (F, G, H, I)	VOC	2027
Natural Gas Turbines NSPS (KKKK)	NOx	2005 or newer
Organic Liquids Distribution (EEE) NESHAP	VOC	July 2023
Process Heaters NOx NSPS (DDDDD)	NOx	2013 or newer
RICE NSPS (IIII, JJJJ)	NOx, CO, VOC (PA only)	2006 or newer
Taconite (RRRRR) NESHAP	PM	2027
Gasoline Distribution	VOC	2027
Oil & Gas NSPS	VOC	Various

Onroad Mobile Projections

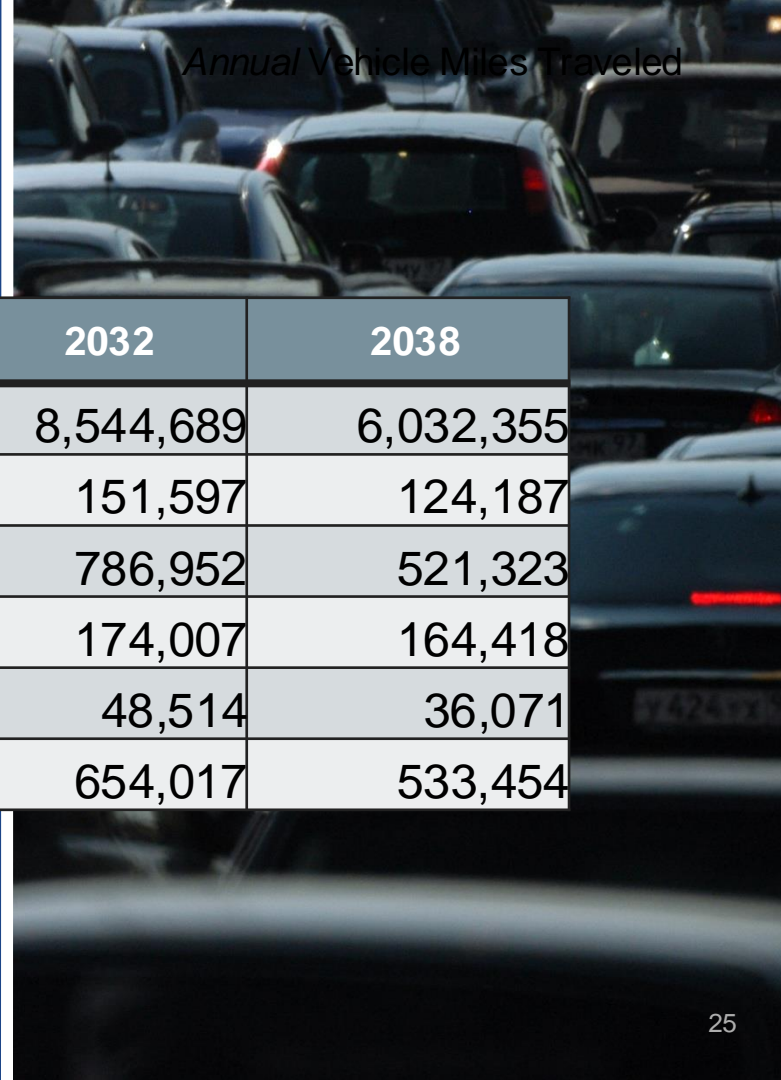
- EPA ran MOVES4 for 2026, 2032, and 2038 to compute emission factors for each year.
- EPA projected VMT to analytic years using AEO 2023-based factors.
- Some states submitted analytic year VMT: NC, NJ, NY, and WI.
- OTAQ developed state and SCC-specific adjustment factors to reflect the impacts of recent rules (California's Advanced Clean Trucks (ACT) and EPA's HD Phase 3 rules (and also LMDV2027 for Class 2b3s)) on analytic year emissions.
- Emissions for 2026, 2032, and 2038 have been developed.

Questions?

See the [onroad/nonroad task force wiki page](#) for more information

Contact Janice Godfrey
(godfrey.janice@epa.gov)

2022v1 National Onroad Emissions by Year (tons/yr)



Pollutant	2022	2026	2032	2038
CO	13,332,341	10,956,906	8,544,689	6,032,355
NH3	185,022	169,503	151,597	124,187
NOX	2,066,044	1,397,975	786,952	521,323
PM10-PRI	189,078	184,178	174,007	164,418
PM25-PRI	70,302	62,467	48,514	36,071
VOC	982,106	788,632	654,017	533,454

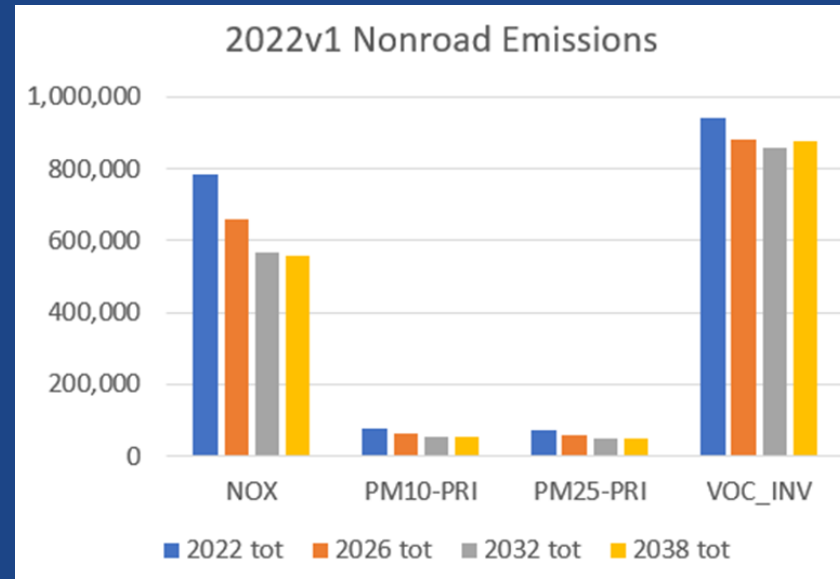
2022v1 National Nonroad Emissions by Year (tons/yr)

Pollutant	2022	2026	2032	2038
CO	11,318,035	11,609,181	12,181,994	12,847,929
NH3	2,045	2,108	2,205	2,333
NOX	782,958	659,710	568,587	559,512
PM10-PRI	77,113	64,409	54,961	52,776
PM25-PRI	72,309	60,087	50,963	48,811
SO2	933	956	1,004	1,077
VOC	942,748	880,137	859,264	876,434

Note that CO increases starting in 2032 but NOx and PM decrease through the years;

VOC increases slightly from 2032 and 2038; SO2 and NH3 increase but are very small

MOVES4 was run for all four years except for California



Commercial Marine Vessel Projections

- OTAQ developed projection factors **by ship type and region** based on the Freight Analysis Framework (FAF) v5
 - Regions: inland, Atlantic, Pacific, gulf, Alaska, Hawaii
 - Ship types: barge, offshore, bulk, fishing, container, ferry, general, government, roll on/roll off, misc., tanker, tour, tug, reefer, cruise, passenger
 - Only U.S. data were used to compute the factors
- Produced by the Bureau of Transportation Statistics (BTS) and supported by the Federal Highway Administration (FHWA)
- Data sources include:
 - Commodity Flow Survey (CFS)
 - Business Market Insights (BMI) database
 - Agricultural data
 - Extraction, utility, construction, service, and other sectors
- NOx scaling factors due to fleet turnover were also applied to C3 vessels

Questions?

See the [marine/air/rail task force wiki](#) for more information

Contact Janice Godfrey
(godfrey.janice@epa.gov)

2022v1 Commercial Marine Vessel Emissions by Year (tons/yr)

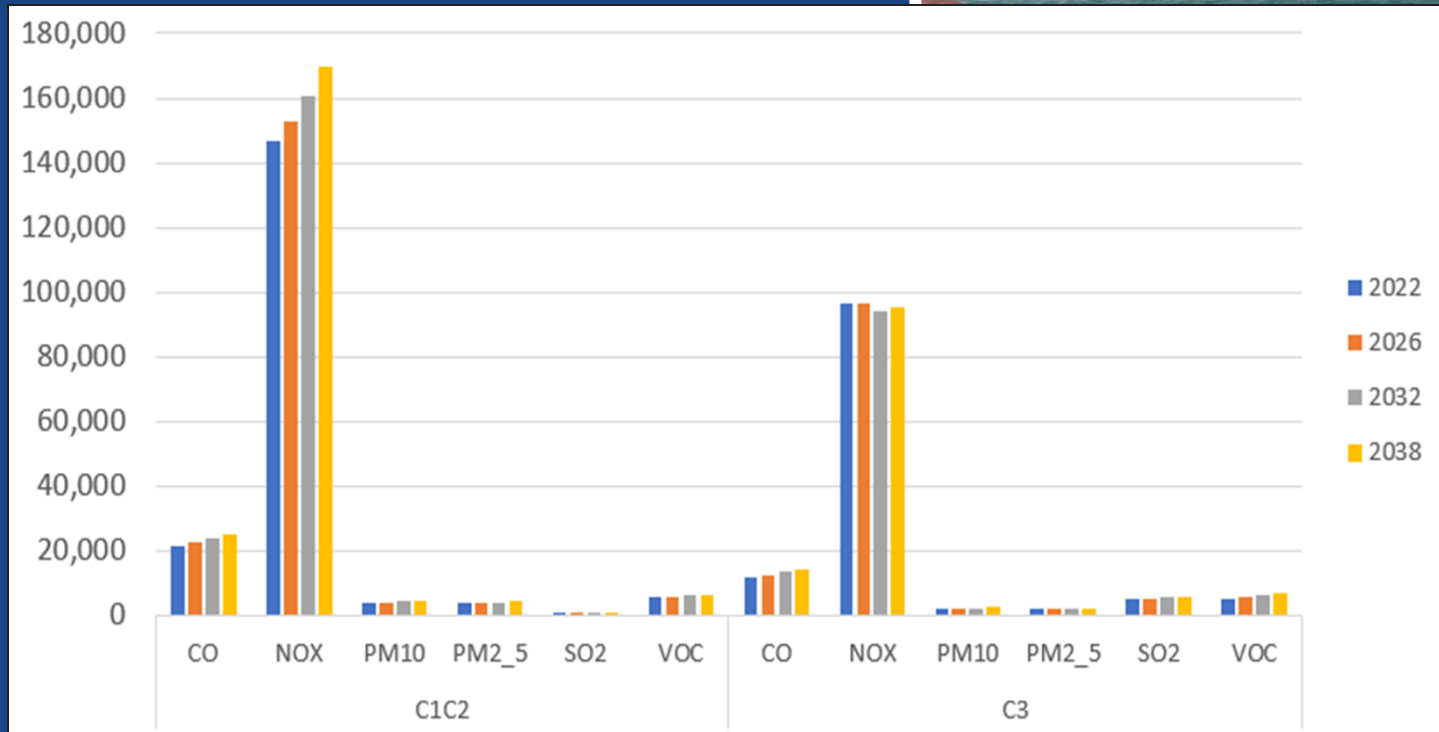
C1C2	2022	2026	2032	2038
CO	21,773	22,610	23,785	25,171
CO2	10,385,428	10,884,004	11,483,959	12,187,020
NH3	75	77	81	86
NOX	146,710	152,629	160,415	169,675
PM10	3,997	4,153	4,368	4,625
PM2_5	3,873	4,021	4,229	4,478
SO2	650	830	887	953
VOC	5,583	5,867	6,149	6,493

NOx and CO2 are the highest emissions from this sector

C3	2022	2026	2032	2038
CO	11,771	12,432	13,415	14,531
CO2	7,743,518	8,178,445	8,822,613	9,548,705
NH3	38	40	43	47
NOX	96,641	96,317	94,196	95,381
PM10	2,141	2,260	2,435	2,633
PM2_5	1,970	2,079	2,240	2,422
SO2	4,874	5,141	5,535	5,982
VOC	5,397	5,708	6,171	6,698

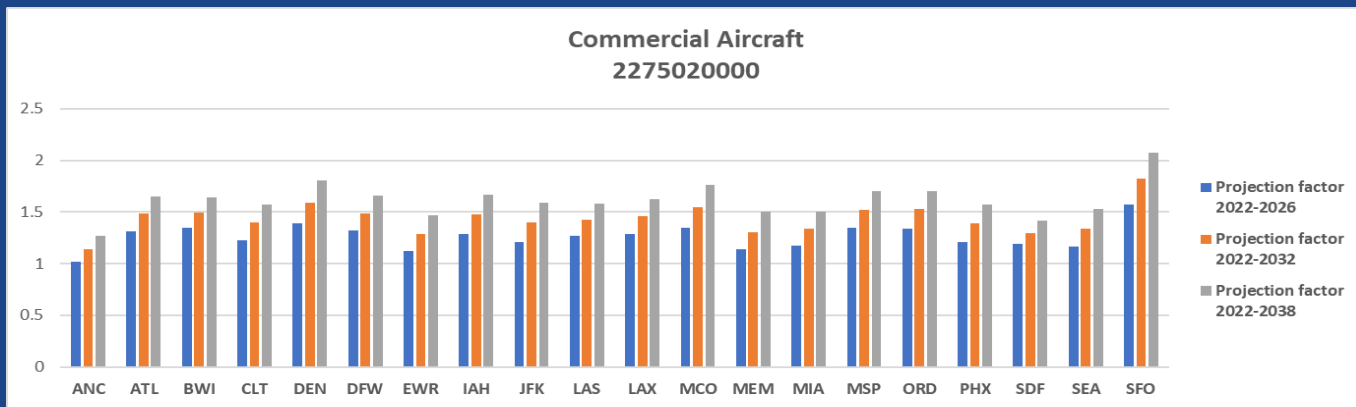
All pollutants are increasing in time except for C3 NOx, which drops in 2032

2022v1 Commercial Marine Vessel Emissions by Year (tons/yr)

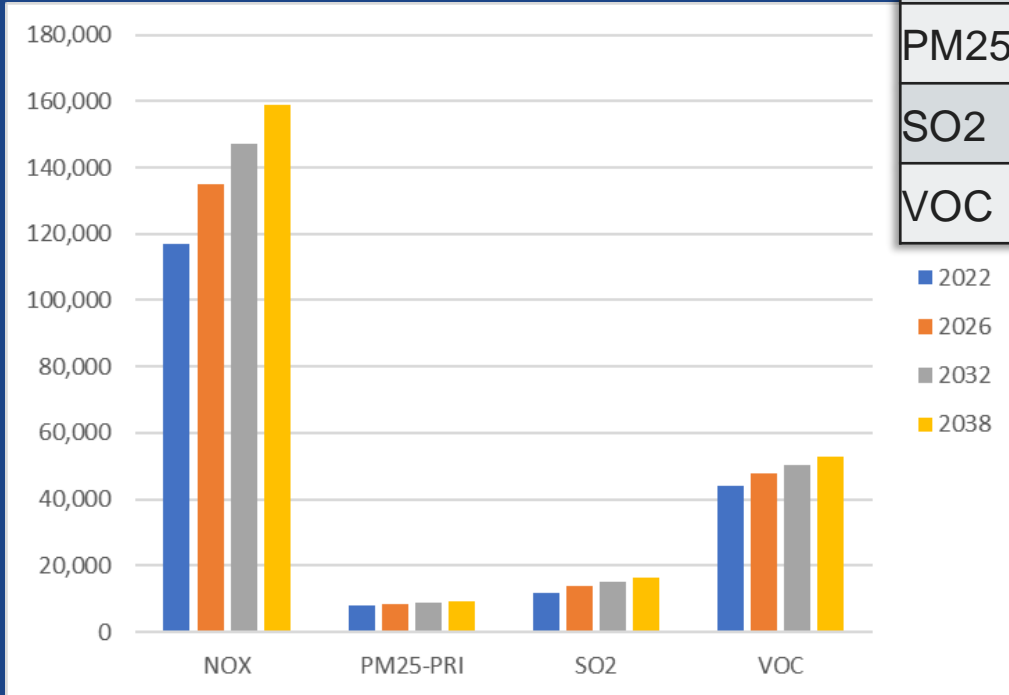


Aircraft Projections

- EPA used data from the most recent [Terminal Area Forecast \(TAF\)](#) released in January 2024 to compute projection factors from 2022 to each analytic year
 - Airport-specific factors computed for airports with specific data in the TAF and for each SCC
 - State average factors computed for each SCC to use for the other airports
 - A few states showed "spikes" on the order of 50% for state average factors. Where this happened, EPA manually adjusted the spike down to something more realistic
- Georgia provided analytic year emissions for Hartsfield-Jackson (ATL)



2022v1 Airport Emissions by Year (tons/yr)



Pollutant	2022	2026	2032	2038
NOX	116,884	135,130	146,915	158,649
PM25-PRI	8,077	8,554	8,856	9,150
SO2	11,956	13,768	14,965	16,157
VOC	43,850	47,811	50,242	52,632

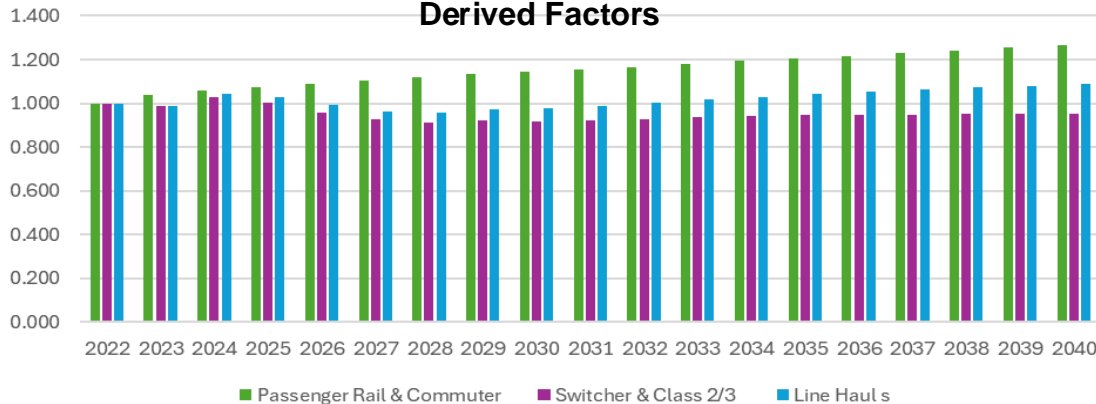
- 2022
- 2026
- 2032
- 2038



Rail Projections

- Projection factors for line haul, switcher and class 2/3 locomotives, passenger rail, and commuter locomotives based on AEO fuel use data.

**AEO R-1 Fuel Use Trends
Derived Factors**

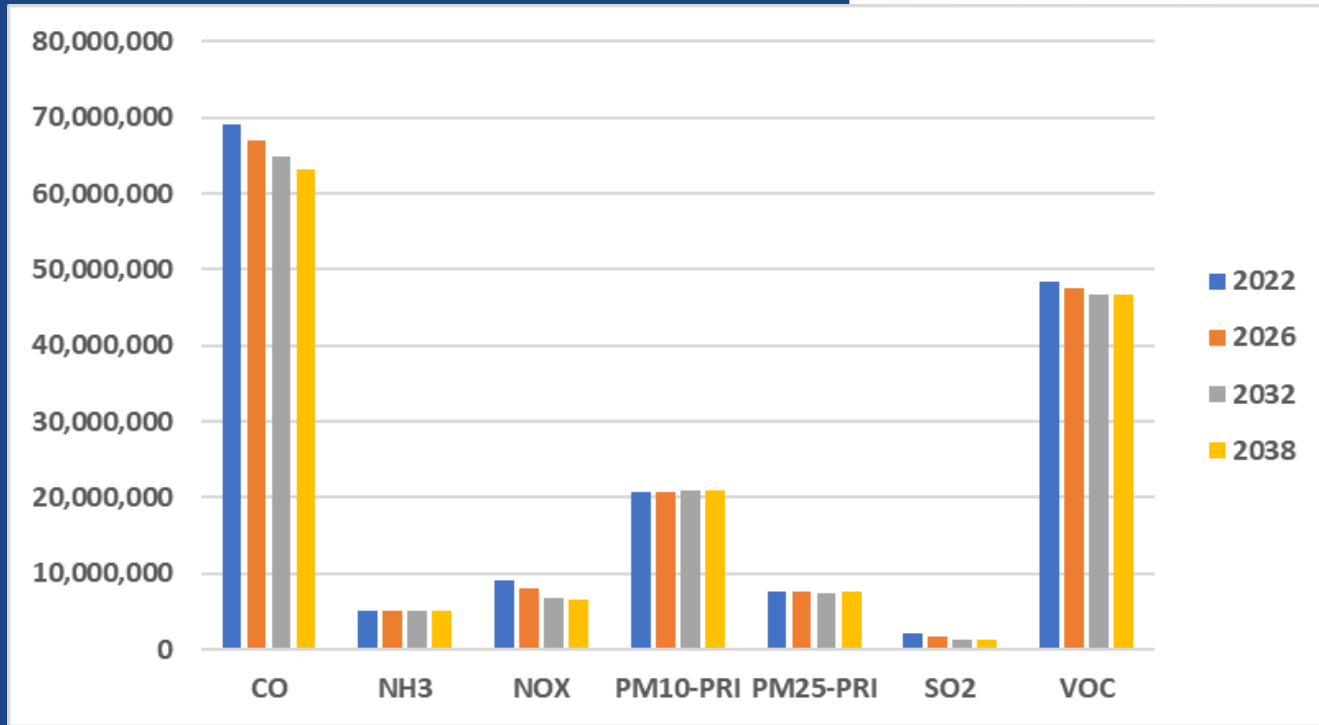


Questions?

See the [marine/air/rail task force wiki page](#) for more information

Contact Mark Janssen
(janssen@ladco.org)

2022v1 Rail Emissions by Year (tons/yr)



Nonpoint Projections

Population

- Commercial Cooking; Solvents (Various – Dry Cleaning, Graphic Arts, Miscellaneous Non-Industrial: Consumer and Commercial, Industrial Surface Coatings); Waste Disposal; Miscellaneous Non-Industrial NEC (Cremation, Health Services)

No Growth

- Residential Wood Combustion; Dust (Unpaved Roads); Solvents (Cutback Asphalt); Miscellaneous Non-Industrial NEC (Portable Gas Cans, Other Combustion); Waste Disposal; Biogenics - Vegetation and Soil; Livestock Waste (Domestic and Other Animals); [Fertilizer Application](#)

EIA's Annual Energy Outlook (AEO)

- Gasoline and Other Industrial Processes; Residential Heating; ICI – Commercial Institutional; ICI – Industrial Boilers ICEs; Dust (Agricultural Crops, Construction, Mining and Quarrying); Agricultural Silage; Solvents (Various – Surface Coating, Degreasing, Miscellaneous Industrial and Non-Industrial: Commercial)

EPA's GHG Tool

- Livestock Waste (Beef, Poultry, Swine); Dust (Agricultural Livestock)

Vehicle Miles Traveled (VMT)

- Dust (Paved Roads and Road Construction); Solvents (Traffic Markings, Emulsified Asphalt, Asphalt Paving)

Questions?

See the [nonpoint projections task force wiki page](#) for more details on the 2022v1 growth indicators

Contact Andy Bollman
(andrew.bollman@deq.nc.gov)
or Lindsay Dayton
(dayton.lindsay@epa.gov)

US EPA Rules with Controls: Nonpoint

- RICE NSPS (engines, natural gas turbines and process heaters)
- Oil and Gas NSPS
- Gasoline distribution NESHAP
- SLT comments (state-level controls)



Oil and Gas Projections

- Production-related sources
 - EIA State historical data for year 2023
 - AEO2023 production forecasts by Supply Region
 - Examined basin by basin trends
 - Working with Kansas to include their county growth factors
- Exploration-related sources
 - Average activity for selected years and use average activity in the Oil and Gas Tool to generate "average" exploration emissions
- States have option to submit alternative projection and controls information

Questions?

See the [oil and gas task force wiki page](#) for more information

Contact Jeff Vukovich
(vukovich.jeffrey@epa.gov)

US EPA Rules with Controls: Oil & Gas

- NSPS 0000 and 0000a
- Oil and Gas Methane Rule (NSPS 0000b and EGs 0000c)
- RICE rule for engines, natural gas turbines and process heaters
- Working with New Mexico to include their state rule



2022v1 Analytic Year Emissions Timeline

- EPA began to release analytic year data via the [2022v1 web page](#) in mid-September
- The 2022v1 analytic year inventory review process uses the online Emissions Data Review Tool and an updated version of the [2022v1 Sharepoint site](#) to accept comments on analytic year emissions
- Plan to finalize 2022v1 analytic year emission **inventories** in December 2024
- Air quality model-ready emissions will be developed sequentially for 2026, 2032, and 2038 and posted as they become available
- EPA plans to finalize documentation of the emissions by January 2025

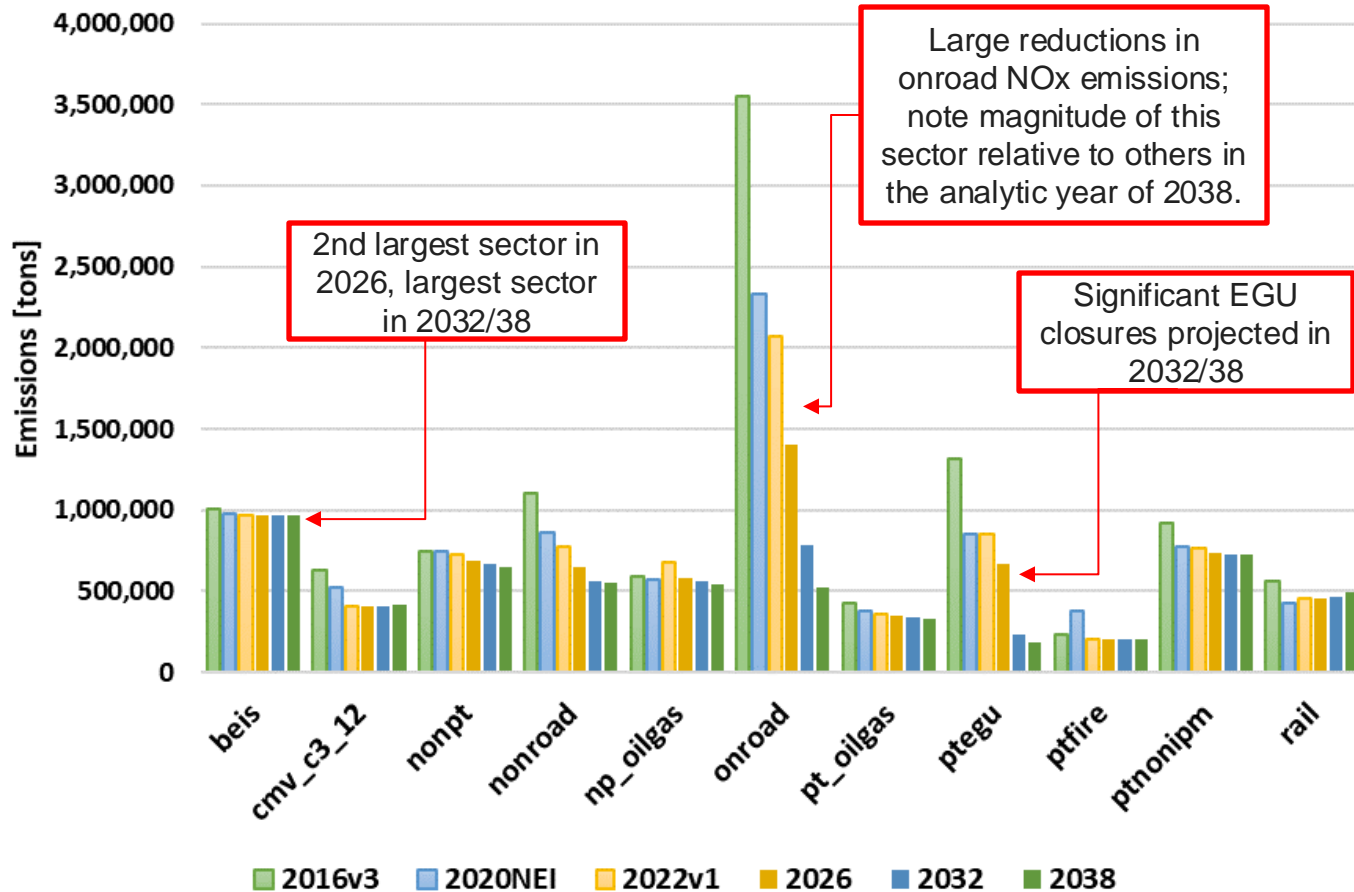
Questions?

Contact Jeff Vukovich
(vukovich.jeffrey@epa.gov)

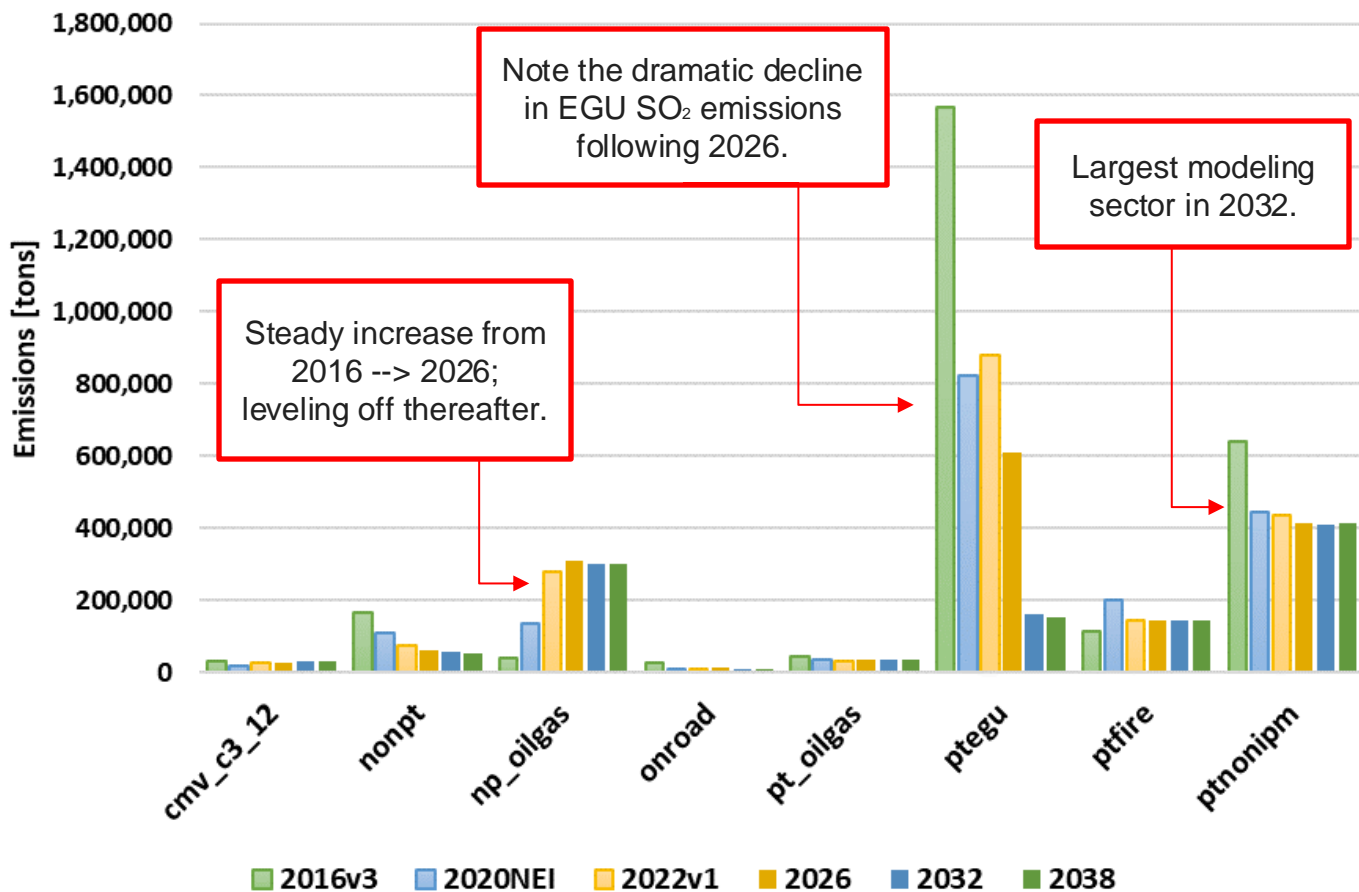
2022v1 Analytic Emissions Results



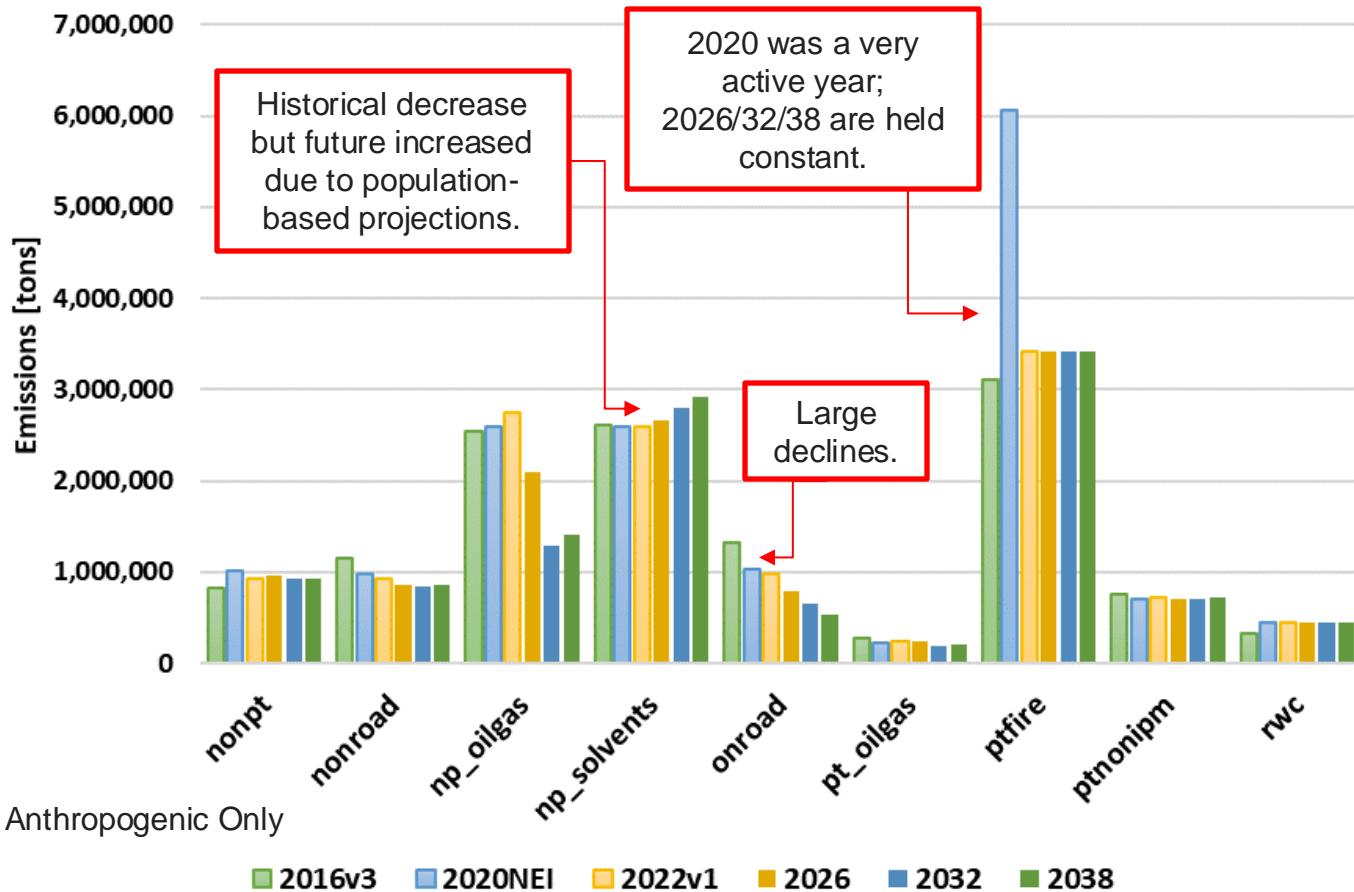
National Nitrogen Oxides Emissions



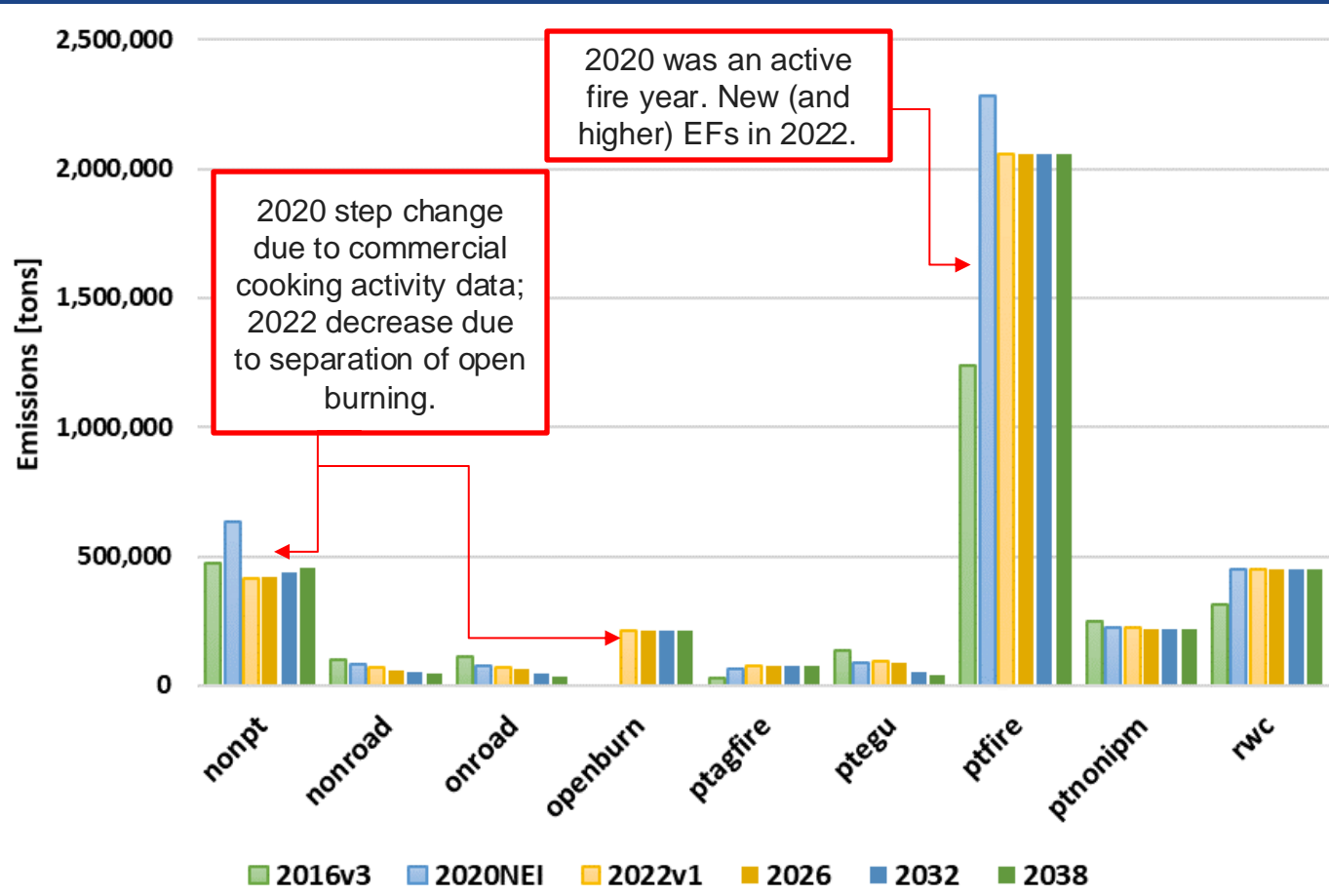
National Sulfur Dioxide Emissions



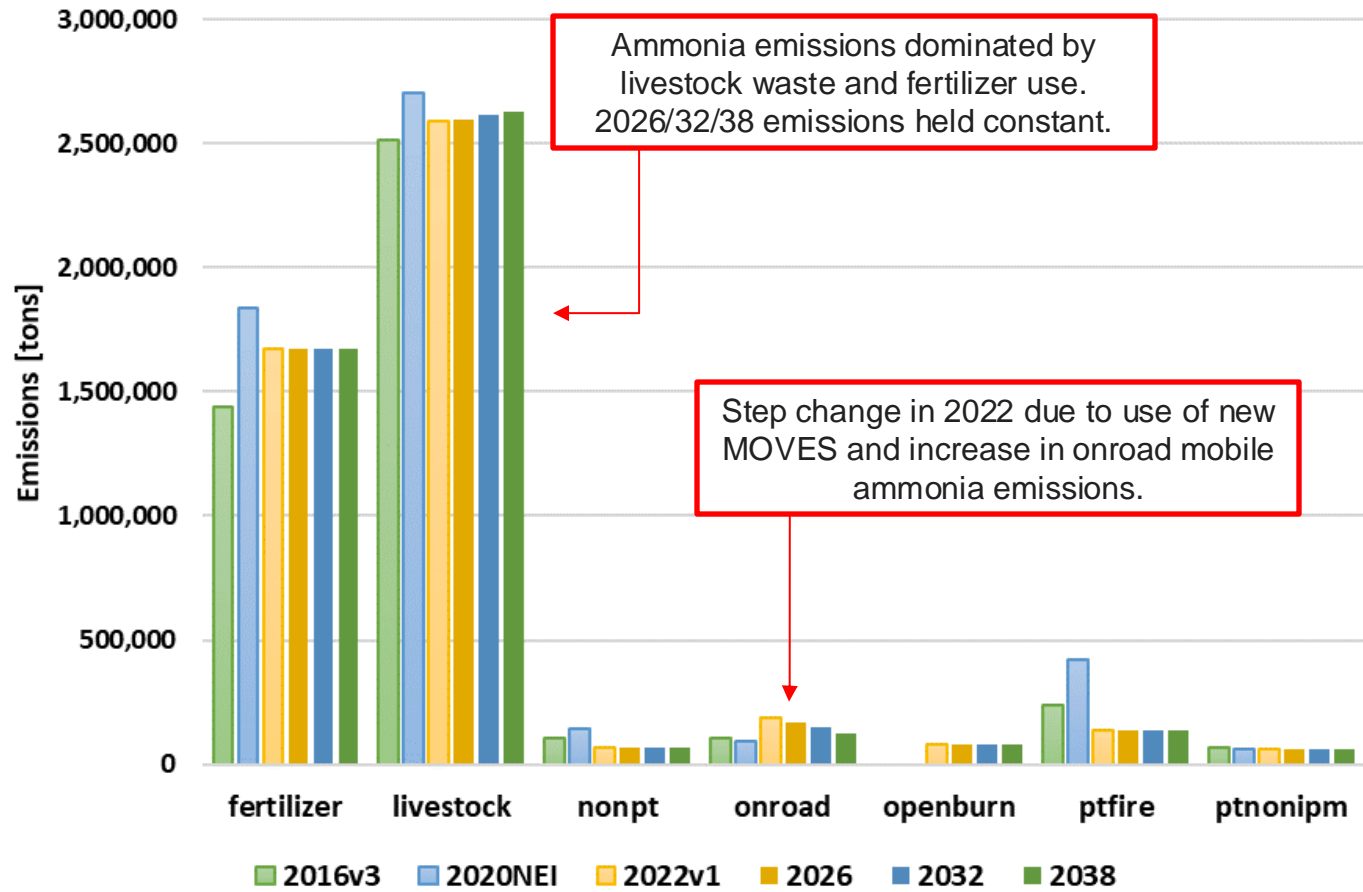
National Volatile Organic Compound* Emissions



National Fine Particulate Emissions



National Ammonia Emissions



Examples of Comments Received on Analytic Year Emissions

67 comments have been received from 13 organizations, so far...

Q: Livestock emissions show increases, historical trends show decreases.

Q: For a certain SCC, control factors were now adequately applied to analytic years.

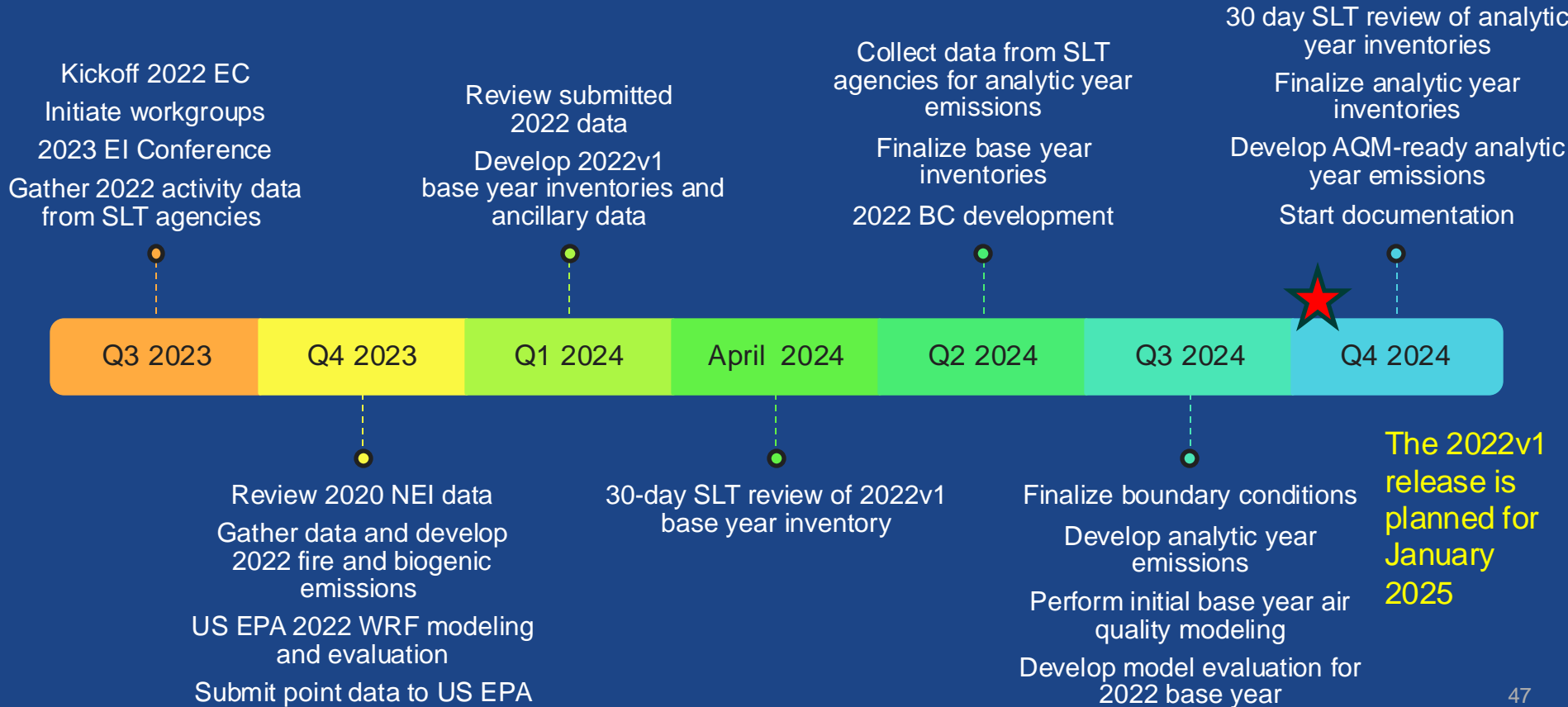
Q: Some facilities appear to be shut down prematurely in future projections.

Q: A fuel change is projected for this facility. The magnitude of SO₂ emissions are projected to decline substantially.

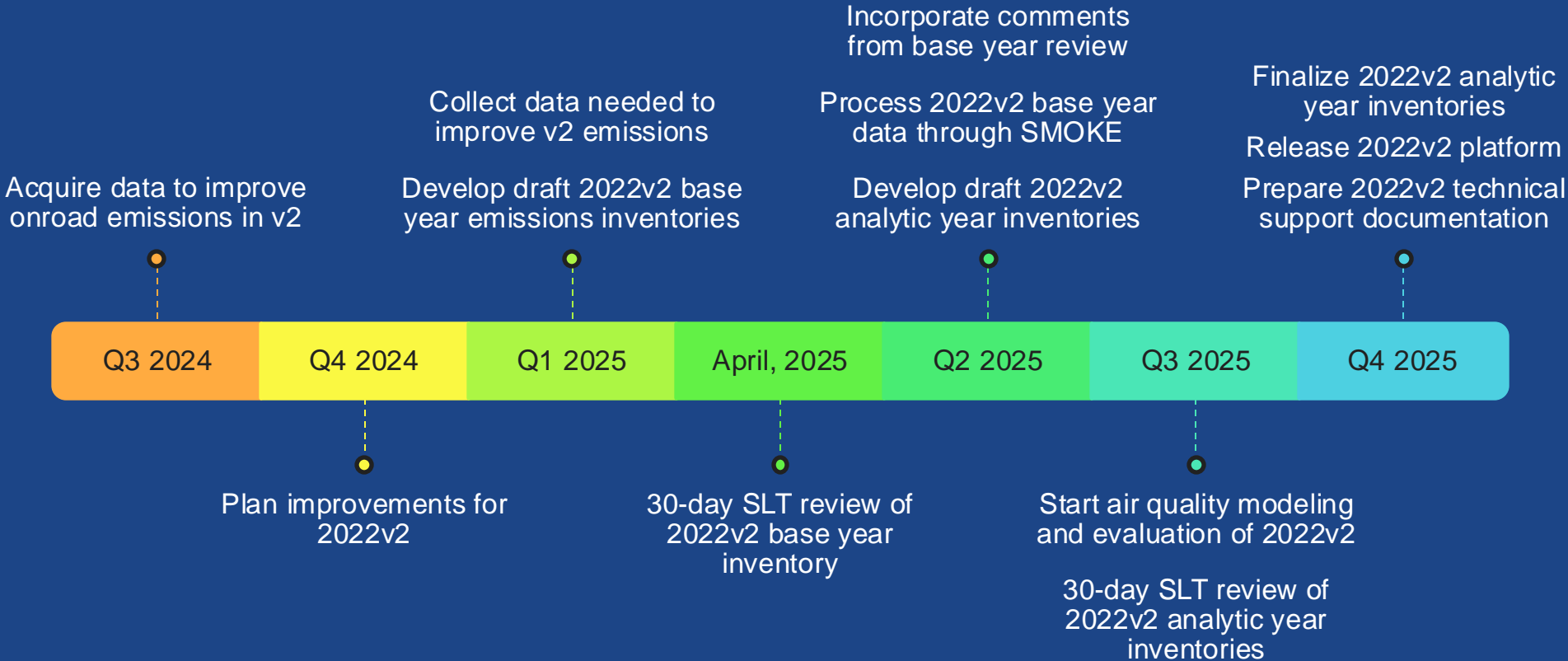
Collaborative Timeline Review and Next Steps



Timeline for 2022v1 Platform Development



Timeline for 2022v2 Platform Development



2022 Platforms and Planning Timelines

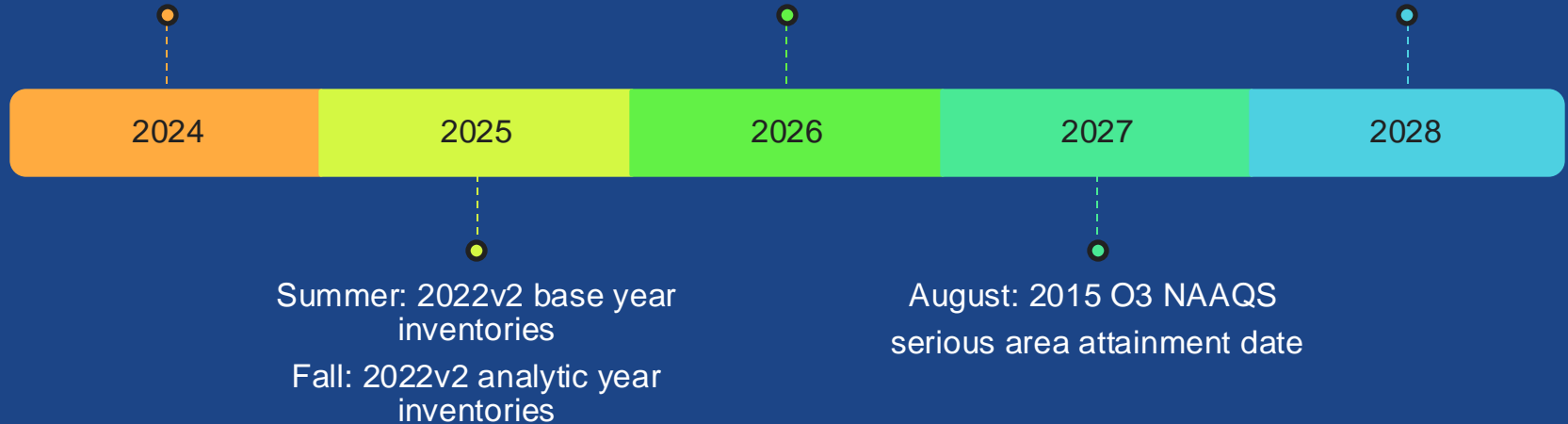
Summer: 2022v1 base year inventories

August: 2015 O3 NAAQS moderate area attainment date

Winter: 2022v1 analytic year inventories

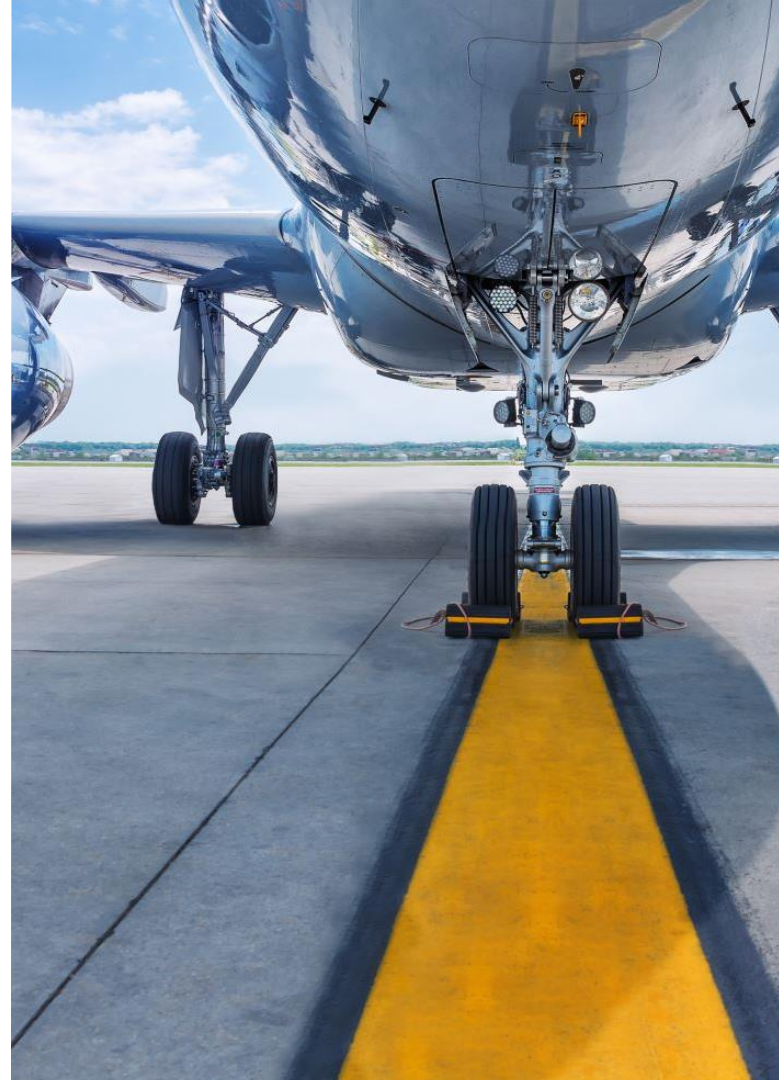
January: 2015 O3 NAAQS Serious NAA SIPs

Summer/Fall: Haze 3rd implementation period SIPs



2023 Aircraft LTO Data Review

- EPA and contractors have assembled airport operations data for the 2023 NEI, including landing-takeoff (LTO) activity
- Data review is requested by **December 8**
- SLTs completing this review will not need to submit an airport emissions file to EIS for the 2023 NEI
- [Instructions and data review details](#)



Stay Informed

- 2022EMP Wiki at Intermountain West Data Warehouse (IWDW)
- 2022v1 web page now available on EPA site: <https://www.epa.gov/air-emissions-modeling/2022v1-emissions-modeling-platform>
- Quarterly outreach calls
 - 1st Wednesday in August, November, February @ 2 p.m. Eastern
- Attend workgroup meetings
 - MJO MOVES, EGU, NOMAD, NOGEC, projections, fires, ...
- Participate in data reviews



[2022 EMP Wiki](#)

Next Steps

- S/L/T agencies can:
 - Participate in workgroup meetings
 - Work with other inventory contacts in your region to review the data
 - Explore the 2022v1 and analytic year data using the online Emissions Review Tool
 - Participate in the analytic year data review
- Workgroups may begin to focus on 2022v2
- **Next quarterly call:** February 5, 2025 @ 2 PM Eastern
- Email [Mary Uhl](#) if you are not already on the email list and want to be added

